



**Procurement of Plant
Design, Supply and Installation
JAIPUR METRO RAIL CORPORATION LIMITED
BIDDING DOCUMENT
for
Procurement
of**

NCB No.-JP/EW/1B/E2

**DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION,
TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV
AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA
SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID
TRANSPORT SYSTEM PROJECT PHASE-1B**

PART-I BIDDING PROCEDURES

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**JAIPUR METRO RAIL CORPORATION LTD.
Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**



JAIPUR METRO

JAIPUR METRO RAIL CORPORATION LIMITED

Invitation for Bids (National Competitive Bidding)

Date:	18.04.2017
Loan/Grant No. and Title:	3062-IND: Jaipur Metro Rail Line 1-Phase B Project
Contract No. and Title:	NCB No. JP/EW/1B/E2: Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 KV AC Traction (Rigid OHE), 33 KV Auxiliary Sub Stations (ASS), Associated Cabling and SCADA Systems for Underground Corridors of Jaipur Mass Rapid Transport System Project Phase-1B at Jaipur, Rajasthan, India
Deadline for Submission of Bids: up to 15:00 Hrs. on 31.05.2017	

- INDIA has received financing from the Asian Development Bank (ADB) toward the cost of **Jaipur Metro Rail Line 1-Phase B Project**. Part of this financing will be used for payments under the Contract named above. Bidding is open to Bidders from eligible source countries of ADB.
- Jaipur Metro Rail Corporation Limited** (JMRCL) ("the Employer") invites sealed bids from the eligible bidders for the **Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 KV AC Traction (Rigid OHE), 33 KV Auxiliary Sub Stations (ASS), Associated Cabling and SCADA Systems for Underground Corridors of Jaipur Mass Rapid Transport System Project Phase-1B at Jaipur, Rajasthan, India – "NCB No. JP/EW/1B/E2"**.
- National Competitive Bidding will be conducted in accordance with ADB's Single –Stage: Two- Envelope bidding procedure and is open to all Eligible bidders as described in the bidding documents.
- Key details of the Bid are as under:-

Bid Security amount	:	Referred to Clause 21 of Instructions to Bidders (ITB)
Completion period of the work	:	80 Weeks
Period of Bidding Documents on inspection and sale	:	From 18.04.2017 to 30.05.2017 (between 09:30 hrs and 18:00 hrs) on all working days and on 31.05.2017 (between 09:30 hrs and 15:00 hrs)

NCB No. JP/EW/1B/E2: Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 KV AC Traction (Rigid OHE), 33 KV Auxiliary Sub Stations (ASS), Associated Cabling and SCADA Systems for Underground Corridors of Jaipur Mass Rapid Transport System Project Phase-1B at Jaipur, Rajasthan, India.

5. Only experienced and eligible bidders should participate in this bidding. Please refer to Section 3 (Evaluation and Qualification criteria) of the Bidding Document.

6. To obtain further information and inspect the bidding documents, bidders should contact:

Mr. Ashwani Saxena, Director (Project),
Jaipur Metro Rail Corporation Limited
3rd Floor, RAJSICO Building, Udyog Bhawan,
Tilak Marg, C-Scheme, City: Jaipur (Rajasthan)
Postal Code: 302005
Country: India
Telephone: +91-141-5192452/456/ +91-9001195205
Facsimile Number: 0141-5192451
Electronic mail Address: jmrctender1bew@gmail.com

7. To purchase the bidding documents in English, Eligible bidders should:

- Write to address above requesting the bidding documents for: **“NCB No. JP/EW/1B/E2: Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 KV AC Traction (Rigid OHE), 33 KV Auxiliary Sub Stations (ASS), Associated Cabling and SCADA Systems for Underground Corridors of Jaipur Mass Rapid Transport System Project Phase-1B at Jaipur, Rajasthan, India”**. The request for the bidding documents shall be delivered to the address above before the latest date and time of sale of bidding documents prescribed above in the ‘Key details of the Bid’.
- Pay a non-refundable fee of INR 21000 towards the cost of the bidding documents. Bidding document requested to be delivered by mail will be dispatched by registered/speed post/courier upon payment of an additional amount of INR 5000. Payment (s) shall be made in the shape of ‘Demand Draft’ in favor of “Jaipur Metro Rail Corporation Ltd” payable at Jaipur. The Employer shall not be held responsible for the postal/courier delay, if any, in the delivery or non-delivery of the Bidding Documents.

8. Deliver your Bid:

- to the address above
- **on or before the deadline: up to 15.00 Hrs on 31.05.2017**
- together with a Bid Security in the form as described in the Bidding Document

Bids will be opened immediately after the deadline for bid submission in the presence of bidders’ representatives who choose to attend.

STANDARD BIDDING DOCUMENT

**Procurement of Plant
Design, Supply, and Installation**

**Single-Stage: Two-Envelope
Bidding Procedure**

Asian Development Bank

December 2015

Foreword

This Standard Bidding Document for Procurement of Plant – Design, Supply, and Installation (SBD Plant) has been prepared by the Asian Development Bank (ADB) and is based on the Master Procurement Document prepared by multilateral development banks and other public international financial institutions which reflects the majority view of these institutions. This document has the structure and the provisions of the Master Procurement Document, except where ADB-specific considerations have required a change.

The SBD Plant is intended to be used for the procurement of plant through international competitive bidding when

- the contract involves the design, supply, installation and commissioning of specially engineered plant and equipment such as turbines, generators, boilers, electrical switchyards/substations, pumping stations, telecommunication systems, process and wastewater treatment plants, and similar projects;
- the value of the plant and equipment represents the major part of the estimated contract value; and
- the nature and complexity of the plant and equipment is such that the facilities cannot safely be taken over by the Employer without comprehensive testing, pre-commissioning, commissioning and acceptance procedures being followed.

The SBD Plant documents anticipate that the contractor is responsible for each activity required to complete the facilities, e.g., design, manufacture, delivery, installation, testing, commissioning, training, and required civil works portions. However, these conditions may be adapted for single-responsibility contracts where some activities, such as parts of the preliminary design or site preparation works, are done by others.

An important feature of this SBD is that it can be used with minimum changes, as it does not contain explanatory commentary not forming part of the bidding document.

This SBD is supported by a User's Guide. The User's Guide contains detailed explanations and recommendations to Employers on how to prepare a specific bidding document for the procurement of plant and how to evaluate bids. The User's Guide is not a part of the bidding document.

To obtain further information on procurement under ADB-financed projects, contact

Operations Services and Financial Management Department (OSFMD)
Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
Email: procurement@adb.org
Tel +63 2 632 2444
Fax +63 2 636 2444 [Attn: Director General, OSFMD]
www.adb.org

Procurement of Plant Design, Supply, and Installation

**Single-Stage: Two-Envelope
Bidding Procedure**

BIDDING DOCUMENT for Procurement of

NCB No.-JP/EW/1B/E2

DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID TRANSPORT SYSTEM PROJECT PHASE-1B

Issued on: April 2017

Invitation for Bids No.: NCB No.: JP/EW/1B/E2

Employer: Jaipur Metro Rail Corporation Limited, Jaipur

Country: INDIA

Preface

This Bidding Document for Procurement of Plant – Design, Supply, and Installation, has been prepared by *Jaipur Metro Rail Corporation Limited* and is based on the Standard Bidding Document for Procurement of Plant – Design, Supply, and Installation (SBD Plant) issued by the Asian Development Bank dated December 2015.

ADB's SBD Plant has the structure and the provisions of the Master Procurement Document entitled "Procurement of Plant – Design, Supply, and Installation", prepared by multilateral development banks and other public international financial institutions except where ADB-specific considerations have required a change.

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JAIPUR METRO RAIL CORPORATION

Name of the Bid: Design, Detail Engineering, manufacture, Supply, Installation, Testing and Commissioning of 25 kV AC Traction (RIGID OHE), 33 kV Auxiliary Sub Stations (ASS), associated cabling and SCADA Systems for Underground Corridors of Jaipur Mass Rapid Transport System Project Phase-1B

NCB NO: JP/EW/1B/E2

Name of the Bidder:

REVISED CHECKLIST FOR BIDDERS QUALIFICATION SUBMISSION

(To be attached with Technical Bid submission)

SL No	Reference to the Bid	Description of Item	Submitted		Submitted on page no
			YES	NO	
1	BDS clause 22.1	Submission has "ORIGINAL" and Two true copies of the same.			
2	Section-4 Vol-I	Letter of Technical Bid			
3	ITB-21& Section-4 Vol-I	Bid security as per applicable format			
4	I	Banks detail for bid security			
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10		Memorandum of Understanding in case of JV/Consortium/Partnership as per BDS clause ITB22.2			
11		Power of Attorney having the specimen signature of authorized signatory duly notarized is enclosed.			
12		Board of Resolution or delegation of authorization for the concerned PoA is enclosed.			

SL No	Reference to the Bid	Description of Item	Submitted		Submitted on page no
			YES	NO	
13		Article of Incorporation of Applicant JV/ Consortium partners are enclosed.			
14		Notes: (i) In case of Foreign Partner(s), Power of Attorney(s) and Board of Resolution confirming authority on the person(s) issuing the Power of Attorney for such actions, shall be submitted <u>duly notarized by the notary public of origin</u>			
15		(ii) In the case of government-owned enterprise, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5			
16	BDF section-	Form PER-I Proposed Personnel			
17	BDF section-	Form PER-II Resume of proposed personnel			
18	BDF section-4	Form ELI - 1: Bidder's Information Sheet			
19	BDF section-4	Form ELI - 2: Joint Venture Information Sheet			
20	BDF section-4	Form LIT - 1: Pending Litigation and Arbitration			
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23	BDF section-4	Form FIN - 3: Availability of Financial Resources (certified by Chartered Accountant)			
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25	BDF section-4	Form FIN- 5: Compliance Check of Financial Resources (certified by Chartered Accountant)			
26	BDF section-4	Form EXP – 1: Contracts of Similar Size and Nature			
27	BDF section-4	Form EXP – 2: Experience in Key Activities			
28	BDF section-4	Form EXP – 3: Subcontractors			
29		Details regarding Letter of Acceptance/Work completion certificates /taking over certificates to substantiate the experience details filled in from EXP-1, EXP-2 , EXP-3			

SL No	Reference to the Bid	Description of Item	Submitted		Submitted on page no
			YES	NO	
30		Successfully or substantially completed certificates successfully from client clearly indicating the nature/scope of work, actual completion cost and actual date of completion for such work should be submitted			
31		In case the work is executed for private client, copy of work order, bill of quantities, bill wise details of payment received certified by Chartered Accountant under his signature, stamp and membership number, Tax Deducted at Source (TDS) certificates for all payments received and copy of final/last bill paid by client shall be submitted			
32		Technical submission in PDF format in a CD			
33	ER	Statement of Deviations as per item no.10 of Section 6 Employer Requirement			
34	BDF	Requirements for Bidder's Technical Proposals as per Section 4			
35	BDF	Schedule of Sub-Contractors			
36	ER	Schedule of Vendors/ Equipment & Systems as per Item no.15			
37	BDF/ER	Project Organisation as per item no. 7 Section 6 and PER-I & II of Section 4			
38	BDF	Proposal for Contractor's Machinery as per form EQU and item no. 8 of Section 4			
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40	Section-6 Clause-12	Outline Quality Plan			
41	Section-6 Clause-13	Outline Safety, Health & Environment Plan			
42	Section-6 Clause-7	Staffing Schedules and Organization Chart			
43		The supporting documents /printed literature are translated in English language and is duly certified by the authorized signatory			
44		Each page of the submittal has been numbered , signed and stamped by authorized signatory.			

Undertaking

This is to undertake that I have checked the above list with our submittal . I am also aware that if the application is not containing the above documents, our application is liable to be rejected

Authorized Signatory



JAIPUR METRO RAIL CORPORATION

Name of the Bid: Design, Detail Engineering, manufacture, Supply, Installation, Testing and Commissioning of 25 kV AC Traction (RIGID OHE), 33 kV Auxiliary Sub Stations (ASS), associated cabling and SCADA Systems for Underground Corridors of Jaipur Mass Rapid Transport System Project Phase-1B

NCB NO: JP/EW/1B/E2

Name of the Bidder:

REVISED CHECK LIST FOR FINANCIAL SUBMISSION (To be attached with Financial Bid submission)

SL No	Reference	Description of Item	Submitted		Submitted on page no
			YES	NO	
1	Section-4 Vol-I	Letter of Price Bid			
2	ER	Pricing of Unqualified Withdrawal of Conditions, Qualifications, Deviations, etc as per item no. 10 of Section 6			
3	BDF Vol I&II	Bill of Quantities / Pricing Document in Sealed condition in Financial package envelope as per Section 4 Vol I & II			
4		Priced BOQ in MS Excel format in a CD in sealed condition in Financial package envelope.			
5		The supporting documents/ printed literature are translated in English language and is duly certified by the authorized signatory			
6		Each page of the submittal has been numbered, signed and stamped by authorized signatory.			
7		Financial Submission has 'ORIGINAL' and 'Two true copies' of the same as per ITB Clause 22.1.			

Undertaking

This is to undertake that I have checked the above list with our submittal . I am also aware that if the application is not containing the above documents, our application is liable to be rejected

Authorized Signatory



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SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID
TRANSPORT SYSTEM PROJECT PHASE-1B**

PART-I BIDDING PROCEDURES

Section 1 - Instructions to Bidders (ITB)

**JAIPUR METRO RAIL CORPORATION LTD.
Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**

Section 1 - Instructions to Bidders

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Section 1 - Instructions to Bidders

A. General

- | | |
|--------------------------------|--|
| 1. Scope of Bid | <p>1.1 In connection with the Invitation for Bids (IFB) indicated in the Bid Data Sheet (BDS), the Employer, as indicated in the BDS, issues this Bidding Document for the procurement of plant and services as specified in Section 6 (Employer's Requirements). The name, identification, and number of lot/s (contract/s) of the international competitive bidding (ICB) are provided in the BDS.</p> <p>1.2 Unless otherwise stated, throughout this Bidding Document definitions and interpretations shall be as prescribed in Section 7 (General Conditions of Contract).</p> |
| 2. Source of Funds | <p>2.1 The Borrower or Recipient (hereinafter called "Borrower") indicated in the BDS has applied for or received financing (hereinafter called "funds") from the Asian Development Bank (hereinafter called "ADB") toward the cost of the project named in the BDS. The Borrower intends to apply a portion of the funds to eligible payments under the contract(s) for which this Bidding Document is issued.</p> <p>2.2 Payments by ADB will be made only at the request of the Borrower and upon approval by ADB in accordance with the terms and conditions of the Financing Agreement between the Borrower and ADB (hereinafter called "Financing Agreement"), and will be subject in all respects to the terms and conditions of that Financing Agreement. No party other than the Borrower shall derive any rights from the Financing Agreement or have any claim to the funds.</p> |
| 3. Fraud and Corruption | <p>3.1 ADB's Anticorruption Policy requires Borrowers (including beneficiaries of ADB-financed activity), as well as Bidders, Suppliers, and Contractors under ADB-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, ADB</p> <p>(a) defines, for the purposes of this provision, the terms set forth below as follows:</p> <ul style="list-style-type: none"> (i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party; (ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation; (iii) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party; (iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party; |

- (v) "obstructive practice" means (a) deliberately destroying, falsifying, altering, or concealing of evidence material to an ADB investigation; (b) making false statements to investigators in order to materially impede an ADB investigation; (c) failing to comply with requests to provide information, documents, or records in connection with an Office of Anticorruption and Integrity (OAI) investigation; (d) threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or (e) materially impeding ADB's contractual rights of audit or access to information; and
 - (vi) "integrity violation" is any act which violates ADB's Anticorruption Policy, including (i) to (v) above and the following: abuse, conflict of interest, violations of ADB sanctions, retaliation against whistleblowers or witnesses, and other violations of ADB's Anticorruption Policy, including failure to adhere to the highest ethical standard.
- (b) will reject a proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the Contract;
 - (c) will cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the Borrower or of a beneficiary of ADB-financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations during the procurement or the execution of that contract, without the Borrower having taken timely and appropriate action satisfactory to ADB to remedy the situation;
 - (d) will impose remedial actions on a firm or an individual, at any time, in accordance with ADB's Anticorruption Policy and Integrity Principles and Guidelines (both as amended from time to time), including declaring ineligible, either indefinitely or for a stated period of time, to participate¹ in ADB-financed, administered, or supported activities or to benefit from an ADB-financed, administered, or supported contract, financially or otherwise, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices or other integrity violations; and
 - (e) will have the right to require that a provision be included in the Bidding Documents and in contracts financed by ADB, requiring Bidders, suppliers and contractors to permit ADB or its representative to inspect their accounts and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by ADB.

3.2 Furthermore, Bidders shall be aware of the provision stated in the General Conditions of Contract (GCC 9.6 and 42.2.1 (c)).

4. Eligible Bidders

4.1 A Bidder may be a natural person, private entity, or government-owned enterprise subject to ITB 4.5 - or any combination of them with a formal intent to enter into an agreement or under an existing agreement in the

¹ Whether as a Contractor, Subcontractor, Consultant, Manufacturer or Supplier, or Service Provider; or in any other capacity (different names are used depending on the particular Bidding Document).

form of a Joint Venture. In the case of a Joint Venture,

- (a) all partners shall be jointly and severally liable, and
- (b) the Joint Venture shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the partners of the Joint Venture during the bidding process and, in the event the Joint Venture is awarded the Contract, during contract execution.

4.2 A Bidder, and all partners constituting the Bidder, shall have the nationality of an eligible country, in accordance with Section 5 (Eligible Countries). A Bidder shall be deemed to have the nationality of a country if the Bidder is a citizen or is constituted, incorporated, or registered, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed subcontractors or suppliers for any part of the Contract including related services.

4.3 A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in this bidding process if any of, including but not limited to, the following apply:

- (a) they have controlling shareholders in common; or
- (b) they receive or have received any direct or indirect subsidy from any of them; or
- (c) they have the same legal representative for purposes of this bid; or
- (d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to material information about or improperly influence the bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or
- (e) a Bidder participates in more than one bid in this bidding process, either individually or as a partner in a joint venture, except for alternative offers permitted under ITB 13. This will result in the disqualification of all Bids in which it is involved. However, subject to any finding of a conflict of interest in terms of ITB 4.3 (a) - (d) above, this does not limit the participation of a Bidder as a subcontractor in another Bid or of a firm as a subcontractor in more than one Bid; or
- (f) a Bidder or any affiliated entity, participated as a consultant in the preparation of the design or technical specifications of the plant and services that are the subject of the Bid; or
- (g) a Bidder was affiliated with a firm or entity that has been hired (or is proposed to be hired) by the Employer or Borrower as Project Manager for the Contract.

4.4 A firm shall not be eligible to participate in any procurement activities under an ADB-financed, administered, or supported project while under temporary suspension or debarment by ADB pursuant to its Anticorruption Policy (see ITB 3), whether such debarment was directly imposed by ADB, or enforced by ADB pursuant to the Agreement for Mutual Enforcement of Debarment Decisions. A bid from a temporary suspended or debarred firm will be rejected.

- 4.5 Government-owned enterprises in the Borrower's country shall be eligible only if they can establish that they (i) are legally and financially autonomous, (ii) operate under commercial law, and (iii) are not dependent agencies of the Employer.
- 4.6 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.
- 4.7 Firms shall be excluded if by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods or contracting of works or services from that country or any payments to persons or entities in that country.
- 4.8 In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to prequalified Bidders.

5. Eligible Plant and Services

- 5.1 The plant and services to be supplied under the Contract shall have their origin in eligible source countries as defined in ITB 4.2 and all expenditures under the Contract will be limited to such plant and services.
- 5.2 For purposes of ITB 5.1 above, "origin" means the place where the plant, or component parts thereof are mined, grown, produced, or manufactured, and from which the services are provided. Plant components are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that is substantially in its basic characteristics or in purpose or utility from its components.

B. Contents of Bidding Document

6. Sections of Bidding Document

- 6.1 The Bidding Document consists of Parts I, II, and III, which include all the sections indicated below, and should be read in conjunction with any addenda issued in accordance with ITB 8.

PART I Bidding Procedures

- Section 1 - Instructions to Bidders (ITB)
- Section 2 - Bid Data Sheet (BDS)
- Section 3 - Evaluation and Qualification Criteria (EQC)
- Section 4 - Bidding Forms (BDF)
- Section 5 - Eligible Countries (ELC)

PART II Requirements

- Section 6 - Employer's Requirements (ERQ)

PART III Conditions of Contract and Contract Forms

- Section 7 - General Conditions of Contract (GCC)
- Section 8 - Special Conditions of Contract (SCC)
- Section 9 - Contract Forms (COF)

- 6.2 The Invitation for Bids (IFB) issued by the Employer is not part of the Bidding Document.
- 6.3 The Employer is not responsible for the completeness of the Bidding Document and its addenda, if they were not obtained directly from the source stated by the Employer in the IFB.

- 6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the Bid.
- 7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting**
- 7.1 A prospective Bidder requiring any clarification on the Bidding Document shall contact the Employer in writing at the Employer's address indicated in the BDS, or raise inquiries during the pre-bid meeting if provided for in accordance with ITB 7.4. The Employer will respond to any request for clarification, provided that such request is received no later than 21 days prior to the deadline for submission of bids. The Employer's response shall be in writing with copies to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. Should the Employer deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under ITB 8 and ITB 24.2.
- 7.2 The Bidder is advised to visit and examine the site where the plant is to be installed and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a contract for the provision of plant and services. The costs of visiting the site shall be at the Bidder's own expense.
- 7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents, will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.
- 7.4 The Bidder's designated representative is invited to attend a pre-bid meeting, if provided for in the BDS. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 7.5 The Bidder is requested to submit any questions in writing, to reach the Employer not later than 1 week before the pre-bid meeting.
- 7.6 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3. Any modification to the Bidding Document that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting.
- 7.7 Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.
- 8. Amendment of Bidding Document**
- 8.1 At any time prior to the deadline for submission of Bids, the Employer may amend the Bidding Document by issuing addenda.

- 8.2 Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Employer in accordance with ITB 6.3.
- 8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may, at its discretion, extend the deadline for the submission of Bids, pursuant to ITB 24.2

C. Preparation of Bids

- 9. Cost of Bidding** 9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
- 10. Language of Bid** 10.1 The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in the English language. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages into the English language, in which case, for purposes of interpretation of the Bid, such translation shall govern.
- 11. Documents Comprising the Bid** 11.1 The Bid shall comprise two envelopes submitted simultaneously, one containing the Technical Bid and the other the Price Bid, both envelopes enclosed together in an outer single envelope.
- 11.2 The Technical Bid submitted by the Bidder shall comprise the following:
- (a) Letter of Technical Bid;
 - (b) Bid Security or Bid-Securing Declaration, in accordance with ITB 21;
 - (c) alternative Bids, if permissible, in accordance with ITB 13;
 - (d) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 22.2;
 - (e) documentary evidence in accordance with ITB 14.1, that the plant and services offered by the Bidder in its Bid or in any alternative Bid, if permitted, are eligible;
 - (f) documentary evidence in accordance with ITB 15, the Bidder's eligibility and qualifications to perform the contract if its Bid is accepted;
 - (g) Technical Proposal in accordance with ITB 17.
 - (h) documentary evidence in accordance with ITB 16, that the plant and services offered by the Bidder conform to the Bidding Document;
 - (i) in the case of a bid submitted by a Joint Venture, the Bid shall include a copy of the Joint Venture Agreement entered into by all partners. Alternatively, a Letter of Intent to execute a Joint Venture Agreement in the event of a successful bid shall be signed by all partners and submitted with the Bid, together with a copy of the proposed agreement;

- (j) list of subcontractors, in accordance with ITB 17.2; and
- (k) any other document required in the BDS.

11.3 The Price Bid submitted by the Bidder shall comprise the following:

- (a) Letter of Price Bid;
- (b) completed schedules as required, including Price Schedules, in accordance with ITB 12 and ITB 18;
- (c) alternative price Bids, if permissible, in accordance with ITB 13; and
- (d) any other document required in the BDS.

12. Letter of Bid and Schedules

12.1 The Letters of Technical Bid and Price Bid, and the Schedules, and all documents listed under ITB 11, shall be prepared using the relevant forms furnished in Section 4 (Bidding Forms). The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested and as required in the BDS.

13. Alternative Bids

13.1 The BDS indicates whether alternative Bids are allowed. If they are allowed, the BDS will also indicate whether they are permitted in accordance with ITB 13.3, or invited in accordance with ITB 13.2 and/or ITB 13.4.

13.2 When alternatives to the Time Schedule are explicitly invited, a statement to that effect will be included in the BDS, and the method of evaluating different time schedules will be described in Section 3 (Evaluation and Qualification Criteria).

13.3 Except as provided under ITB 13.4 below, Bidders wishing to offer technical alternatives to the Employer's requirements as described in the Bidding Document must also provide: (i) a price at which they are prepared to offer a plant meeting the Employer's requirements; and (ii) all information necessary for a complete evaluation of the alternatives by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed installation methodology and other relevant details. Only the technical alternatives, if any, of the lowest evaluated Bidder conforming to the basic technical requirements shall be considered by the Employer.

13.4 When Bidders are invited in the BDS to submit alternative technical solutions for specified parts of the facilities, such parts shall be described in Section 6 (Employer's Requirements). Technical alternatives for the specific parts of the facilities that comply with the performance and technical criteria specified for the plant and services shall be considered by the Employer on their own merits, pursuant to ITB 32.

14. Documents Establishing the Eligibility of Plant and Services

14.1 To establish the eligibility of the plant and services in accordance with ITB 5, Bidders shall complete the country of origin declarations in the Price Schedule Forms, included in Section 4 (Bidding Forms).

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| 15. Documents Establishing the Eligibility and Qualifications of the Bidder | <p>15.1 To establish its eligibility and qualifications to perform the Contract in accordance with Section 3 (Evaluation and Qualification Criteria), the Bidder shall provide the information requested in the corresponding information sheets included in Section 4 (Bidding Forms).</p> <p>15.2 Domestic Bidders, individually or in joint ventures, applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility as described in ITB 38.</p> |
| 16. Documents Establishing Conformity of the Plant and Services | <p>16.1 The documentary evidence of the conformity of the plant and services to the Bidding Document may be in the form of literature, drawings and data, and shall furnish:</p> <ul style="list-style-type: none"> (a) a detailed description of the essential technical and performance characteristics of the plant and services, including the functional guarantees of the proposed plant and services, in response to the Specification; (b) a list giving full particulars, including available sources, of all spare parts and special tools necessary for the proper and continuing functioning of the plant for the period named in the BDS, following completion of plant and services in accordance with provisions of the contract; and (c) a commentary on the Employer's Specifications and adequate evidence demonstrating the substantial responsiveness of the plant and services to those specifications. Bidders shall note that standards for workmanship, materials and equipment designated by the Employer in the Bidding Document are intended to be descriptive (establishing standards of quality and performance) only and not restrictive. The Bidder may substitute alternative standards, brand names and/or catalog numbers in its Bid, provided that it demonstrates to the Employer's satisfaction that the substitutions are substantially equivalent or superior to the standards designated in the Specifications. |
| 17. Technical Proposal, Subcontractors | <p>17.1 The Bidder shall furnish a Technical Proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section 4 (Bidding Forms), in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work requirements and the completion time.</p> <p>17.2 For major items of plant and services as listed by the Employer in Criterion 2.5 of Section 3 (Evaluation and Qualification Criteria), which the Bidder intends to purchase or subcontract, the Bidder shall give details of the name and nationality of the proposed Subcontractors, including Manufacturers, for each of those items. In addition, the Bidder shall include in its Bid information establishing compliance with the requirements specified by the Employer for these items. Bidders are free to list more than one Subcontractor against each item of the plant and services. Quoted rates and prices will be deemed to apply to whichever Subcontractor is appointed, and no adjustment of the rates and prices will be permitted.</p> |

- 17.3 The Bidder shall be responsible for ensuring that any Subcontractor proposed complies with the requirements of ITB 4, and that any plant, or services to be provided by the Subcontractor comply with the requirements of ITB 5 and ITB 15.1

18. Bid Prices and Discounts

- 18.1 Unless otherwise specified in the BDS and/or Section 6 (Employer's Requirements), bidders shall quote for the entire plant and services on a "single responsibility" basis such that the total Bid price covers all the Contractor's obligations mentioned in or to be reasonably inferred from the Bidding Document in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation, and completion of the plant. This includes all requirements under the Contractor's responsibilities for testing, pre-commissioning and commissioning of the plant and, where so required by the Bidding Document, the acquisition of all permits, approvals, and licenses, etc.; the operation, maintenance, and training services and such other items and services as may be specified in the Bidding Document, all in accordance with the requirements of the General Conditions. Items against which no price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the prices for other items.

- 18.2 Bidders are required to quote the price for the commercial, contractual and technical obligations outlined in the Bidding Document.

- 18.3 Bidders shall give a breakdown of the prices in the manner and detail called for in the Price Schedules included in Section 4 (Bidding Forms). Where no different Price Schedules are included in the Bidding Document, Bidders shall present their prices in the following manner: Separate numbered Schedules included in Section 4 (Bidding Forms) shall be used for each of the following elements. The total amount from each Schedule (Nos. 1 to 4) shall be summarized in a Grand Summary (Schedule No. 5) giving the total bid price(s) to be entered in the Letter of Price Bid. Absence of the total bid price in the Letter of Price Bid may result in the rejection of the Bid.

Schedule No. 1: Plant and Mandatory Spare Parts Supplied from Abroad

Schedule No. 2: Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Schedule No. 3: Design Services

Schedule No. 4: Installation and Other Services

Schedule No. 5: Grand Summary (Schedule Nos. 1 to 4)

Schedule No. 6: Recommended Spare Parts

Bidders shall note that the plant and mandatory spare parts included in Schedule Nos. 1 and 2 above exclude materials used for civil, building, and other construction works. All such materials shall be included and priced under Schedule No. 4, Installation and Other Services.

- 18.4 In the Schedules, Bidders shall give the required details and a breakdown of their prices as follows:

- (a) Plant to be Supplied from Abroad (Schedule No. 1):
 - (i) the price of the plant shall be quoted carriage and insurance paid (CIP)-named place of destination basis specified in the BDS;
 - (ii) all customs duties and other taxes paid or payable in the Employer's country on the plant if the contract is awarded to the Bidder; and
 - (iii) the total price for the plant.
 - (b) Plant Supplied from Within the Employer's Country (Schedule No. 2):
 - (i) the price of the plant shall be quoted on an EXW Incoterm basis (ex works, ex factory, ex warehouse, ex showroom, as applicable), including all customs duties and sales and other taxes already paid or payable on the components and raw material used in the manufacture or assembly of plant quoted ex works or ex factory, or on the previously imported plant of foreign origin quoted ex warehouse, ex showroom;
 - (ii) sales tax and other taxes payable in the Employer's country on the plant if the contract is awarded to the Bidder, and
 - (iii) the total price for the plant.
 - (c) Design Services. (Schedule No. 3). Rates or prices shall include all taxes, duties, levies, and charges payable in the Employer's country as of 28 days prior to the deadline for submission of Bids.
 - (d) Installation and Other Services (Schedule No. 4) shall be quoted separately and shall include rates or prices for local transportation, insurance, and other services incidental to delivery of the plant, all labour, contractor's equipment, temporary works, materials, consumables, and all matters and things of whatsoever nature, including operations and maintenance services, the provision of operations and maintenance manuals, training, etc., where identified in the Bidding Document, as necessary for the proper execution of the installation and other services, including all taxes, duties, levies, and charges payable in the Employer's country as of 28 days prior to the deadline for submission of bids.
 - (e) Recommended spare parts (Schedule No. 6) shall be quoted separately as specified in either subparagraph (a) or (b) above in accordance with the origin of the spare parts.
- 18.5 The current edition of Incoterms, published by the International Chamber of Commerce shall govern.
- 18.6 The prices shall be either fixed or adjustable as specified in the BDS.
- (a) In the case of Fixed Price, prices quoted by the Bidder shall be fixed during the Bidder's performance of the contract and not subject to variation on any account. A Bid submitted with an adjustable price quotation will be treated as nonresponsive and rejected.
 - (b) In the case of Adjustable Price, prices quoted by the Bidder shall be subject to adjustment during performance of the contract to reflect changes in the cost elements such as labour, material, transport, and contractor's equipment in accordance with the procedures specified in the corresponding appendix to the Contract Agreement. A Bid

submitted with a fixed price quotation will not be rejected, but the price adjustment will be treated as zero. Bidders are required to indicate the source of labour and material indexes in the corresponding Form in Section 4 (Bidding Forms).

- 18.7 If so indicated in BDS 1.1, Bids are being invited for individual lots (contracts) or for any combination of lots (packages). Bidders wishing to offer any price reduction (discount) for the award of more than one contract shall specify in their Letter of Price Bid the price reductions applicable to each package, or alternatively, to individual contracts within the package, and the manner in which the price reductions will apply.
- 19. Currencies of Bid and Payment**
- 19.1 The currency(ies) of the bid shall be, as specified in the BDS.
- 19.2 Bidders may be required by the Employer to justify, to the Employer's satisfaction, their local and foreign currency requirements.
- 20. Period of Validity of Bids**
- 20.1 Bids shall remain valid for the period specified in the BDS after the bid submission deadline date prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as nonresponsive.
- 20.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with ITB 21, it shall also be extended 28 days beyond the deadline of the extended bid validity period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its Bid.
- 21. Bid Security/ Bid Securing Declaration**
- 21.1 Unless otherwise specified in the BDS, the Bidder shall furnish as part of its Bid, in original form, either a Bid-Securing Declaration or a bid security as specified in the BDS. In the case of a bid security, the amount and currency shall be as specified in the BDS.
- 21.2 If a Bid-Securing Declaration is required pursuant to ITB 21.1, it shall use the form included in Section 4 (Bidding Forms). The Employer will declare a Bidder ineligible to be awarded a Contract for a specified period of time, as indicated in the BDS, if a Bid-Securing Declaration is executed.
- 21.3 If a bid security is specified pursuant to ITB 21.1, the bid security shall be, at the Bidder's option, in any of the following forms:
- (a) an unconditional bank guarantee,
 - (b) an irrevocable letter of credit, or
 - (c) a cashier's or certified check,
- all from a reputable source from an eligible country as described in Section 5 (Eligible Countries). In the case of a bank guarantee, the bid security shall be submitted using either the Bid Security Form included in Section 4 (Bidding Forms) or another form acceptable to the Employer. The form must include the complete name of the Bidder. The bid security shall be valid for 28 days beyond the original validity period of the Bid, or beyond

any period of extension if requested under ITB 20.2.

- 21.4 Unless otherwise specified in the BDS, any Bid not accompanied by a substantially compliant bid security or Bid-Securing Declaration, if one is required in accordance with ITB 21.1, shall be rejected by the Employer as nonresponsive.
- 21.5 If a bid security is specified pursuant to ITB 21.1, the bid security of the unsuccessful Bidder shall be returned as promptly as possible upon the successful Bidder's furnishing of the performance security pursuant to ITB 45.
- 21.6 If a bid security is specified pursuant to ITB 21.1, the bid security of successful Bidders shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required performance security.
- 21.7 The bid security may be forfeited or the Bid-Securing Declaration executed:
 - (a) if a Bidder withdraws its Bid during the period of bid validity specified by the Bidder on the Letters of Technical Bid and Price Bid, except as provided in ITB 20.2 or
 - (b) if the successful Bidder fails to:
 - (i) sign the Contract in accordance with ITB 44;
 - (ii) furnish a performance security in accordance with ITB 45; or
 - (iii) accept the arithmetical corrections of its Bid in accordance with ITB 36.
- 21.8 The bid security or the Bid-Securing Declaration of a Joint Venture shall be in the name of the Joint Venture that submits the Bid. If the Joint Venture has not been legally constituted at the time of bidding, the bid security or the Bid-Securing Declaration shall be in the names of all future partners as named in the letter of intent referred to in ITB 4.1.

22. Format and Signing of Bid

- 22.1 The Bidder shall prepare one original set of the Technical Bid and one original set of the Price Bid comprising the Bid as described in ITB 11 and clearly mark it "ORIGINAL - TECHNICAL BID" and "ORIGINAL - PRICE BID". Alternative bids, if permitted in accordance with ITB 13, shall be clearly marked "ALTERNATIVE". In addition, the Bidder shall submit copies of the Bid, in the number specified in the BDS and clearly mark each of them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.
- 22.2 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the BDS and shall be attached to the Bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the bid, except for unamended printed literature, shall be signed or initialed by the person signing the Bid. If a Bidder submits a deficient authorization, the Bid shall not be rejected in the first instance. The Employer shall request the Bidder to submit an acceptable

authorization within the number of days as specified in the BDS. Failure to provide an acceptable authorization within the prescribed period of receiving such a request shall cause the rejection of the Bid.

- 22.3 A Bid submitted by a Joint Venture shall be signed so as to be legally binding on all partners.
- 22.4 Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.

D. Submission and Opening of Bids

23. Submission, Sealing, and Marking of Bids

- 23.1 Bidders may submit their Bids by mail or by hand. When so specified in the BDS, Bidders shall have the option of submitting their Bids electronically. Procedures for submission, sealing and marking are as follows:
- (a) Bidders submitting Bids by mail or by hand shall enclose the original and each copy of the Bid, including alternative Bids, if permitted in accordance with ITB 13, in separate sealed envelopes, duly marking the envelopes as "ORIGINAL," "ALTERNATIVE," and "COPY." These envelopes containing the original and the copies shall then be enclosed in one single envelope. The rest of the procedure shall be in accordance with ITB 23.2 to ITB 23.6.
 - (b) Bidders submitting Bids electronically shall follow the electronic bid submission procedures specified in the BDS.
- 23.2 The inner and outer envelopes shall
- (a) bear the name and address of the Bidder,
 - (b) be addressed to the Employer in accordance with ITB 24.1, and
 - (c) bear the specific identification of this bidding process indicated in the BDS 1.1.
- 23.3 The outer envelopes and the inner envelopes containing the Technical Bid shall bear a warning not to open before the time and date for the opening of Technical Bid, in accordance with ITB 27.1.
- 23.4 The inner envelopes containing the Price Bid shall bear a warning not to open until advised by the Employer in accordance with ITB 27.7.
- 23.5 Alternative Bids, if permissible in accordance with ITB 13, shall be prepared, sealed, marked, and delivered in accordance with the provisions of ITB 20 and ITB 21, with the inner envelopes marked in addition "ALTERNATIVE NO...." as appropriate.
- 23.6 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

24. Deadline for Submission of Bids

- 24.1 Bids must be received by the Employer at the address and no later than the date and time indicated in the BDS.

- 24.2 The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

25. Late Bids

- 25.1 The Employer shall not consider any Bid that arrives after the deadline for submission of Bids, in accordance with ITB 24. Any Bid received by the Employer after the deadline for submission of Bids shall be declared late, rejected, and returned unopened to the Bidder.

26. Withdrawal, Substitution, and Modification of Bids

- 26.1 A Bidder may withdraw, substitute, or modify its Bid after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 22.2, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Bid must accompany the respective written notice. All notices must be:
- (a) prepared and submitted in accordance with ITB 22 and ITB 23 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked "Withdrawal," "Substitution," "Modification;" and
 - (b) received by the Employer prior to the deadline prescribed for submission of Bids, in accordance with ITB 24.
- 26.2 Bids requested to be withdrawn in accordance with ITB 26.1 shall be returned unopened to the Bidders.
- 26.3 No Bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of Bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Technical Bid or any extension thereof.

27. Bid Opening

- 27.1 The Employer shall open the Technical Bids in public at the address, on the date, and time specified in the BDS in the presence of Bidder's designated representatives and anyone who choose to attend. Any specific electronic bid opening procedures required if electronic bidding is permitted in accordance with ITB 23.1, shall be as specified in the BDS. The Price Bids will remain unopened and will be held in custody of the Employer until the specified time of their opening. If the Technical Bid and the Price Bid are submitted together in one envelope, the Employer may reject the entire Bid. Alternatively, the Price Bid may be immediately resealed for later evaluation.
- 27.2 First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding Bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at bid opening.
- 27.3 Second, outer envelopes marked "SUBSTITUTION" shall be opened. The inner envelopes containing the Substitution Technical Bid and/or Substitution Price Bid shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Bidder unopened. Only the Substitution Technical Bid, if any, shall be opened, read out, and recorded. Substitution Price Bid will remain unopened in accordance with ITB 27.1. No envelope shall be substituted unless the corresponding

Substitution Notice contains a valid authorization to request the substitution and is read out and recorded at bid opening.

27.4 Next, outer envelopes marked "MODIFICATION" shall be opened. No Technical Bid and/or Price Bid shall be modified unless the corresponding Modification Notice contains a valid authorization to request the modification and is read out and recorded at the opening of Technical Bids. Only the Technical Bids, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Price Bids, both Original as well as Modification, will remain unopened in accordance with ITB 27.1.

27.5 All other envelopes holding the Technical Bids shall be opened one at a time, and the following read out and recorded:

- (a) the name of the Bidder;
- (b) whether there is a modification or substitution;
- (c) the presence of a bid security or a Bid-Securing Declaration, if required; and
- (d) any other details as the Employer may consider appropriate.

Only Technical Bids and alternative Technical Bids read out and recorded at bid opening shall be considered for evaluation. Unless otherwise specified in the BDS, all pages of the Letter of Technical Bid are to be initialed by at least three representatives of the Employer attending the bid opening. No Bid shall be rejected at the opening of Technical Bids except for late Bids, in accordance with ITB 25.1.

27.6 The Employer shall prepare a record of the opening of Technical Bids that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, substitution, or modification; and alternative Bids; and the presence or absence of a bid security or a Bid-Securing Declaration, if one was required. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders who submitted Bids on time, and posted online when electronic bidding is permitted.

27.7 At the end of the evaluation of the Technical Bids, the Employer will invite bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Price Bids. The date, time, and location of the opening of Price Bids will be advised in writing by the Employer. Bidders shall be given reasonable notice of the opening of Price Bids.

27.8 The Employer will notify Bidders in writing who have been rejected on the grounds of their Technical Bids being substantially nonresponsive to the requirements of the Bidding Document and return their Price Bids unopened.

27.9 The Employer shall conduct the opening of Price Bids of all Bidders who submitted substantially responsive Technical Bids, in the presence of Bidders' representatives who choose to attend at the address, on the date, and time specified by the Employer. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.

27.10 All envelopes containing Price Bids shall be opened one at a time and the

following read out and recorded:

- (a) the name of the Bidder;
- (b) whether there is a modification or substitution;
- (c) the Bid Prices, including any discounts and alternative offers; and
- (d) any other details as the Employer may consider appropriate.

Only Price Bids, discounts, and alternative offers read out and recorded during the opening of Price Bids shall be considered for evaluation. Unless otherwise specified in the BDS, all pages of the Letter of Price Bid and Price Schedules are to be initialed by at least three representatives of the Employer attending bid the opening. No Bid shall be rejected at the opening of Price Bids.

- 27.11 The Employer shall prepare a record of the opening of Price Bids that shall include, as a minimum: the name of the Bidder, the Bid Price (per lot if applicable), any discounts, and alternative offers. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders who submitted Bids on time, and posted online when electronic bidding is permitted.

E. Evaluation and Comparison of Bids

- | | |
|--|--|
| 28. Confidentiality | <p>28.1 Information relating to the evaluation of Bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on the Contract award is communicated to all Bidders.</p> <p>28.2 Any attempt by a Bidder to influence the Employer in the evaluation of the Bids or Contract award decisions may result in the rejection of its Bid.</p> <p>28.3 Notwithstanding ITB 28.2, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it should do so in writing.</p> |
| 29. Clarification of Bids | <p>29.1 To assist in the examination, evaluation, and comparison of the Technical and Price Bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or prices in the Price Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids, in accordance with ITB 36.</p> <p>29.2 If a Bidder does not provide clarifications of its Bid by the date and time set in the Employer's request for clarification, its Bid may be rejected.</p> |
| 30. Deviations, Reservations, and Omissions | <p>30.1 During the evaluation of Bids, the following definitions apply:</p> <ul style="list-style-type: none"> (a) "Deviation" is a departure from the requirements specified in the Bidding Document; |

- (b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and
- (c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Document.

31. Examination of Technical Bids

- 31.1 The Employer shall examine the Technical Bid to confirm that all documents and technical documentation requested in ITB 11.2 have been provided, and to determine the completeness of each document submitted. If any of these documents or information is missing, the Bid may be rejected.
- 31.2 The Employer shall confirm that the following documents and information have been provided in the Technical Bid. If any of these documents or information is missing, the offer shall be rejected.
- (a) Letter of Technical Bid;
 - (b) written confirmation of authorization to commit the Bidder;
 - (c) Bid Security or Bid-Securing Declaration, if applicable; and
 - (d) Technical Proposal in accordance with ITB 17.

32. Responsiveness of Technical Bid

- 32.1 The Employer's determination of a bid's responsiveness is to be based on the contents of the Bid itself, as defined in ITB11.
- 32.2 A substantially responsive Technical Bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,
- (a) if accepted, would:
 - (i) affect in any substantial way the scope, quality, or performance of the plant and services specified in the Contract; or
 - (ii) limit in any substantial way, inconsistent with the Bidding Document, the Employer's rights or the Bidder's obligations under the proposed Contract; or
 - (b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.
- 32.3 The Employer shall examine the technical aspects of the Bid submitted in accordance with ITB 17, Technical Proposal, in particular to confirm that all requirements of Section 6 (Employer's Requirements) have been met without any material deviation, reservation, or omission.
- 32.4 If a Bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

33. Nonmaterial Nonconformities

- 33.1 Provided that a Bid is substantially responsive, the Employer may waive any nonconformities in the Bid that do not constitute a material deviation, reservation, or omission.

- 33.2 Provided that a Bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the Price Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.
- 33.3 Provided that a Bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component. The adjustment shall be made using the method indicated in Section 3 (Evaluation and Qualification Criteria).

**34. Detailed
Evaluation of
Technical Bids**

- 34.1 The Employer will carry out a detailed technical evaluation of the Bids not previously rejected as being substantially nonresponsive, to determine whether the technical aspects are in compliance with the Bidding Document. The Bid that does not meet minimum acceptable standards of completeness, consistency, and detail, and the specified minimum and/or maximum requirements for specified functional guarantees, will be treated as nonresponsive and hence rejected. To reach such a determination, the Employer will examine and compare the technical aspects of the bids on the basis of the information supplied by the Bidders, taking into account the following:
- (a) overall completeness and compliance with the Employer's Requirements; deviations from the Employer's Requirements; conformity of the plant and services offered with specified performance criteria; suitability of the plant and services offered in relation to the environmental and climatic conditions prevailing at the site; and quality, function and operation of any process control concept included in the Bid. The Bid that does not meet minimum and/or maximum acceptable standards of completeness, consistency, and detail will be rejected for non-responsiveness;
 - (b) type, quantity, and long-term availability of mandatory and recommended spare parts and maintenance services; and
 - (c) other relevant factors, if any, listed in Section 3 (Evaluation and Qualification Criteria).
- 34.2 Where alternative technical solutions have been allowed in accordance with ITB 13, and offered by the Bidder, the Employer will make a similar evaluation of the alternatives. Where alternatives have not been allowed but have been offered, they shall be ignored.

**35. Eligibility and
Qualification of
the Bidder**

- 35.1 The Employer shall determine to its satisfaction during the evaluation of Technical Bids whether a Bidder meets the eligibility and qualifying criteria specified in Section 3 (Evaluation and Qualification Criteria).
- 35.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 15.

- 35.3 An affirmative determination shall be a prerequisite for the opening and evaluation of a Bidder's Price Bid. A negative determination shall result into the disqualification of the Bid, in which event the Employer shall return the unopened Price Bid to the Bidder.
- 35.4 The capabilities of the manufacturers and subcontractors proposed in its Bid for the major items of plant and services to be used by the lowest evaluated Bidder will also be evaluated for acceptability in accordance with Section 3 (Evaluation and Qualification Criteria). Their participation should be confirmed with a letter of intent between the parties, as needed. Should a manufacturer or subcontractor be determined to be unacceptable, the Bid will not be rejected, but the Bidder will be required to propose, without changing its bid price, an acceptable substitute manufacturer or subcontractor meeting the minimum technical specifications stated in Section 6 (Employer's Requirements). If a Bidder does not provide an acceptable substitute manufacturer or subcontractor by the date and time set in the Employer's request for substitution of manufacturer or subcontractor, its Bid may be rejected.
- 35.5 Prior to signing the Contract, the corresponding Appendix to the Contract Agreement shall be completed, listing the approved manufacturers or subcontractors for each item concerned.
- 36. Correction of Arithmetical Errors**
- 36.1 During the evaluation of Price Bids, the Employer shall correct arithmetical errors on the following basis:
- (a) where there are errors between the total of the amounts given under the column for the price breakdown and the amount given under the Total Price, the amounts given under the column for the price breakdown shall prevail and the Total Price will be corrected accordingly;
 - (b) where there are errors between the total of the amounts of Schedule Nos. 1 to 4 and the amount given in Schedule No. 5 (Grand Summary), the total of the amounts of Schedule Nos. 1 to 4 shall prevail and the Schedule No. 5 (Grand Summary) will be corrected accordingly;
 - (c) if there is a discrepancy between the grand total price given in Schedule No. 5 (Grand Summary) and the bid amount in item (c) of the Letter of Price Bid, the grand total price given in Schedule No. 5 (Grand Summary) will prevail and the bid amount in item (c) of the Letter of Price Bid will be corrected; and
 - (d) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetical error, in which case the amount in figures shall prevail subject to (a), (b), and (c) above.
- 36.2 If the Bidder that submitted the lowest evaluated Bid does not accept the correction of errors, its Bid shall be disqualified and its bid security may be forfeited or its Bid-Securing Declaration executed.
- 37. Conversion to Single Currency**
- 37.1 For evaluation and comparison purposes, the currency(ies) of the Bid shall be converted into a single currency as specified in the BDS .

- 38. Margin of Preference** 38.1 Unless otherwise specified in the BDS, a margin of preference shall not apply.
- 39. Evaluation of Price Bids** 39.1 The Employer shall use the criteria and methodologies listed in this clause. No other evaluation criteria or methodologies shall be permitted.
- 39.2 I. To evaluate a Price Bid, the Employer shall consider the following:
- (a) the bid price, excluding provisional sums and the provision, if any, for contingencies in the Price Schedules;
 - (b) price adjustment for correction of arithmetical errors in accordance with ITB 36.1;
 - (c) price adjustment due to discounts offered in accordance with ITB 18.7;
 - (d) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 33.3;
 - (e) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 37; and
 - (f) the evaluation factors indicated in Section 3 (Evaluation and Qualification Criteria).
- II. The Employer's evaluation of a Bid will exclude and not take into account,
- (a) in the case of Plant and Mandatory Spare Parts (Schedule No. 1) supplied from abroad, all taxes and duties, applicable in the Employer's country and payable on the Plant and Mandatory Spare Parts if the Contract is awarded to the Bidder; and
 - (b) in the case of Plant and Mandatory Spare Parts (Schedule No. 2) supplied from within the Employer's country, sales and other taxes, applicable in the Employer's country and payable on the Plant and Mandatory Spare Parts if the Contract is awarded to the Bidder.
- 39.3 If price adjustment is allowed in accordance with ITB 18.6, the estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.
- 39.4 If this Bidding Document allows Bidders to quote separate prices for different lots (contracts), and the award to a single Bidder of multiple lots (contracts), the methodology to determine the lowest evaluated price of the lot (contract) combinations, including any discounts offered in the Letter of Price Bid, is specified in Section 3 (Evaluation and Qualification Criteria).
- 39.5 If the Bid, which results in the lowest Evaluated Bid Price, is seriously unbalanced or front loaded in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Price Schedules, to demonstrate the internal consistency of those prices with the methods and time schedule proposed. After evaluation of the price analyses, taking into consideration the terms of payments, the Employer may require that the amount of the performance security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.
- 40. Comparison of Bids** 40.1 The Employer shall compare all substantially responsive Bids to determine the lowest evaluated Bid, in accordance with ITB 39.2.

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| 41. Employer's Right to Accept Any Bid, and to Reject Any or All Bids | 41.1 The Employer reserves the right to accept or reject any Bid, and to annul the bidding process and reject all Bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all Bids submitted and specifically, bid securities, shall be promptly returned to the Bidders. |
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F. Award of Contract

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| 42. Award Criteria | 42.1 The Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated Bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be eligible and qualified to perform the Contract satisfactorily. |
| 43. Notification of Award | 43.1 Prior to the expiration of the period of bid validity, the Employer shall notify the successful Bidder, in writing, that its Bid has been accepted.

43.2 At the same time, the Employer shall also notify all other Bidders of the results of the bidding. The Employer will publish in an English language newspaper or well-known freely accessible website the results identifying the Bid and lot numbers, and the following information: (i) name of each Bidder who submitted a bid; (ii) bid prices as read out at bid opening; (iii) name and evaluated prices of each bid that was evaluated; (iv) name of Bidders whose Bids were rejected and the reasons for their rejection; and (v) name of the winning Bidder, and the price it offered, as well as the duration and summary scope of the contract awarded. After publication of award, unsuccessful Bidders may request in writing to the Employer for a debriefing seeking explanations on the grounds on which their Bids were not selected. The Employer shall promptly respond in writing to any unsuccessful Bidder who, after publication of contract award, request for a debriefing.

43.3 Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract. |
| 44. Signing of Contract | 44.1 Promptly after notification, the Employer shall send the successful Bidder the Contract Agreement.

44.2 Within 28 days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer. |
| 45. Performance Security | 45.1 Within 28 days of the receipt of notification of award from the Employer, the successful Bidder shall furnish the performance security in accordance with the conditions of contract, subject to ITB 39.5, using for that purpose the Performance Security Form included in Section 9 (Contract Forms), or another form acceptable to the Employer.

45.2 Failure of the successful Bidder to submit the above-mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security or execution of the Bid-Securing Declaration. In that event, the Employer may award the Contract to the next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily. |



**Procurement of Plant
Design, Supply and Installation
JAIPUR METRO RAIL CORPORATION LIMITED
BIDDING DOCUMENT
for
Procurement
of**

NCB No.-JP/EW/1B/E2

**DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION,
TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV
AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA
SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID
TRANSPORT SYSTEM PROJECT PHASE-1B**

PART-I BIDDING PROCEDURES

Section 2 - Bid Data Sheet (BDS)

**JAIPUR METRO RAIL CORPORATION LTD.
Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**

Section 2 - Bid Data Sheet

This section consists of provisions that are specific to each procurement and supplement the information or requirements included in Section 1 - Instructions to Bidders.

A. General

ITB 1.1	<p>The number of the Invitation for Bids (IFB) is :</p> <p>The Employer is:</p> <p style="text-align: center;">JAIPUR METRO RAIL CORPORATION LTD. Khanij Bhawan, Tilak Marg, C-Scheme, Jaipur (Rajasthan), India, PIN-302 005</p> <p>The ICB may be read as National Competitive Bidding (NCB)</p> <p>The name of the NCB: JP/EW/1B/E2</p> <p>Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 KV AC traction (Rigid OHE), 33 KV Auxiliary Sub Stations (ASS), Associated Cabling and SCADA Systems for underground corridors of Jaipur Mass Rapid Transport System Project Phase-1B</p> <p>The identification number of the NCB is: JP/EW/1B/E2</p> <p>The number and identification of lots (contracts) comprising this NCB is: One</p> <hr/>
ITB 2.1	<p>The Borrower is: INDIA</p> <p>The borrower has received the financing from Asian Development Bank for the project defined below.</p> <p>The name of the Project is: Jaipur Metro Rail Project (Phase-1B).</p>

B. Contents of Bidding Documents

ITB 7.1	<p>For <u>clarification purposes</u> only, the Employer's address is:</p> <p>Attention: Director Project</p> <p>Street address: RAJSICO Building, Udyog Bhawan, Tilak Marg, C-Scheme</p>
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	<p>Floor/Room number: 3rd floor</p> <p>City: Jaipur (Rajasthan)</p> <p>ZIP code: 302 005</p> <p>Country: India</p> <p>Telephone: +91-141-5192 452/456</p> <p>Fax: +91-141-5192 451</p> <p>E-mail address: jmrctender1bew@gmail.com</p>
ITB 7.4	<p>A Pre-Bid meeting will take place. If a Pre-Bid meeting will take place, date, time and place are as follows :</p> <p>Date: 15.05.2017</p> <p>Time: 11.00 hrs</p> <p>Place: Jaipur Metro Rail Corporation Limited RAJSICO Building, , Udyog Bhawan ,Tilak Marg, C-Scheme, Jaipur (Rajasthan) 302 005, India</p> <p>Bidder is requested to submit any questions/clarification, if any, in writing to reach the Employer by 08.05.2017.</p> <p>A site visit conducted by the Employer will be organized at the request of the bidder.</p>

C. Preparation of Bids

ITB 11.2 (k)	<p>The Bidder shall submit with its Technical Bid the following additional documents:</p> <ul style="list-style-type: none"> (i) One set of original Bid Documents issued by the Employer. All the pages of every part of the Bid Documents issued by the Employer and submitted by the Bidder shall be stamped and signed by the authorized signatory of the Bidder. (ii) Tender Index: The Bidder shall include with his Bid an index which cross refers all of the Employer's requirements elaborated in these documents to all the individual sections within this Bid for the Technical Package. The bid package must be clearly presented, all pages numbered and aid out in a logical sequence with main and sub headings to facilitate evaluation.
ITB 11.3 (d)	<p>The Bidder shall submit with its Price Bid the following additional documents:</p> <p>Tender Index: The Bidder shall include with his Bid an index which cross refers all of the Employer's requirements elaborated in these documents to all the</p>

	individual sections within this Bid for the Financial Package. The bid package must be clearly presented, all pages numbered and aid out in a logical sequence with main and sub headings to facilitate evaluation.
ITB 12.1	The units and rates in figures entered into the Price Schedules should be typewritten or if written by hand, must be in print form. Price Schedules not presented accordingly may be considered nonresponsive.
ITB 13.1	Alternative bids are not permitted.
ITB 13.2	Alternatives to the Time Schedule shall not be permitted.
ITB 13.4	Alternative technical solutions shall be permitted for the following parts of the plant and services: N/A
ITB 16.1 (b)	The period following completion of plant and services in accordance with provisions of the contract shall be 80 weeks
ITB 18.1	Bidders shall quote for all the items in the Schedule of Prices in Section-4 (Bidding Forms)
ITB 18.4(a)(i)	The Incoterm for quoting plant to be supplied from abroad is: N/A
ITB 18.6	The prices quoted by the Bidder shall be adjustable as per Appendix -2 of Section -9 (Contract forms).
ITB 19.1	<p>The currencies of the Bid shall be as follows:</p> <ul style="list-style-type: none"> (a) The prices shall be quoted either in the currency of the Bidder's home country, or in any fully convertible currency of up to three foreign currencies. (b) A Bidder expecting to incur a portion of its expenditures in the performance of the Contract in more than one currency, and wishing to be paid accordingly, shall so indicate in the Schedule of Prices and the Letter of Price Bid. (c) If some of the contract expenditures related to Design, Installation and Other Services are to be incurred in the Employer's country, such expenditures shall be quoted in either foreign and/or local currency, depending upon the currency in which the costs are to be incurred. (d) Bidders may be required by the Employer to clarify their local and foreign currency requirements, and to substantiate that the amounts included in the Price Schedules are reasonable and responsive to ITB 18.1 in which case a detailed breakdown of its foreign currency requirements shall be provided by the Bidder

	(e) During the performance of the contract, the foreign currency portions of the outstanding balance of the Contract Price may be adjusted by agreement between the Employer and the Contractor to reflect any changes in foreign currency requirements for the contract. Any such adjustment shall be effected by comparing the amounts quoted in the bid with the amounts already used in the Facilities and the Contractor's future needs for imported items.
ITB 20.1	The bid validity period shall be 180 days.
ITB 21.1	The Bidder shall furnish a bid security in the amount of: Indian Rupees 3 Million.
ITB 21.2	The ineligibility period will be: N/A
ITB 21.4	Any bid not accompanied by an irrevocable and callable bid security shall be rejected by the Employer as nonresponsive. However, if a bidder submits a bid security that deviates in form, amount, and/or period of validity, the Employer shall request the Bidder to submit a compliant bid security within 14 days of receiving such a request. Failure to provide a compliant bid security within the prescribed period of receiving such a request shall cause the rejection of the Bid.
ITB 22.1	In addition to the original Bid, the number of copies is: Two
ITB 22.2	<p>The written confirmation of authorization to sign on behalf of the Bidder shall consist of :-</p> <ul style="list-style-type: none"> (a) A written power of attorney authorizing the signatory (ies) of the Bid to commit the Bidder of each member of the partnership, consortium or joint venture. In case of Foreign Partner(s), Power of Attorney(s) and Board Resolution confirming authority on the person(s) issuing the Power of Attorney for such actions, shall be submitted duly notarized by the notary public of origin. (b) Where the Bidder comprises a partnership, consortium or joint venture, the Bidder shall update the following information: <ul style="list-style-type: none"> (i) Memorandum of Understanding signed by all Participants shall be provided; and (ii) Nomination of one of the members of the partnership, consortium or joint venture to be in-charge; and this authorization shall be covered in the Power of Attorney signed by the legally authorized signatories of all members of consortium or joint venture.
ITB 22.2	The Bidder shall submit an acceptable authorization within 14 days.

D. Submission and Opening of Bids

ITB 23.1	Bidders shall not have the option of submitting their bids electronically.
ITB 23.1 (b)	N/A
ITB 24.1	<p>For <u>bid submission purposes</u> only, the Employer's address is</p> <p>Attention: Director Project</p> <p>Street address: RAJSICO Building, Udyog Bhawan, Tilak Marg, C-Scheme</p> <p>Floor/Room number: 3rd floor</p> <p>City: Jaipur (Rajasthan)</p> <p>ZIP code: 302 005</p> <p>Country: India</p> <p>The deadline for bid submission is</p> <p>Date: 31.05.2017</p> <p>Time: 15.00 hrs</p>
ITB 27.1	<p>The bid opening of Technical Bids shall take place at</p> <p>Jaipur Metro Rail Corporation Limited,</p> <p>RAJSICO Building, Udyog Bhawan, Tilak Marg,</p> <p>C-Scheme, City: Jaipur (Rajasthan)</p> <p>ZIP Code: 302 005</p> <p>Country: India</p> <p>Date: 31.05.2017</p> <p>Time: Immediately after the deadline for bid submission</p>
ITB 27.1	"Electronic bid opening procedure" - NOT APPLICABLE.
ITB 27.5	The Letter of Technical Bid shall be initialed by at least 3 representatives of the Employer attending Technical Bid opening.
ITB 27.10	The Letter of Price Bid and Price Schedules shall be initialed by at least 3 representatives of the Employer attending the Price Bid opening.

E. Evaluation and Comparison of Bids

ITB 37.1	<p>The currency that shall be used for bid evaluation and comparison purposes to convert all bid prices expressed in various currencies into a single currency is: Indian Rupees (INR)</p> <p>The source of the selling exchange rate shall be: Reserve Bank of India</p> <p>The date for the selling exchange rate shall be: 28 days prior to the deadline for submission of the bids.</p>
ITB 38.1	<p>A margin of preference shall not apply.</p>



**Procurement of Plant
Design, Supply and Installation
JAIPUR METRO RAIL CORPORATION LIMITED
BIDDING DOCUMENT
for
Procurement
of**

NCB No.-JP/EW/1B/E2

**DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION,
TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV
AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA
SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID
TRANSPORT SYSTEM PROJECT PHASE-1B**

PART-I BIDDING PROCEDURES

Section 3 - Evaluation and Qualification Criteria

JAIPUR METRO RAIL CORPORATION LTD.

**Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**

Section 3 - Evaluation and Qualification Criteria

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1. Evaluation

1.1 Technical Evaluation

In addition to the criteria listed in ITB 34.1 (a) – (b), other relevant factors are as follows:

Evaluation of the Bidder's Technical Proposal will include an assessment of the Bidder's technical capacity to mobilize key equipment and personnel for the contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section 6 (Employer's Requirements).

Non-compliance with equipment and personnel requirements described in Section 6 (Employer's Requirements) shall not normally be a ground for bid rejection and such non-compliance will be subject to clarification during bid evaluation and rectification prior to contract award.

1.2 Alternative Technical Solutions

N/A

1.3 Economic Evaluation

In addition to the criteria listed in ITB 39.2 I (a)–(e), other relevant factors are as follows:

Adjustments in price that result from the procedures outlined below shall be added, for purposes of comparative evaluation only, to arrive at an "Evaluated Bid Price." Bid prices quoted by Bidders shall remain unaltered.

1.3.1 Quantifiable Deviations and Omissions

Quantifiable Deviations and Omissions from the contractual obligations: the evaluation shall be based on the evaluated cost of fulfilling the contract in compliance with all contractual obligations under this Bidding Document.

1.3.2 Time Schedule

Time to complete the plant and services from the effective date specified in Article 3 of the Contract Agreement for determining the time for completion of pre-commissioning activities is: 80 weeks. No credit will be given for earlier completion.

1.3.3 Operating and Maintenance Costs

N/A

1.3.4 Functional Guarantees of the facilities

N/A

1.3.5 Work, Services, Facilities, etc., to be provided by the Employer

N/A

1.3.6 Specific Additional Criteria

N/A

1.3.7 Domestic Preference

N/A

1.4 Multiple Contracts

N/A

2. Qualification

It is the legal entity or entities comprising the Bidder, and not the Bidder's parent companies, subsidiaries, or affiliates, that must satisfy the qualification criteria described below.

2.1 Eligibility

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	

2.1.1 Nationality

Nationality in accordance with ITB Subclause 4.2.	must meet requirement	must meet requirement	must meet requirement	not applicable	Forms ELI - 1; ELI - 2 with attachments
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2.1.2 Conflict of Interest

No conflicts of interest in accordance with ITB Subclause 4.3.	must meet requirement	must meet requirement	must meet requirement	not applicable	Letter of Technical Bid
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2.1.3 ADB Eligibility

Not having been declared ineligible by ADB, as described in ITB Subclause 4.4.	must meet requirement	must meet requirement	must meet requirement	not applicable	Letter of Technical Bid
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2.1.4 Government-Owned Enterprise

Bidder required meeting conditions of ITB Subclause 4.5.	must meet requirement	must meet requirement	must meet requirement	not applicable	Forms ELI - 1; ELI - 2 with attachments
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2.1.5 United Nations Eligibility

Not having been excluded by an act of compliance with a UN Security Council resolution in accordance with ITB Subclause 4.7.	must meet requirement	must meet requirement	must meet requirement	not applicable	Letter of Technical Bid
--	-----------------------	-----------------------	-----------------------	----------------	-------------------------

2.2 Pending Litigation and Arbitration

Pending litigation and arbitration criterion shall apply.¹

2.2.1 Pending Litigation and Arbitration

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
All pending litigation and arbitration, if any, shall be treated as resolved against the Bidder and so shall in total not represent more than 60 percent of the Bidder's net worth calculated as the difference between total assets and total liabilities.	must meet requirement by itself or as partner to past or existing Joint Venture	not applicable	must meet requirement by itself or as partner to past or existing Joint Venture	not applicable	Form LIT - 1

2.3 Financial Situation

2.3.1 Historical Financial Performance

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Submission of audited financial statements or, if not required by the law of the Bidder's country, other financial statements acceptable to the Employer, for the last three years to demonstrate the current soundness of the Bidder's financial position. As a minimum, the Bidder's net worth for the last year calculated as the difference between total assets and total liabilities should be positive.	must meet requirement	not applicable	must meet requirement	not applicable	Form FIN - 1 with attachments

2.3.2 Average Annual Turnover

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Minimum average annual turnover of INR 20 Crore calculated as total certified payments received for contracts in progress or completed, within the last three years.	must meet requirement	must meet requirement	must meet 20 % of the requirement	must meet 30 % of the requirement	Form FIN - 2

2.3.3 Financial Resources¹

If the bid evaluation process and the decision for the award of the Contract takes more than one (1) year from the date of bid submission, Bidders shall be asked to resubmit their current contract commitments and latest information on financial resources supported by latest audited accounts / audited financial statements, or if not required by the law of the Bidder's country, other financial statements acceptable to the Employer, and the Bidders' financial capacity shall be reassessed on this basis.

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
The Bidder must demonstrate that it has the financial resources to meet:					
(a) its current contract commitments, as defined in FIN-4 (Total Financial Requirements for Current Contract Commitments), plus	must meet requirement	not applicable	must meet requirement for its own contractual commitments	not applicable	Form FIN - 4
(b) The requirements for the Subject Contract of INR 4 Crore.	must meet requirement	must meet requirement	must meet 20 % (A)	must meet 30% (B)	Form FIN – 3 and Form FIN - 4

NOTE: The entries made under clause 2.3.2 and 2.3.3 and Section-4 (FIN-1 to FIN-5) shall have cross references to submitted financial statements. The above Statements shall also be certified by Chartered Accountant.

2.4 Bidder's Experience

2.4.1 Contracts of Similar Size and Nature

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Participation in at least one contract as contractor / sub contractor that has been successfully or substantially completed within the last 15 (Fifteen) years and that is similar to the proposed contract, where the value of the Bidder's participation is INR 3 Crore or more . The similarity of the Bidder's participation shall be based on the physical size, nature of works, complexity, methods, technology or other characteristics as described in Section 6 (Employer's Requirements).	Must meet requirement	not applicable	Not applicable	must meet requirement	Form EXP – 1

2.4.2 Experience in Key Activities

(Must be complied with by the Bidder in all. In case of a Joint Venture Bidder, at least one of the partners must have experience in the key activity. If the activity can be subcontracted, the requirement must be specified in criterion 2.5 of Section 3.)

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
For the above or other contracts executed during the period stipulated in 2.4.1 above, a minimum experience in the following key activities:					
1 Design, Detail Engineering, , supply, Installation, Testing and commissioning of 1.5 kV and above Traction (Rigid OCS) in Metro Rail Systems / Suburban Railways / Mainline Railways Projects	must meet requirements	Not applicable	Not applicable	must meet requirements	Form EXP - 2
2, Detail Engineering, , supply, installation, testing and commissioning of 11 kV and above Indoor auxiliary substation in Metro Rail System / Suburban / Mainline Railway Project.	must meet requirements	Not applicable	Not applicable	must meet requirements	Form EXP - 2

3. Installation & commissioning of SCADA for Traction or Power Supply System for Metro Rail System / Suburban / Mainline Railway Project.	must meet requirements	Not applicable	Not applicable	must meet requirements	Form EXP - 2
4. 11kV and above cable laying, testing & commissioning in Government / PSU	must meet requirements	Not applicable	Not applicable	must meet requirements	Form EXP - 2

Note: Key activities at S. No 3 & 4 can be subcontracted as specified in criteria 2.5 of section 3

2.5 Subcontractors

Subcontractors or Manufacturers for the following major items of plant and services must meet the following minimum criteria, herein listed for that item. Failure to comply with this requirement will result in rejection of the subcontractor as well as the Bidder.

Item No.	Description of Item	Minimum Criteria to be met	Documents Submission Requirements
1	Experience of Installation & Commissioning of SCADA for Traction or Power Supply System for Metro Rail System / Suburban / Mainline Railway	At least one completed similar work of Metro Rail System / Suburban / Mainline Railway Project within last 15 years	EXP-3
2	Experience of 11kV and above cable laying, testing & commissioning	At least one completed similar work of Government / PSU within last 15 year .	EXP-3



**Procurement of Plant
Design, Supply and Installation
JAIPUR METRO RAIL CORPORATION LIMITED
BIDDING DOCUMENT
for
Procurement
of**

NCB No.-JP/EW/1B/E2

**DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION,
TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV
AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA
SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID
TRANSPORT SYSTEM PROJECT PHASE-1B**

PART-I BIDDING PROCEDURES

Section 4 –Vol. I - Bidding Forms (BDF)

JAIPUR METRO RAIL CORPORATION LTD.

**Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**

Section 4 - Bidding Forms

This section contains the forms to be completed by the Bidder and submitted as part of its Bid.

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Letter of Technical Bid

-- Note --

The bidder must accomplish the Letter of Technical Bid on its letterhead clearly showing the bidder's complete name and address.

Date:

NCB No.: **JP/EW/1B/E2**

Invitation for Bid No.: **JP/EW/1B/E2**

To:

Chairman and Managing Director
JAIPUR METRO RAIL CORPORATION LTD.
Khanij Bhawan, Tilak Marg,
C-Scheme, Jaipur (Rajasthan),
India, PIN-302 005

NCB No.-JP/EW/1B/E2: Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 kV AC traction (Rigid OHE), 33 kV Auxiliary Sub Stations (ASS), Associated Cabling and SCADA Systems for underground corridors of Jaipur Mass Rapid Transport System Project Phase-1B

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 8.
- (b) We offer to design, manufacture, test, deliver, install, pre-commission, and commission in conformity with the Bidding Document the following Plant and Services:

Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 kv AC traction (Rigid OHE), 33 kv Auxiliary Sub Stations (ASS), Associated Cabling and SCADA Systems for underground corridors of Jaipur Mass Rapid Transport System Project Phase-1B
- (c) Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period of 180 days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
- (d) We, including any Subcontractors or Manufacturers for any part of the Contract, have or will have nationalities from eligible countries, in accordance with ITB 4.2.

- (e) We, including any Subcontractors or Suppliers for any part of the Contract, do not have any conflict of interest in accordance with ITB 4.3.
- (f) We are not participating, as a Bidder in more than one bid in this bidding process in accordance with ITB 4.3(e), other than alternative offers submitted in accordance with ITB 13.
- (g) Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible by ADB, under the Employer's country laws or official regulations or by an act of compliance with a decision of the United Nations Security Council.
- (h) [We are not a government-owned enterprise] / [We are a government-owned enterprise but meet the requirements of ITB 4.5].¹
- (i) We agree to permit ADB or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by ADB.
- (j) If our Bid is accepted, we commit to mobilizing key equipment and personnel in accordance with the requirements set forth in Section 6 (Employer's Requirements) and our technical proposal, or as otherwise agreed with the Employer.
- (k) It is confirmed and declared that we, or any of our associate, have not been engaged in any fraudulent and corrupt practice as defined in ITB 3 and clause 6 of General Conditions of Contract.
- (l) We do hereby undertake that we have not been banned for business by any central / state government department or public sector undertaking and also that none of our work was rescinded by the JMRC after award of contract during last 5 years due to non performance

Name

In the capacity of

Signed

Duly authorized to sign the Bid for and on behalf of

Date

¹ Use one of the two options as appropriate.

Letter of Price Bid

-- Note --

The bidder must accomplish the Letter of Price Bid on its letterhead clearly showing the bidder's complete name and address.

Date:

NCB No.: **JP/EW/1B/E2**

Invitation for Bid No.: **JP/EW/1B/E2**

To:
Chairman and Managing Director
JAIPUR METRO RAIL CORPORATION LTD.
Khanij Bhawan, Tilak Marg,
C-Scheme, Jaipur (Rajasthan),
India, PIN-302 005

NCB No.-JP/EW/1B/E2: Design, Detail Engineering, Mnaufacture, Supply, Installation, Testing and Commissioning of 25 kv AC traction (Rigid OHE), 33 kv Auxiliary Sub Stations (ASS), Associated Cabling and SCADA Systems for underground corridors of Jaipur Mass Rapid Transport System Project Phase-1B

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Document, including Addenda issued in accordance with Instructions to Bidders (ITB) 8. _____
- (b) We offer to design, manufacture, test, deliver, install, pre-commission, and commission in conformity with the Bidding Document the following Plant and Services:

Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 kv AC traction (Rigid OHE), 33 kv Auxiliary Sub Stations (ASS), Associated Cabling and SCADA Systems for underground corridors of Jaipur Mass Rapid Transport System Project Phase-1B

- (c) The total bid price, excluding any discounts offered in item (d) below is the sum of

[amount of foreign currency in words], [amount in figures], and [amount of local currency in words], [amount in figures]

- (d) *The total bid price from the Grand Summary (Schedule No. 5) should be entered by the Bidder inside this box. Absence of the total bid price in the Letter of Price Bid may result in the rejection of the bid.*

he discounts offered and the methodology for their application are as follows: _____

- (e) Our Bid shall be valid for a period of 180 days from the date fixed for the submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
- (f) If our Bid is accepted, we commit to obtain a performance security in accordance with the Bidding Document.
- (g) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract: ¹

Name of Recipient	Address	Reason	Amount
.....
.....

- (h) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed.
- (i) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.
- (j) We agree to permit ADB or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by ADB.

Name

In the capacity of

Signed

Duly authorized to sign the Bid for and on behalf of

Date

¹ If none has been paid or is to be paid, indicate "None."

Price Schedules

PREAMBLE

General

1. The Price Schedules are divided into separate Schedules as follows:
BOQ Part 1 for ROCS Works
BOQ Part 2 for ASS Works and General requirement
2. The Schedules do not generally give a full description of the plant to be supplied and the services to be performed under each item. Bidders shall be deemed to have read the Employer's Requirements and other sections of the Bidding Document and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.
3. If Bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITB 7 prior to submitting their bid.
4. The Country of Origin of the items quoted for shall be as per the list of eligible countries under Section 5. The following extract of ADB guidelines shall be referred to, while deciding the country of origin of each item by the bidder.

"To be eligible, goods must have been mined, grown, or produced in an ADB member country. That is, the goods should have come into existence in an ADB member country in the form in which they are to be purchased. Goods are produced or deemed to come into existence when through manufacturing, processing, or substantial and major assembling of components, another commercially recognized product results that is substantially different from its components. For example, where a computer is assembled or manufactured needs to be an eligible source, and not the source of the computer's components."
5. After award of the contract, the bidder shall be at liberty to change the country of origin of any item contained in the BoQ at vendor approval stage, without any financial obligation on either side, irrespective of the country of origin, indicated at the time of quoting of the bid. However, the items shall be as per the specifications as given in the Employer's Requirement (Section 6) and the Country of Origin shall be as per Section 5 in any case.

Pricing

6. The units and rates in figures entered into the Price Schedules should be typewritten or if written by hand, must be in print form. Price Schedules not presented accordingly may be considered nonresponsive. Any alterations necessary due to errors, etc., shall be initialed by the Bidder.
As specified in the Bid Data Sheet and Special Conditions of Contract, prices shall be fixed and firm for the duration of the Contract, or prices shall be subject to adjustment in accordance with the corresponding Appendix (Price Adjustment) to the Contract Agreement.
7. Bid prices shall be quoted in the manner indicated and in the currencies specified in the Instructions to Bidders in the Bidding Document.
For each item, Bidders shall complete each appropriate column in the respective Schedules, giving the price breakdown as indicated in the Schedules.
Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section 6 (Employer's Requirements) or elsewhere in the Bidding Document.

8. Payments will be made to the Contractor in the currency or currencies indicated under each respective item.
9. When requested by the Employer for the purposes of making payments or part payments, valuing variations or evaluating claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.
10. **“The bidder can quote the bid price against each item in INR or in Foreign Currency/Currencies or in a combination of both as indicated in Section 2 – (Bid Data Sheet). The bidder is advised to read the BoQ provisions carefully and quote the price accordingly. Each column of the currency is to be quoted independently and no inter conversion of currency is required”.**

Schedules of Rates and Prices

Refer Section-4 Volume-2 (BoQ)

BOQ Part 1 for ROCS works.

BOQ Part 2 for ASS Works.

Bid Security

Bank Guarantee

.....*Bank's name, and address of issuing branch or office*¹.....

Beneficiary: *Name and address of employer*

Date:

Bid Security No.:

We have been informed that *name of the bidder* (hereinafter called "the Bidder") has submitted to you its bid dated (hereinafter called "the Bid") for the execution of *name of contract* under Invitation for Bids No. ("the IFB").

Furthermore, we understand that, according to your conditions, bids must be supported by a bid guarantee.

At the request of the Bidder, we *name of Bank* hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *amount in figures* (..... *amount in words*) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

- (a) has withdrawn its Bid during the period of bid validity specified by the Bidder in the Letters of Technical and Price Bid; or
- (b) does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter "the ITB"); or
- (c) having been notified of the acceptance of its Bid by the Employer during the period of bid validity, (i) fails or refuses to execute the Contract Agreement, or (ii) fails or refuses to furnish the Performance Security, in accordance with the ITB.

This guarantee will expire (a) if the Bidder is the successful Bidder, upon our receipt of copies of the Contract Agreement signed by the Bidder and the Performance Security issued to you upon the instruction of the Bidder; or (b) if the Bidder is not the successful Bidder, upon the earlier of (i) our receipt of a copy of your notification to the Bidder of the name of the successful Bidder, or (ii) 28 days after the expiration of the Bidder's bid.

Consequently, any demand for payment under this guarantee must be received by us at the office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458.²

.....*Bank's seal and authorized signature(s)*

-- Note --

In case of a joint venture, the bid security must be in the name of all partners to the joint venture that submits the bid.

¹ All italicized text is for use in preparing this form and shall be deleted from the final document.

² Or 758 as applicable.

Bid-Securing Declaration

N/A

Technical Proposal

Site Organization

Method Statement

Mobilization Schedule

Construction Schedule

Plant

Personnel

Equipment

Proposed Subcontractors for Major Items of Plant and Services

Manufacturer's Authorization

Time Schedule

Functional Guarantee of the Proposed Facilities

Site Organization

Method Statement

Mobilization Schedule

Construction Schedule

Plant

Personnel

Form PER – 1: Proposed Personnel

Bidders should provide the details of proposed personnel and their experience record in the relevant Information Forms below for each of the candidate.

1.	Title of position*
	Name
2.	Title of position*
	Name
3.	Title of position*
	Name
4.	Title of position*
	Name
etc.	Title of position*
	Name

-- Note --

* As listed in Section 6 (Employer's Requirements).

Equipment

Form EQU: Equipment

The Bidder shall provide adequate information and details to demonstrate clearly that it has the capability to meet the equipment requirements indicated in Section 6 (Employer's Requirements), using the Forms below. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

Item of Equipment		
Equipment Information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current Status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment <input type="checkbox"/> Owned <input type="checkbox"/> Rented <input type="checkbox"/> Leased <input type="checkbox"/> Specially manufactured	

Omit the following information for equipment owned by the Bidder.

Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Telex
Agreements	Details of rental/lease/manufacture agreements specific to the project	

Proposed Subcontractors and/or Manufacturers for Major Items of Plant and Services

The following Subcontractors and/or Manufacturers are proposed for carrying out the item of the facilities indicated. Bidders are free to propose more than one for each item.

Major Items of Plant and Services	Proposed Subcontractors or Manufacturers	Nationality

Manufacturer's Authorization

N/A

Time Schedule

N/A

Functional Guarantee of the Proposed Facilities

N/A

Bidder's Qualification

To establish its qualifications to perform the contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

Form ELI - 1: Bidder's Information Sheet

Bidder's Information	
Bidder's legal name	
In case of Joint Venture, legal name of each partner	
Bidder's country of constitution	
Bidder's year of constitution	
Bidder's legal address in country of constitution	
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)	
<p>Attached are copies of the following documents:.</p> <p><input type="checkbox"/> 1. In case of single entity, articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and ITB 4.2</p> <p><input type="checkbox"/> 2. Authorization to represent the firm or Joint Venture named above, in accordance with ITB 22.2</p> <p><input type="checkbox"/> 3. In case of Joint Venture, letter of intent to form Joint Venture or Joint Venture agreement, in accordance with ITB 4.1</p> <p><input type="checkbox"/> 4. In case of a government-owned enterprise, any additional documents not covered under 1 above required to comply with ITB 4.5</p>	

Form ELI - 2: Joint Venture Information Sheet

Each member of the Joint Venture must fill out this form separately. Subcontractor must fill out this form.

Joint Venture/Subcontractor Information	
Bidder's legal name	
Joint Venture Partner's or Subcontractor's legal name	
Joint Venture Partner's or Subcontractor's country of constitution	
Joint Venture Partner's or Subcontractor's year of constitution	
Joint Venture Partner's or Subcontractor's legal address in country of constitution	
Joint Venture Partner's or Subcontractor's authorized representative information (name, address, telephone numbers, fax numbers, e-mail address)	
Attached are copies of the following documents: <ul style="list-style-type: none"> <input type="checkbox"/> 1. Articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and ITB 4.2 <input type="checkbox"/> 2. Authorization to represent the firm named above, in accordance with ITB 22.2 <input type="checkbox"/> 3. In the case of government-owned enterprise, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5 	

Subcontractors are those listed in Technical Proposal – Proposed Subcontractors and/or Manufacturers for Major Items of Plant and Services.

Form LIT – 1: Pending Litigation and Arbitration

Each Bidder must fill out this form if so required under Criterion 2.2 of Section 3 (Evaluation and Qualification Criteria) to describe any pending litigation or arbitration formally commenced against it.

In case of joint ventures, each Joint Venture Partner must fill out this form separately, and provide the Joint Venture Partner name below:

Joint Venture Partner: _____

Pending Litigation and Arbitration			
<p>Choose one of the following:</p> <p><input type="checkbox"/> No pending litigation and arbitration.</p> <p><input type="checkbox"/> Below is a description of all pending litigation and arbitration against the Bidder (or each Joint Venture member if Bidder is a Joint Venture).</p>			
Year	Matter in Dispute	Value of Pending Claim in INR Equivalent	Value of Pending Claim as a Percentage of Net Worth

- Note -

This form shall only be included if Criterion 2.2 of Section 3 (Evaluation and Qualification Criteria) is applicable.

Form FIN - 1: Historical Financial Performance

Each Bidder must fill out this form.

In case of joint ventures, each Joint Venture Partner must fill out this form separately, and provide the Joint Venture Partner name below:

Joint Venture Partner: _____

Financial Data for Previous Years [INREquivalent]		
Year 1:	Year 2:	Year __:

Information from Balance Sheet

Total Assets (TA)			
Total Liabilities (TL)			
Net Worth = TA-TL			
Current Assets (CA)			
Current Liabilities (CL)			
Working Capital = CA - CL			

Most Recent Working Capital		To be obtained for most recent year and carried forward to FIN-3 Line 1; in case of Joint Ventures, to the corresponding Joint Venture Partner's FIN-3
-----------------------------	--	--

Information from Income Statement

Total Revenues			
Profits Before Taxes			
Profits After Taxes			

- ☐ Attached are copies of financial statements (balance sheets including all related notes, and income statements) for the last three years, as indicated above, complying with the following conditions.
- Unless otherwise required by Section 3 of the Bidding Documents, all such documents reflect the financial situation of the legal entity or entities comprising the Bidder and not the Bidder's parent companies, subsidiaries or affiliates.
 - Historical financial statements must be audited by a certified accountant.
 - Historical financial statements must be complete, including all notes to the financial statements.
 - Historical financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).

Form FIN - 2: Average Annual Turnover

Each Bidder must fill out this form.

The information supplied should be the Annual Turnover of the Bidder or each member of a Joint Venture in terms of the amounts billed to clients for each year for work in progress or completed, converted to INR at the specified exchange rate at the end of the period reported.

In case of joint ventures, each Joint Venture Partner must fill out this form separately, and provide the Joint Venture Partner name below:

Joint Venture Partner: _____

Annual Turnover Data for the Last . . . Years			
Year	Amount Currency	Exchange Rate	INR Equivalent
Average Annual Turnover			

Form FIN – 3: Availability of Financial Resources

Bidders must demonstrate sufficient financial resources, usually comprising of Working Capital supplemented by credit line statements or overdraft facilities and others to meet the Bidder's financial requirements for

- (a) its current contract commitments, and
- (b) the subject contract.

In case of joint ventures, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner name below:

Joint Venture Partner: _____

Financial Resources		
No.	Source of financing	Amount (INR equivalent)
1	Working Capital (to be taken from FIN-1)	
2	Credit Line ^a	
3	Other Financial Resources	
Total Available Financial Resources		

^a To be substantiated by a letter from the bank issuing the line of credit.

Form FIN- 4: Financial Requirements for Current Contract Commitments

Bidders (or each Joint Venture partner) should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

In case of joint ventures, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner name below:

Joint Venture Partner: _____

Current Contract Commitments						
No.	Name of Contract	Employer's Contact (Address, Tel, Fax)	Contract Completion Date	Outstanding Contract Value (X)	Remaining Contract Period in months (Y)	Monthly Financial Resources Requirement (X / Y)
1						
2						
3						
4						
Total Monthly Financial Requirement for Current Contract Commitments						INR

Form FIN - 5: Compliance Check of Financial Resources (Criterion 2.3.3 of Section 3)**Form FIN-5A: For Single Entities**

For Single Entities:	Total Available Financial Resources from FIN-3 (C)	Total Monthly Financial Requirement for Current Contract Commitments (CCC) from FIN-4 (D)	Available Financial Resources net of CCC (C-D)		Requirement ^a
_____ (Name of Bidder)	_____	_____	_____		100% of Requirement from Section 3 - 2.3.3(b) _____

Form FIN-5B: For Joint Ventures

For Joint Ventures:	Total Available Financial Resources from FIN-3 (C)	Total Monthly Financial Requirement for Current Contract Commitments (CCC) from FIN-4 (D)	Available Financial Resources net of CCC (C-D)		Requirement ^a
One Partner:					
_____ (Name of Partner)	_____	_____			B(%) of Requirement _____
Each (Other) Partner:					
_____ (Name of Partner 1)	_____	_____			A(%) of Requirement _____
_____ (Name of Partner 2)	_____	_____			A(%) of Requirement _____
_____ (Name of Partner 3)	_____	_____			A(%) of Requirement _____
All partners combined			(C-D) ^b = _____		100% of Requirement from Section 3 - 2.3.3(b) _____

- Note -

Form FIN - 5 is made available for use by the bidder as a self-assessment tool, and by the employer as evaluation work sheet, to determine compliance with financial resources.

^a Requirement for the subject contract is defined in Criterion 2.3.3(b) of Section 3. Value A is the required percentage of the subject contract, which each partner must meet; and value B is the required percentage of the subject contract, which one partner must meet. A and B values are defined in Criterion 2.3.3 of Section 3 (Evaluation and Qualification Criteria).

^b $\Sigma (C - D)$ = sum of available financial resources net of current contract commitments (CCC) for all partners.

Form EXP – 1: Contracts of Similar Size and Nature

Fill out one (1) form per contract.

Contract of Similar Size and Nature																			
Contract No of		Contract Identification																	
Award Date		Completion Date																	
Role in Contract	<input type="checkbox"/> Contractor <input type="checkbox"/> Management Contractor <input type="checkbox"/> Subcontractor																		
Total Contract Amount	INR																		
If partner in a Joint Venture or subcontractor, specify participation of total contract amount	Percent of Total	Amount																	
Employer's name Address Telephone number Fax number E-mail																			
Description of the similarity in accordance with Criterion 2.4.1 of Section 3																			
<p>Design, Detail Engineering, supply, Installation, Testing and commissioning of 1.5 kV and above Traction (Rigid OCS) in Metro Rail Systems / Suburban Railways / Mainline Railways Projects.</p> <p style="text-align: center;">or</p> <p>Detail Engineering, , supply, Installation, Testing and commissioning of 11 kV and above Indoor auxiliary substation in Metro Rail System / Suburban / Mainline Railway Project.</p> <p>Note:- In case bidder claims experience for a project undertaken as a member of JV, the particular firm's position in the JV needs to be clearly brought out in the clients' certificate or Joint Venture MOU/Agreement. The bidder shall clearly identify the following to meet the experience requirement:-</p> <table border="1" style="width: 100%;"> <thead> <tr> <th>Type of Services Rendered</th> <th>Lead Partner</th> <th>Partner-1</th> <th>Partner-2</th> </tr> </thead> <tbody> <tr> <td>Design/ Design Verification / Detail Engineering</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Supply</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Installation, Testing and Commissioning</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>The experience will be considered as per the percentage participation of the applicant in the JV or Association of the completed work.</p>				Type of Services Rendered	Lead Partner	Partner-1	Partner-2	Design/ Design Verification / Detail Engineering				Supply				Installation, Testing and Commissioning			
Type of Services Rendered	Lead Partner	Partner-1	Partner-2																
Design/ Design Verification / Detail Engineering																			
Supply																			
Installation, Testing and Commissioning																			

Form EXP - 2: Experience in Key Activities

Fill out one (1) form per contract.

Contract with Similar Key Activities		
Contract No of	Contract Identification	
Award Date		Completion Date
Role in Contract	<input type="checkbox"/> Contractor <input type="checkbox"/> Management Contractor <input type="checkbox"/> Subcontractor	
Total Contract Amount	INR	
If partner in a Joint Venture or subcontractor, specify participation of total contract amount	Percent of Total	Amount
Employer's name Address Telephone number Fax number E-mail		
Description of the key activities in accordance with Criterion 2.4.2 of Section 3		
	<ol style="list-style-type: none"> 1 Design, Detail Engineering, , supply, Installation, Testing and commissioning of 1.5 kV and above Traction (Rigid OCS) in Metro Rail Systems / Suburban Railways / Mainline Railways Projects. 2. Detail Engineering, supply, installation, testing and commissioning of 11 kV and above Indoor auxiliary substation in Metro Rail System / Suburban / Mainline Railway Project. 3. Installation & commissioning of SCADA for Traction or Power Supply System for Metro Rail System / Suburban / Mainline Railway Project. 4. 11kV and above cable laying, testing & commissioning in Government / PSU. 	

Note; The Key Activity at Sl. No. 3 & 4 above can be sub contracted.

Form EXP - 3: Subcontractors

Fill out one (1) form per contract.

Contract for the Major Items		
Contract No of	Contract Identification	
Award Date		Completion Date
Role in Contract	<input type="checkbox"/> Contractor <input type="checkbox"/> Management Contractor <input type="checkbox"/> Subcontractor	
Total Contract Amount	INR	
If partner in a Joint Venture or subcontractor, specify participation of total contract amount	Percent of Total	Amount
Employer's name Address Telephone number Fax number E-mail		
Description of the major items in accordance with Criterion 2.5 of Section 3		
	<ol style="list-style-type: none"> Experience of installation & commissioning of SCADA for Traction or Power Supply System for Metro Rail System / Suburban / Mainline Railway. Experience of 11kV and above cable laying, testing & commissioning in Government/PSU. <p>Note:- The bidder shall enclose the undertaking/ MOU from the intended sub-contractors to substantiate their willingness and experience in the concern field. The details regarding completion of works shall be submitted for bidder and intended sub-contractors. The proposal will be evaluated accordingly.</p>	

1. Fill up one (1) form per contract.
2. Value of successfully completed portion of any ongoing work up to period of bid preparation will also be considered for qualification of construction experience criteria. Substantially completed means 80% of the contract value.
3. For successfully or substantially completed works, value of work done shall be updated to 'the deadline for submission of bids' price level assuming 2% inflation per year for foreign currency and 5% inflation for Indian currency. Substantially completed means 80% of the contract value. For the purpose of evaluation, all prices will be converted to INR by using Exchange (Selling) rates **as per Section-2 BDS clause ITB 37.1.**
4. Documentary proof such as successfully or substantially completed certificates from client clearly indicating the nature/scope of work, actual completion cost and actual date of completion for such work should be submitted. In case the work is executed for private client, copy of work order, bill of quantities, bill wise details of payment received certified by Chartered Accountant under his signature, stamp and membership number, Tax Deducted at Source (TDS) certificates for all payments received and copy of final/last bill paid by client shall be submitted.
5. Only the value of contract as executed by the Bidder/Member in its own name should be indicated. Where a work is undertaken by a group, only that portion of the contract which is undertaken by the concerned applicant/member should be indicated and the remaining done by the other members of the group be excluded. This is to be substantiated with documentary evidence which clearly mentioned the length of tunnel and number of stations along with its plan area completed.



**Procurement of Plant
Design, Supply and Installation
JAIPUR METRO RAIL CORPORATION LIMITED
BIDDING DOCUMENT
for
Procurement
of**

NCB No.-JP/EW/1B/E2

**DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION,
TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV
AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA
SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID
TRANSPORT SYSTEM PROJECT PHASE-1B**

PART-I BIDDING PROCEDURES

Section 5 – Eligible Countries (ELC)

**JAIPUR METRO RAIL CORPORATION LTD.
Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**

Section 5 - Eligible Countries

- | | |
|---------------------------------|-------------------------------------|
| 1. Afghanistan | 35. Micronesia, Federated States of |
| 2. Armenia | 36. Mongolia |
| 3. Australia | 37. Myanmar |
| 4. Austria | 38. Nauru |
| 5. Azerbaijan | 39. Nepal |
| 6. Bangladesh | 40. The Netherlands |
| 7. Belgium | 41. New Zealand |
| 8. Bhutan | 42. Norway |
| 9. Brunei Darussalam | 43. Pakistan |
| 10. Cambodia | 44. Palau |
| 11. Canada | 45. Papua New Guinea |
| 12. China, People's Republic of | 46. Philippines |
| 13. Cook Islands | 47. Portugal |
| 14. Denmark | 48. Samoa |
| 15. Fiji | 49. Singapore |
| 16. Finland | 50. Solomon Islands |
| 17. France | 51. Spain |
| 18. Georgia | 52. Sri Lanka |
| 19. Germany | 53. Sweden |
| 20. Hong Kong, China | 54. Switzerland |
| 21. India | 55. Taipei, China |
| 22. Indonesia | 56. Tajikistan |
| 23. Ireland | 57. Thailand |
| 24. Italy | 58. Timor-Leste |
| 25. Japan | 59. Tonga |
| 26. Kazakhstan | 60. Turkey |
| 27. Kiribati | 61. Turkmenistan |
| 28. Korea, Republic of | 62. Tuvalu |
| 29. Kyrgyz Republic | 63. United Kingdom |
| 30. Lao PDR | 64. United States of America |
| 31. Luxembourg | 65. Uzbekistan |
| 32. Malaysia | 66. Vanuatu |
| 33. Maldives | 67. Viet Nam |
| 34. Marshall Islands | |



**Procurement of Plant
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**DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION,
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SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID
TRANSPORT SYSTEM PROJECT PHASE-1B**

PART-I BIDDING PROCEDURES

**Section 4 – Vol. II - Bidding Forms (BDF)
(Schedules of Prices)**

**JAIPUR METRO RAIL CORPORATION LTD.
Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**

BID TOTAL – JP/EW/1B/E2

In accordance with the accompanying and signed form of bid, we (the Bidder) offer to supply, install, test, commission, and remedy at any defects of the whole said works for “Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 kv AC traction (Rigid OHE), 33 kv Auxiliary Sub Stations (ASS), Associated Cabling and SCADA Systems for underground corridors of Jaipur Mass Rapid Transport System Project Phase-1B”, in conformity with the said drawings, particular specifications, conditions of contracts and other contract documents of bid for the following sums:

DESCRIPTION	Total Brought from below Bills	
	INR	Foreign Currency
PRICES FOR WORKS ON UNDERGROUND SECTION FROM CHHOTI CHAUPAR TO BADI CHAUPAR		
Part 1 25 kV AC traction (Rigid OHE)		
Part 2 33 kV Auxiliary Sub Stations (ASS), Associated Cabling and SCADA Systems and General Requirement under the contract		
TOTAL SUM		

TOTAL SUM IN WORDS, OF INDIAN RUPEES
TOTAL SUM IN WORDS, OF FOREIGN CURRENCY

DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID TRANSPORT SYSTEM PROJECT PHASE-1B

CONTRACT PACKAGE – JP/EW/1B/E2

**Part-1
Rigid OHE**

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INSTRUCTIONS FOR COMPLETING THE PRICING DOCUMENT

General Requirements

This Part of the Contract is a fixed Lump Sum Price Contract for “Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 kV AC Traction (RIGID OHE), 33 kV Auxiliary Sub Stations (ASS), associated cabling and SCADA Systems for Underground Corridors of Jaipur Mass Rapid Transport System Project Phase-1B”

Bidders’s is requested to refer clause 6 of SCC while quoting the rates.

A. Apportionment of Fixed Lump Sum Price to Sections and to Cost Centres and Milestones under each Section

- 1 The whole of Works including design is divided into Sections, primarily on geographical basis. Each Section is divided into the various Cost Centres named according to their general scope of work.
- 2 The fixed Lump Sum price for the whole of Works shall be apportioned by the bidder amongst the various sections. The apportioned amount for each Section will be further distributed among various Cost Centres included in that Section, separately for foreign currency and for the Rupee portion. The apportioned amount for each Cost Centre will be further distributed amongst various Milestones included in that Cost Centre, separately for the Foreign Currency and the Rupee Portion.
- 3 The sum of amounts shown against Milestones in a Cost Centre is the Cost Centre total that is to be carried forward to the Section Summary. The division of the respective Cost Centre totals between Indian Currency and Foreign currency shall be shown in the said Summary. The Section Summary will be carried forward to the bid Total.
- 4 The scope and extent of the Works are to be ascertained by reference to the Contract Documents as a whole and shall not be limited in any manner whatsoever by the descriptions of the Cost Centres under each Section or of the Milestones under each Cost Centre, as given in the Appendices to the Pricing document.

5 Not used.

B. Milestones Achievement Periods

1. The Milestones under each Cost Centre shall identify verifiable steps towards the completion of the work within that Cost Centre under a Section. The Bidders's shall indicate the periods (in weeks from the Commencement Date of the Works) within which he shall achieve each Milestone.

C. Milestone Payment Schedule (MPS)

1. The MPS completed by the Contractor shall set out the maximum cumulative amount for all Cost Centres for all Sections put together in relation to each month for which payment may be sought in accordance with Clause 7 of the SCC. This information should also be presented in a tabular form. Monthly Cash Flows for the Contract will form part of the Pricing Document.
2. The MPS covers the period which will commence on the first day of the calendar month next after the month containing the Commencement Date of the Works as per the Contract. The first application for interim payment may be made not earlier than during the month following the calendar month next after the month containing the Commencement Date of the Works, such first application relating to the first month (i.e. month 1) of the MPS.

3. **The price shall not be unbalanced therefore, the price quoted in the Cost Center-C (Installation and Site Testing) and Cost Center-D (System Acceptance Tests, Integrated Testing and Commissioning) shall not be less than 15% and 10% of the price quoted in the Cost Center-B (Manufacture and Delivery).**

D. BidTotal

1. The Bid Total submitted by the Bidders's shall be in the format shown in the Pricing Document.
2. The Pricing Document contains Sections, Cost Centres under each Section, and Milestones under each Cost Centre. The Sections, Cost Centres and Milestones have been prepared to indicate the extent of detail required in the Tender. The Bidders's shall prepare and complete documents, in this format, as being his bid and submit as part of the Financial Package.
3. The Pricing Document completed and submitted by the Bidders's, as part of his bid, should use an indexing and page numbering system such that its extent and completeness is clearly evident.

E. Currency

1. Section Totals, Cost Centre Totals and Milestone amounts shall be indicated in Indian Rupees and in a foreign currency as per clause 19.1 of ITB stated in BDS, wherever required.

F. Milestones

1. Cost Centres under each Section are fixed and shall not be changed by the Bidders's. The Bidders's, however, may add additional Milestones in a Cost Centre provided such Milestones genuinely related to that Cost Centre activity. The Cost Centres represent the major items of the Works for which the Employer will pay the Contractor, and the Bidders's shall ensure that he has allowed for all his costs he requires for the Contract to meet the Employer's Requirements.
2. If during the course of execution, it becomes necessary, to meet the Employer's Requirements (as indicated in these Tender Documents), to add more Milestones in a Cost Centre, the Lump Sum Price of the whole of Works, which will remain unaltered, will be reapportioned amongst the Sections, and further redistributed under the Cost Centres in each Sections and the Milestones in each Cost Centre. The liability of the Employer will be limited to the fixed Lump sum Price already accepted and the Contractor will have no right to claim any thing over and above the fixed Lump Sum price for any such addition of Milestones in any Cost Centre. The decision of the Employer will be final and binding in such matters and will not be subject to Conciliation or Arbitration.
3. The Milestones represent the completion of verifiable activities to be undertaken by the Contractor. A date for the achievement of each Milestone expressed as a number of weeks from the Commencement Date of the Works shall be entered in the column provided. Milestones that lead to achievement of a Stage must always precede the Key Date for achievement of that Stage. Milestones shall be converted to Calendar dates when the Notice to Proceed is issued.

G. Terms of Payment (for only Milestone works)

1. In case of 'Lump Sum' contract with cost centre and Milestone payment, the fixed Lump Sum Price shall be apportioned by the Contractor amongst the various Cost Centres. The amount thus apportioned under each Cost Centre will be further apportioned amongst various Milestones with the approval of the Employer. The Contractor shall be entitled to submit to the

Engineer requests for interim payments only upon the achievement of one or more of the Milestones described in the Cost Centre.

2. At the beginning of each month, the Engineer shall issue to the Contractor certificate in respect of each Milestone due to be achieved in the preceding month stating:
 - a.) the date on which the Milestone was achieved; or
 - b.) the non-achievement of the Milestone.
3. The Contractor shall submit a statement in three copies to the Engineer at the beginning of each month, in a form approved by the Engineer, showing the amounts to which the Contractor is entitled, together with supporting documents; including Milestone Certificates. The statement shall include the following items, as applicable, which shall be expressed in the various currencies in which the Contract Price is payable, in the sequence listed:
 - a.) the amount due in respect of Milestones certified achieved by the Engineer under each Cost Centre;
 - b.) any amounts to be added and deducted for the advance payments and recovery thereof;
 - c) any other additions or deductions is due and approved by the Engineer in accordance with the Contract; and
 - (d) the deduction of the amounts certified in all previous Interim Payment Certificates.The Contractor shall not submit more than one request for interim payment per month.
4. If any Milestone is not achieved by the end of the month in which it is scheduled to be achieved, the Engineer shall suspend the payment relating to the Cost Centre in which the Milestone is included. Payments suspended under this Clause shall be resumed by being included in the next application for interim payment made after the Milestone is achieved.
5. In case of 'Lump Sum' or 'Item rate' contracts with payment schedule, the contractor shall be entitled to be paid from time to time, normally once in a calendar month, by way of 'on account' bill as per the payment schedule indicated in Bill of Quantity(BOQ) or as finally approved by the Engineer.
6. No amount will be certified or paid until the Employer has received, and approved, the Performance security and the parent Company Undertakings and Guarantees in accordance with Sub-Clause 4.2. Thereafter, the Engineer shall, within 21 days of receiving a statement and supporting documents, deliver to the Employer, with a copy to the Contractor, an Interim Payment Certificate showing the amount which the Engineer considers to be due; if no payment is considered to be due, the Engineer shall promptly notify the Contractor accordingly.
7. Where only a part of the payment applied for is disputed, payment certificate shall be issued for the undisputed amount. The Engineer shall have the power to omit from any of the contractor's requests for payment the value of any work executed or Materials supplied or services rendered, with which he may for the time being be dissatisfied and for that purpose and for any other reason which to him may seem proper, may delete, correct or modify the sum(s) previously certified by him as being due to the Contractor.

Appendix A 2**Vendor Approval**

It shall be obligatory for the Contractor to obtain Notice of 'No Objection' from the Engineer for the selection of the vendors for all items of work, even if the name of the vendor is specified in the Contractor's Technical Submission and the works to be done including purchase of materials and equipment is in accordance with the Standards specified in the Contract.

In case of vendor selected from the vendor list provided in the contract,

- (a) A list of vendors is provided in this contract, whose material have been used by DMRC/JMRC in U/G stations.
- (b) Contractor in general shall use the material of make as per vendor list unless specified in BOQ or equivalent meeting the Bid specifications as approved by the Employer's representative.
- (c) The contractor shall ensure the correct selection of the make meeting the specifications and its application. Before placing the order for procurement, the sample of approved make shall be verified for its suitability to the specification and application. In case Employer's representative/ engineer, (whose decision will be final and binding on both parties) considers that the make/ model proposed by the contractor does not meet the Bid requirement, the contractor will be required to propose an alternative make acceptable to the Employer's Representative.
- (d) The contractor will submit a list 'A' of vendors for all the items of the BOQ contract
 - (i) The list should include the items for which the contractor is proposing the product of the vendor list.
 - (ii) The contractor will be advised 'No Objection' with following caveat:-
 - The model etc. to be supplied will be the latest or superior one.
 - The contractor will be required to submit the technical proposal for the scrutiny
 - (iii) For the items, contractor desires to propose new vendor, proposal to be submitted in accordance as List 'B'.
 - (iv) The contractor will submit the undertaking that above lists i.e. List 'A' and List 'B' includes all the items required in the contract.

Vendor to be selected who are capable to provide good after sales services available in Jaipur during DLP and thereafter.

Vendor Approval and Selection Procedure

- (1) In the event of contractor wanting to use alternate makes other than those stipulated, for any reason, The contractor can send a proposal after ensuring that what he proposes at least meets the specifications both, the quality and safety standard of the stipulated makes, the alternate proposed product should be a proven one. He shall also stand full guarantee to his alternate proposal and if at any stage it is found that the material is not suitable or meeting the Bid requirement, the contractor shall replace the material and provide the material from the vendor list alternative acceptable make without any additional cost to JMRC. The alternate makes material can be used only after an approval accorded by the Employer, whose decision will be final in the matter.
- (2) The approval of any equipment or product to be used shall be done in two stages:-
 - (a) **Stage-I**
 - Assessment of capability of proposed Vendor to supply a particular equipment or product, with quality and performance requirements, as required by Specifications as well as other contract conditions. The proposed product should be a proven product in service for at least 3 years.
 - Assessment of the financial and functional strength of the Vendor to supply the requisite quantity of equipment and product as per delivery schedule acceptable to contractor and engineer to deliver the project in time.
 - (b) **Stage-II**

16 Stage-II called as Technical Submission Approval Stage, selection of Equipment or product from the equipment / products manufactured / supplied by the vendor will be done. This stage includes thorough technical assessments about the conformance of the offered equipment / product to the Specifications and other requirements.
 - (c) To obtain Vendor Approval the Contractor must apply with the four sets of the following documents to the Engineer
 - (i) Company Profile and Experience of the Vendor
 - (ii) Clause wise compliance of the relevant Clauses of Specifications.
 - (iii) Details of supplies / orders executed in last ten years for the type of equipment / product offered. Supplies / orders executed for Underground Metro Systems shall be specifically mentioned
 - (iv) Details of the facilities available at the Works / Manufacturing Unit where the proposed equipment / product shall be manufactured.
 - (v) ISO 9000 Certification for the Works / Manufacturing Unit where the proposed equipment / product shall be manufactured (The Works / Manufacturing Unit where the proposed equipment / product shall be manufactured must have ISO 9000 Certification)
 - (vi) Proof regarding compliance to Manufacturer's Qualifications. The offered products must be proven in service.
 - (vii) Audited Financial Statements of the Vendor for the last three years.
 - (viii) Type test certificates/ Performance certificate from accredited laboratories for the proposed type of equipment / products to establish the technical capability of the vendor (In case, specific requirements are mentioned in the relevant sections of Specifications with regard to type testing, same shall also be complied additionally). Type test should not be more than 5 years old.
 - (ix) The vendor shall not have been blacklisted by any Govt. Agency in India.
 - (x) Any other item as required by Employer / Employer's Representative.

- (d) Contractor must certify the check list provided that vendor Proposal is complete and all the above documents are available in the Vendor Proposal. In addition, the Contractor must check / certify compliance to the Specifications before forwarding the same.
 - (e) Incomplete Vendor Proposal will not be treated as a submission and will be returned.
 - (f) Engineer will give Approval to the Vendor Proposal (received complete with all the documents mentioned above) expeditiously.
 - (g) Technical submission shall be accompanied with the calculations / other technical documents to justify the selection of any particular model of equipment / product, detailed technical features / parameters of the selected product, type test certificates from the accredited laboratories for the offered products, any other document required by the Engineer.
 - (h) Engineer will give Approval to the Technical Proposal (received complete with all the documents mentioned above) expeditiously.
- (3) It may be noted that Approval of Vendors as per Point (3) above shall only be done by Employer / Engineer after the award of the work. Vendor submissions shall not be evaluated during the Bid evaluation. Conditional Bid offers received from Bidders with particular Vendors for supply of equipment/ products will not be evaluated during evaluation and will be dealt with after award of the work.
- (4) It may further be noted that Employer / Engineer shall be under no obligation to accept equipment / products manufactured by the successful Bidder, unless it meets the entire criterion mentioned above.

For Design and Build Contracts

In addition to above, in Design and Build Contracts the following shall also be ensured for the Vendor Approval and Selection:-

1. Proven Design

The Contractor shall develop the design based on this specification and on sound proven and reliable engineering practices. The broad design details shall be submitted with technical support data in the technical bid. Detailed calculations shall be submitted to the Engineer during the design process stage for review and approval.

1.1 Systems and Sub-Systems

Manufacturer shall have at least 5 years experience of design and manufacturing of similar system. Proposed systems from the proposed manufacturing unit shall have been in use and have established their satisfactory performance and reliability for 3 years in minimum.

All sub-systems, equipments and major components etc. (hereinafter referred as 'sub-systems') shall be state-of-art and of proven design.

Proposed Systems/ sub-systems shall have been in use and have established their satisfactory performance and reliability on at least Two mass rapid transit systems (including Railway or Airports) in revenue service over a period of three years or more either outside the country of origin at an average in two different countries or in JMRC. Systems/ Sub-systems/ components used in JMRC do not get automatically qualified for use unless specifically approved by the Engineer for this project. If required by the Engineer, Contractor shall provide certificate of satisfactory performance for a period of five years or more from the Metro operators. Where similar System/ Sub-systems of a different rating are already proven in service as per the above criteria then the supply shall be based on such sub-systems.

All 'sub systems' shall be procured from the approved vendors and sourced from only such manufacturing units that have supplied the sub-systems that fulfill the proven design requirements as above.

In case the contractor proposes to use systems or sub-system(s) that do not fulfill the above said criteria then the contractor shall furnish sufficient information to prove the basic soundness and reliability of the offered systems and sub-system(s) for review of the Engineer.

The Engineer's decision on contractor's proposal shall be final and binding.

For sourcing the equipment from indigenous manufacturing facilities, following conditions shall be complied:-

- (i) In case the vendor uses his own facilities for indigenization after part supply of equipment from the approved manufacturing unit, no change in design, component type/make, quality standards, manufacture procedure, etc. shall be made without specific approval of the Engineer.
- (ii) In case OEM wants to use manufacturing facilities in India (other than his own) for items for which the OEM has been approved, it shall enter into an agreement with such selected Indian equipment manufacturer and obtain prior approval from JMRC. No change in composition, rating, type, model no., manufacturing process, quality standards, design, etc. and make of the components used in assemblies/sub-assemblies of such equipment as manufactured by the approved parent vendor shall be made without specific approval of the Engineer.
- (iii) In case OEM wishes to change/make/type specifications, etc. of any sub-components for supplies to be sourced from Indian facility, specific prior approval of the Engineer shall be obtained for changes made, model, specification, etc. Responsibility for obtaining such prior approval shall rest solely with the contractor.

Format for submitting the vendor approval request shall be given to the contractor during initial stages and approved format shall be followed throughout the contract.

Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 kV AC Traction (RIGID OHE), 33 kV Auxiliary Sub Stations (ASS), associated cabling and SCADA Systems for Underground Corridors OF Jaipur Mass Rapid Transport System Project Phase-1B

CONTRACT PACKAGE – JP/EW/1B/E2

Statement A

Bid Total

Statement A – Bid Total for ROCS (Part 1)

(THIS DOCUMENT IS TO BE PREPARED AND COMPLETED BY THE BIDDERS)

In accordance with the accompanying and signed form of tender, we (the Bidders) offer to supply, install, test, commission, and remedy at any defects of the whole said works, in conformity with the said drawings, particular specifications, conditions of contracts and other contract documents of JP/EW/1B/E2 for the following sums:

S.No.	DESCRIPTION	Total brought from above Bills	
		Indian Rupees	Foreign Currency
1.	ROCS Works (Part 1)		
Grand Total			
SUM IN WORDS, OF INDIAN RUPEES			
SUM IN WORDS, OF FOREIGN CURRENCY			

DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID TRANSPORT SYSTEM PROJECT PHASE-1B

CONTRACT PACKAGE – JP/EW/1B/E2

Statement B

Section Summaries

Statement B – SECTION SUMMARIES**Corridor - Chand Pole to Badi Chaupar**

Cost Centres	Description of Cost Centres	Amount in Foreign Currency	Amount in Indian Rupees
A	Detailed Design		
Sections- Chand Pole to Badi Chaupar			
B1	Manufacture and Delivery		
C1	Installation and Site Testing		
D1	System Acceptance Tests, Integrated Testing and Commissioning		
TOTAL CARRIED TO BID TOTAL			

SECTION – MISCELLANEOUS**Corridor- Chand Pole to Badi Chaupar**

Cost Centres	Description of Cost Centres	Amount in Foreign Currency	Amount in Indian Rupees
A	Preliminaries and General Requirements		
B	Training		
C	Spares		
D	Supervision of Maintenance		
E	Manuals		
TOTAL CARRIED TO BID TOTAL			

Statement – F

	Unit Prices for Additional Items	Amount in Foreign Currency	Amount in Indian Rupees
TOTAL CARRIED TO BID TOTAL			

DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID TRANSPORT SYSTEM PROJECT PHASE-1B

CONTRACT PACKAGE - JP/EW/1B/E2

Statement C

Brief Description of Sections

Statement C - BRIEF DESCRIPTION OF SECTIONS

The work of Chand Pole to Badi Chaupar

Sections	U/G Route Km in Section (Approx)	No of U/G Stations	Expected Date of ROD
Corridor- Chand Pole to Badi Chaupar			
Chand pole to Badi Choupar	2.119 km and Y siding of length 0.225km	2	Feb'2018
Total*	2.119 km and Y siding of length 0.225 km	2	

*Bidders's shall ascertain the length of U/G corridor for providing the ROCS in particular section from the Alignment drawings. Any change up to plus/minus 250 mtr in the Alignment of the overall corridor shall not be considered as a variation.

DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID TRANSPORT SYSTEM PROJECT PHASE-1B

CONTRACT PACKAGE - JP/EW/1B/E2

Statement D

Corridor - Chand Pole to Badi Chaupar

Corridor - Chand Pole to Badi Chaupar

COST CENTRE A -- DETAILED DESIGN

This cost centre comprises all those obligations and ongoing activities throughout the contract not associated directly with any other cost centre.

This cost centre a comprises all activities relating to the detailed design of 25kv Rigid OCS, , SSP for underground section Chand Pole to Badi Chaupar

This includes but is not limited to:

Submission of the Preliminary Design, Final Design and drawings for various equipment and subsystems including the requirement of space and mounting details.

Specifications for various equipment and subsystems,

Schedule of materials required implementing the design.

Submission of "as-built drawings".

Preliminary simulation study

Final simulation studyValidation (Auditing) of Design & Installation of Rocs.Any other item(s) considered necessary to comply with the scope of work.

Corridor - Chand Pole to Badi Chaupar

COST CENTRE A -- DETAILED DESIGN

MILE STONE NO.	WORK DESCRIPTION	Apportioned Amount		Country of Origin	Weeks for completion of Milestone from Commencement Date
	MILESTONE ACTIVITY	Amount in Foreign Currency	Amount in Indian Rupees		
	(Rigid OCS, Cabling Works including return traction cables, longitudinal and transverse bonding cables etc. in stations and tunnels, Earth System and other related works)				
A1	Preliminary design and specifications				
A2	Final design and specifications				
A3	Schedule of materials				
A4	"As-built Drawings"				
A5	Preliminary simulation study				
A6	Final simulation study				
A7	Validation (Auditing) of Design & Installation of ROCS.				
A8	Any other item(s) considered necessary to comply with the Scope of Work				
	COST CENTRE TOTAL CARRIED TO SECTION SUMMARY				

Corridor - Chand Pole to Badi Chaupar

COST CENTRE B1 – MANUFACTURE AND DELIVERY

This Cost Centre comprises all those obligations and ongoing activities throughout the Contract not associated directly with any other Cost Centre.

This includes but is not limited to receipt/ delivery of following equipment for section Chand Pole to Badi Chaupar after, factory acceptance test, provision of indemnity bond and proof of insurance:

Delivery of equipment for the Rigid OCS for corridor chand pole to badi chaupar at contractor's premises in jaipur.

Delivery of equipment for the Sub Sectioning and Paralleling Post (SSP) at Badi Chaupar station at Contractor's premises in Jaipur.

Delivery of equipment for Earthing & Bonding including thermosetting weld & cables, Tunnel Earth Wire (TEW), Return Conductor, Earth Wire, etc. for section Chand Pole to Badi Chaupar at Contractor's premises in Jaipur .

Any other item(s) considered necessary to comply with Scope of Work.

Corridor - Chand Pole to Badi Chaupar

COST CENTRE B1 -- MANUFACTURE AND DELIVERY

MILE STONE NO.	WORK DESCRIPTION	Apportioned Amount		Weeks for completion of Milestone from Commencement Date	Country of Origin
		Amount in Foreign Currency	Amount in Indian Rupees		
	MILESTONE ACTIVITY				
	Obtain the "Notice of No Objection" or "Notice of No Objection subject to..." from the Engineer for each of the following Milestone activities after: <ul style="list-style-type: none"> • Certification of factory acceptance test • Provision of Indemnity Bond • Proof of insurance 				
B1-1	Delivery Of Equipment for Rigid OCS for the Sections Chand Pole to Badi Chaupar at Contractor's premises in Jaipur.				
A	Conductor Rail, Interlocking Joints & Insulators				
B	Contact Wire				
C	Steel Parts				
D	Any Other ROCS Equipments				
B1-2	Delivery of equipment for the Sub Sectioning And Paralleling Post (SSP) at Badi Chaupar at Contractor's premises in Jaipur				
A	25kV Gas Insulated Switchgear				
B	25kV Cables				
C	3.3kV Cables				

D	Any Other Sub-Sectioning and Paralleling Post Equipments				
B1-3	Delivery of equipment for Earthing & Bonding including thermosetting weld & cables, Tunnel Earth Wire (TEW), Return Conductor, Earth Wire, etc. for section Chand Pole to Badi Chaupar section at Contractor's premises in Jaipur				
A	Overhead Protection Conductor (OPC)				
B	Return Conductor (RC)				
C	Tunnel Earth Wire (TEW)				
D	Any Other Earthing & Bonding Equipments				
B1-4	Any other item(s) considered necessary to comply with Scope of Work.				
COST CENTRE TOTAL CARRIED TO SECTION SUMMARY					

Corridor - Chand Pole to Badi Chaupar

COST CENTRE C1 – INSTALLATION AND SITE TESTING

This Cost Centre comprises all those obligations and ongoing activities throughout the Contract not associated directly with any other Cost Centre.

This includes but is not limited to delivery to site from Contractor's premises in Jaipur , submission of installation plan, installation drawings, inspection of equipment and site preparations, pre- installation tests, installation of equipment, post-installation tests, energisation and any other item(s) considered necessary to comply with the scope of work for:

Delivery to site from Contractor's premises in Jaipur, installation and testing (includes pre-installation tests and post installation tests) and energisation of all equipment for the RIGID OCS from Chand Pole To Badi Chaupar section.

Delivery to site from contractor's premises in Jaipur, installation and testing (includes pre-installation tests and post installation tests) and energisation of all equipment for the Sub Sectioning And Paralleling Post (SSP) at Badi Chaupar Station.

Delivery to site from Contractor's premises in Jaipur, installation and testing (includes pre-installation tests and post installation tests) and energisation of all equipment for Earthing & Bonding including Thermosetting weld & cables, Tunnel Earth Wire (TEW), Return Conductor, Earth Wire, etc. for section Chand Pole To Badi Chaupar.

Any other item(s) considered necessary to comply with the scope of work.

Corridor - Chand Pole to Badi Chaupar COST CENTRE C1 –INSTALLATION AND SITE TESTING

MILE STONE NO.	WORK DESCRIPTION	Apportioned Amount		Country of Origin	Weeks for completion of Milestone from Commencement Date
	MILESTONE ACTIVITY	Amount in Foreign Currency	Amount in Indian Rupees		
	Obtain the "Notice of No Objection" or "Notice of No Objection subject to..." from the Engineer for each of:				
C1-1	Delivery to Site from Contractor's premises in Jaipur, Installation and Testing (includes pre-installation tests and post installation tests) and energisation of all equipment for the Rigid OCS from Chand Pole to Badi Chaupar section.				
C1-2	Delivery to Site from Contractor's premises in Jaipur Installation and Testing (includes pre-installation tests and post installation tests) and energisation of all equipment for the Sub-Sectioning and Paralleling Post (SSP) at Badi Chaupar Station.				
C1-3	Delivery to Site from Contractor's premises in Jaipur , Installation and Testing (includes pre-installation tests and post installation tests) and energisation of all equipment for Earthing & Bonding including Thermosetting weld & cables, Tunnel Earth Wire (TEW), Return Conductor, Earth Wire, etc. for section Chand Pole to Badi Chaupar				
C1-4	Any other item(s) considered necessary to comply with the Scope of Work				
COST CENTRE TOTAL CARRIED TO SECTION SUMMARY					

Corridor - Chand Pole to Badi Chaupar

COST CENTRE D1 – SYSTEM ACCEPTANCE TESTS, INTEGRATED TESTING AND COMMISSIONING

This cost centre comprises all those obligations and ongoing activities throughout the Contract not associated directly with any other Cost Centre.

This includes but is not limited to:

System acceptance tests in accordance with accepted System Acceptance Plan.

Integrated testing and commissioning in conjunction with designated contractors.

Service Trials. Tests required for verification of design parameters.

Safety certification, in the approved format, for opening the section for revenue operation, including for Traction power.

Any other item(s) considered necessary to comply with the Scope of Work.

Corridor - Chand Pole to Badi Chaupar**COST CENTRE D1 – SYSTEM ACCEPTANCE TESTS, INTEGRATED TESTING AND COMMISSIONING**

MILE- STONE NO.	WORK DESCRIPTION	Apportioned Amount		Country of Origin	Weeks for completion of Milestone from Commencement Date
	MILESTONE ACTIVITY	Amount in Foreign Currency	Amount in Indian Rupees		
D1-1	<p>Obtain the “Notice of No Objection” or “Notice of No Objection Subject to ---” from the Engineer for the System Acceptance Test (SAT) Plan for the Cost Centres as a whole included in Section covering:</p> <p>RIGID OCS for Section Chand Pole To Badi Chaupar</p> <p>Sub Sectioning And Paralleling Post (SSP) at Badi Chaupar Station.</p> <p>Integrated Testing of SCADA system with other system wide contractors for Section Chand Pole to Badi Chaupar Earthing & Bonding Including Thermosetting Weld (if any) & Cables, Tunnel Earth Wire (TEW), Return conductor, Earth Wire, etc. for section Chand Pole To Badi Chaupar</p>				

D1-2	<p>Obtain the “Notice of No Objection” or “Notice of No Objection Subject to ---“ from the Engineer for the Integrated Testing and Commissioning Plan for:</p> <p>Rigid OCS for Section Chand Pole to Badi Chaupar SUB Sectioning and Paralleling Post (SSP) at Badi Chaupar Station.</p> <p>Integrated testing of SCADA system with other system wide Contractors for Section Chand Pole to Badi Chaupar.</p> <p>Earthing & Bonding including Thermosetting weld & cables, Tunnel Earth Wire (TEW), Return Conductor, Earth Wire, etc. for Section Chand Pole to Badi Chaupar.</p>				
D1-3	<p>Obtain the “Notice of No Objection” or “Notice of No Objection Subject to ---“ from the Engineer for the completion of System Acceptance Test (SAT) for the Cost Centres as a whole included in Section covering:</p> <p>RIGID OCS for Section Chand Pole To Badi Chaupar Sub Sectioning And Paralleling Post (SSP) at Badi Chaupar Station.</p> <p>Integrated Testing of SCADA system with other system wide contractors for Section Chand Pole to Badi Chaupar Earthing & Bonding Including Thermosetting Weld & Cables, Tunnel Earth Wire (TEW), Return conductor, Earth Wire, etc. for section Chand Pole To Badi Chaupar</p>				

D1-4	Obtain the “Notice of No Objection” or “Notice of No Objection Subject to ---“ from the Engineer for the completion of Integrated Testing and Commissioning Plan for: Rigid OCS for Section Chand Pole to Badi Chaupar SUB Sectioning and Paralleling Post (SSP) at Badi Chaupar Station. Integrated testing of SCADA system with other system wide Contractors for Section Chand Pole to Badi Chaupar. Earthing & Bonding including Thermosetting weld & cables, Tunnel Earth Wire (TEW), Return Conductor, Earth Wire, etc. for Section Chand Pole to Badi Chaupar .				
D1-5	Obtain the “Notice of No Objection” or “Notice of No Objection Subject to- “from the Engineer for completion of Service Trials.				
D1-6	Obtain the “Notice of No Objection” or “Notice of No Objection Subject to -“ from the Engineer for Detailed Safety Report				
D1-7	Obtain the “Notice of No Objection” or “Notice of No Objection Subject to --“from the Engineer for Safety Certificate.				
D1-8	Any other item(s) considered necessary to comply with the Scope of Work.				
COST CENTRE TOTAL CARRIED TO SECTION SUMMARY					

DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID TRANSPORT SYSTEM PROJECT PHASE-1B

CONTRACT PACKAGE – JP/EW/1B/E2

STATEMENT - E

SECTION—MISCELLANEOUS

Corridor - Chand Pole to Badi Chaupar

SECTION -- MISCELLANEOUS

Corridor - Chand Pole to Badi Chaupar

COST CENTRE A – PRELIMINARIES AND GENERAL REQUIREMENTS

This Cost Centre comprises all those obligations and on going activities throughout the Contract not associated directly with any other Cost Centre.

This includes but is not limited to:

- Submission of Works Programme to complete JP/EW/1B/E2 Contract.
- Submission of Project Management Plan.
- Submission of interface Management Plan and Detailed interface Documents.
- Submission of Design Submission Programme.
- Submission of Quality Assurance Plan.
- Submission of Safety Assurance Plan and Site Safety Plan.
- Submission of Environmental Plan.
- Submission of Inspection, Testing & Commissioning (including Integrated Testing & Commissioning) Plan.
- Submission of simulated Traction Power System Design.
- Any other item (s) considered necessary to comply with the Scope of Work.

SECTION -- MISCELLANEOUS**Corridor - Chand Pole to Badi Chaupar****COST CENTRE A – PRELIMINARIES AND GENERAL REQUIREMENTS**

MILE STONE NO.	WORK DESCRIPTION	Apportioned Amount		Country of Origin	Weeks for completion of Milestone from Commencement Date
	MILESTONE ACTIVITY	Amount in Foreign Currency	Amount in Indian Rupees		
	Obtain the "Notice of No Objection" or "Notice of No Objection subject to..." from the Engineer for:				
A1	Works Programme for complete Contract.				
A2	Project Management Plan				
A3	Interface Management Plan and Detailed Interface Document				
A4	Design Submission Programme				
A5	Quality Assurance Plan				
A6	Safety Assurance Plan & Site Safety Plan.				
A7	Environment Plan				
A8	Inspection, Testing, Commissioning and Integrated Testing Plan				
A9	Simulated System Design for Traction Power System				
A10	Any other item(s) considered necessary by the Contractor to comply with the Scope of Work.				
COST CENTRE TOTAL CARRIED TO SECTION SUMMARY					

SECTION -- MISCELLANEOUS
Corridor - Chand Pole to Badi Chaupar
COST CENTRE B – TRAINING

This Cost Centre comprises all those obligations and ongoing activities throughout the Contract not associated directly with any other Cost Centre.

This shall include but not be limited to:

Provision of instructors by the Contractor for training of operating and maintenance personnel of the employer in india

Training of operating and maintenance personnel of the Employer offshore at the Contractor's facilities and mrts.

Furnishing of training manuals and associated materials.

Any other item(s) considered necessary to comply with the Scope of Work.

Notes:

The Bidders's shall not complete the column "Weeks for completion of Milestone from Commencement Date.

The dates for the operation of these Milestone Activities will be at the discretion of the Employer.

The travel, boarding and lodging expenses for the employer's trainees sent overseas will be borne by the employer.

The monthly cash flow on the basis of which the PV is to be worked out will exclude the amount of this Cost Centre though this cost centre shall be included in the section MS Summary and the Tender Total.

SECTION -- MISCELLANEOUS**Corridor - Chand Pole to Badi Chaupar****COST CENTRE B – TRAINING**

MILE- STONE NO.	WORK DESCRIPTION	Apportioned Amount		Country of Origin	Weeks for completion of Milestone from Commencement Date
	MILESTONE ACTIVITY	Amount in Foreign Currency	Amount in Indian Rupees		
	Obtain the “Notice of No Objection” or “Notice of No Objection Subject to ---” from the Engineer for:			N/A	
B1	Training of Employer’s personnel (6 man-weeks) overseas in Contractor/Sub-Contractor’s Works and MRTS.			N/A	
B2	Provision of Contractor’s Instructors (8 man-weeks) for training of Employer’s operating personnel in India.			N/A	
B3	Provision of Contractor’s Instructors (30 man-weeks) for Training of Employer’s maintenance personnel in India.			N/A	
B4	Submission of Training Manuals in Original plus five hard copies and in electronic format.			N/A	
B5	Any other item(s) necessary to comply with the Scope of Work.			N/A	
	COST CENTRE TOTAL CARRIED TO SECTION MS SUMMARY				

SECTION -- MISCELLANEOUS

Corridor - Chand Pole to Badi Chaupar

COST CENTRE C – SPARES

This Cost Centre comprises all those obligations and ongoing activities throughout the Contract not associated directly with any other Cost Centre.

This shall include but not be limited to supply of spares for complete JP/EW/1B/E2 Contract:

RIGID OCS from Chand Pole to Badi Chaupar

Sub Sectioning and Paralleling Post (SSP) AT Badi Chaupar Station.

SCADA system for Chand Pole to Badi Chaupar.

Earthing & Bonding Including Thermosetting weld & cables, Tunnel Earth Wire (TEW), Return Conductor, Earth Wire, etc. for Chand Pole to Badi Chaupar

Any other item(s) considered necessary by the contractor to comply with the Scope of Work.

SECTION -- MISCELLANEOUS**Corridor - Chand Pole to Badi Chaupar****COST CENTRE C – SPARES**

MILE- STONE NO.	WORK DESCRIPTION	Apportioned Amount		Country of Origin	Weeks for completion of Milestone from Commencement Date
	MILESTONE ACTIVITY	Amount in Foreign Currency	Amount in Indian Rupees		
	Obtain the "Notice of No Objection" or "Notice of No Objection Subject to ---" from the Engineer for delivery of the following in accordance with the Employer's Requirements:				
C1	Delivery to Site the spares for Section -- Chand Pole to Badi Chaupar as mentioned in chapter 18 of TS OHE Table 18.2-1				
C2	Delivery at site working model for training as per TS OHE clause 20.6				
C3	Any other item(s) considered necessary to comply with the Scope of Work.				
	COST CENTRE TOTAL CARRIED TO SECTION SUMMARY				

SECTION -- MISCELLANEOUS

Corridor Chand Pole to Badi Chaupar

COST CENTRE D – SUPERVISION OF MAINTENANCE*

This Cost Centre comprises all those obligations and ongoing activities throughout the Contract not associated directly with any other Cost Centre.

Rigid OCS from Chand Pole to Badi Chaupar

Sub Sectioning and Paralleling Post (SSP) at badi chaupar station

SCADA system for Chand Pole to Badi Chaupar

Earthing & Bonding including Thermosetting weld & cables, Tunnel Earth Wire (TEW), Return Conductor, Earth Wire, etc. for Chand Pole to Badi Chaupar

Any other item(s) considered necessary by the contractor to comply with the Scope Of Work

The Contractor shall provide experts for supervision of maintenance in accordance with the Employer's Requirements.

Staff and labour will be provided by the Employer.

The Experts will be required during the interval commencing from start of service trials on the Section until six months after Revenue Operation Date (ROD) of the section.

* This excludes Contractor's obligations and responsibilities during the Defects Liability Period.

NOTES:

1. The deployment of the experts under this Cost Centre may not be continuous and they may be required to supervise the maintenance in short periods at a time. The number of man months of experts shall, however, not exceed 40 man-months. Payment for this Cost Centre will be made on man month's basis.
2. The Bidders's shall not complete the column "Weeks for completion of Milestone from Commencement Date".

3. The dates for completion of the Milestone Activities will be at the discretion of the Employer.
4. The monthly cash flow on the basis of which the PV is to be worked out shall exclude the amount of this Cost Centre though this Cost Centre will be included in the Section MS Summary and the Tender Total.

SECTION -- MISCELLANEOUS**Corridor - Chand Pole to Badi Chaupar****COST CENTRE D – SUPERVISION OF MAINTENANCE**

MILE- STONE NO.	WORK DESCRIPTION	Apportioned Amount		Country of Origin	Weeks for completion of Milestone from Commencement Date
	MILESTONE ACTIVITY	Amount in Foreign Currency	Amount in Indian Rupees		
	Obtain the "Notice of No Objection" or "Notice of No Objection Subject to ---" from the Engineer for completion of the following in accordance with the Employer's Requirements:				N/A
D1*	Supervision of Maintenance (40 man months)*				N/A
	COST CENTRE TOTAL CARRIED TO SECTION SUMMARY				N/A

* This excludes Contractor's obligations and responsibilities during the Defects Liability Period.

SECTION -- MISCELLANEOUS

Corridor - Chand Pole to Badi Chaupar COST CENTRE E – MANUALS

(The Manuals shall be bilingual in Hindi & English)

This Cost Centre comprises all those obligations and ongoing activities throughout the Contract not associated directly with any other Cost Centre.

This shall include but not be limited to:

Provision of operating manuals (hard copies and electronic format) for:

Traction power Distribution, Rigid OCS, , SSP, Overall Earthing system before commencement of Integrated Testing and Commissioning for Chand Pole to Badi Chaupar

Provision of maintenance manuals in one original and five hard copies and in electronic format) for:

Provision of sub-systems/systems and spare parts catalogue - hard copies and electronic format)

Any other item(s) considered necessary to comply with the Scope of Work.

SECTION -- MISCELLANEOUS**Corridor - Chand Pole to Badi Chaupar****COST CENTRE E – MANUALS***(The Manuals shall be bilingual in Hindi & English)*

MILE- STONE NO.	WORK DESCRIPTION	Apportioned Amount		Country of Origin	Weeks for completion of Milestone from Commencement Date
	MILESTONE ACTIVITY	Amount in Foreign Currency	Amount in Indian Rupees		
	Obtain The “Notice Of No Objection” Or “Notice Of No Objection Subject To ---“ from the Engineer on delivery of the final manuals for Traction Power, ROCS, SSP, , Overall Earthing System Before Commencement of Integrated Testing And Commissioning for Chand Pole to Badi Chaupar				
E1	Operating Manuals (Original plus five hard copies) and in Electronic Format				
E2	Maintenance Manuals (Original plus five hard copies) and in Electronic Format				
E3	Subsystems/ Systems spare parts catalogue (Original plus five hard copies) and in Electronic Format.				
E4	Any other item(s) considered necessary to comply with the scope of Work.				
COST CENTRE TOTAL CARRIED TO SECTION SUMMARY					

**Design, Detail Engineering, Manufacture, Supply, Installation, Testing and Commissioning of 25 kV AC Traction (RIGID OHE), 33 kV Auxiliary Sub Stations (ASS), associated cabling and SCADA Systems for Underground Corridors OF Jaipur Mass Rapid Transport System Project
Phase-1B**

CONTRACT PACKAGE – JP/EW/1B/E2

Statement F – Unit Prices

STATEMENT – F**Unit Prices****Unit Prices of Items for Additional Quantities**

Sl. No.	Item Description	Unit	Quantity	Rate		Country of Origin
				Amount in Foreign Currency	Amount in Indian Rupees	
1.	25kV Rigid OCS Conductor Rail	Km	1			
2.	Contact wire	Km	1			
3.	Support insulator for 25kV Rigid OCS	Nos	1			
4.	Anchor Assembly for 25kV Rigid OCS	Nos	1			
5.	Expansion Joint for 25kV Rigid OCS	Nos	1			
6.	Air Section for Rigid OCS	Nos	1			
7.	ROCS Protection Cover	Nos	1			
8.	Transition arrangement from ROCS to Flex. OHE	Nos	1			
9.	OPC 70 mm ² Copper	Km	1			
10.	RC 240 mm ² Aluminum	Km	1			
11.	TEW 150 mm ² Copper	Km	1			
12.	Steady Arm	No	1			
13.	Support Bracket	No	1			
14.	25 kV Cable	Km	1			

15.	25kV cable termination kits	Nos	1			
16.	Earthing flats	km	1			
17.	Earthing Electrodes	Nos	1			
18.	LT AC Distribution Board in SP, SS & SSP	Nos	1			
19.	DC Distribution Board in SP, SS & SSP	Nos	1			
20.	Protection Panel for 25kV OCS feeder Circuit Breaker	Nos	1			
21.	25 KV GIS cubicle (With C.B. 2000A)	Nos	1			
22.	25 KV GIS cubicle (With C.B. 1250A)	Nos	1			
TOTAL						

NOTE:

1. The unit price shall be an all inclusive fixed price for delivery, installation, testing and commissioning. The price will include all associated accessories and fixtures of the respective items and all duties, taxes, etc. including tax deducted at source.
2. The unit prices shall be valid until the Taking over Certificate of the last Section.
3. **These unit rates shall be considered for the purpose of comparative evaluation of Tenders.**
4. **THE CONTRACT PRICE WILL BE LOADED BY TOTAL PRICE OF THIS STATEMENT F, FOR FINANCIAL EVALUATION.**

DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID TRANSPORT SYSTEM PROJECT PHASE-1B

CONTRACT PACKAGE – JP/EW/1B/E2

Statement G – Monthly Cash Flows

STATEMENT G – Monthly Cash Flows for the Contract

This Document is to be prepared by the Bidders's as per clause C. Milestone Payment Schedule

Note: The amount of Cost Centres B and D of Section Miscellaneous will not be included in the Monthly Cash Flows.

DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID TRANSPORT SYSTEM PROJECT PHASE-1B

CONTRACT PACKAGE – JP/EW/1B/E2

Part-2
Auxiliary Sub Stations

BILL OF QUANTITIES
(BOQ)

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1. EXPLANATORY NOTES OF BOQ

1.1 General

The item description is intended to briefly describe the work to be performed under that item and to identify associated work. It is not a full and complete description of the work to be performed. The Contractor shall carry out all the work necessary to meet the requirements of the Specification.

1.2 AUXILIARY LINE

The following bills pertain to “Auxiliary Line” for different Sections:

Bill No.	Section
	Auxiliary Line Chand Pole – Badi Chaupar)

The Explanatory Notes given hereunder are applicable to the corresponding items in the above Bills.

Item 1.0: 33kV/415V Transformers

The price shall cover the cost of supplying a 33kV/415V, 3 phase transformer, as per specification, complete in all respects, of capacities as mentioned below:

- 2500 kVA
- 3150 kVA

The above specified ratings are for the Air Natural cooling of the transformers.

The price shall also include the cost of necessary arrangements for installing the transformer inside the ASS Room, in a metallic enclosure to be provided along with the transformer, by the contractor, complete with doors, locks, interlocking arrangements etc. The price of Transformer shall be shown against the appropriate sub-item.

The Bidders shall ensure that all equipment, interlocks and interface equipment specified in the tender document are included under this item and detail of equipment etc., if any, other than those listed above, should be explicitly included hereunder, in the tender

Item 2.0: 33kV Switchgear (GIS)

Item 2.1: Protection Circuit Breaker Panel (1250A), with CT and PT, complete

The price shall cover the cost of supplying 33kV GIS Circuit Breakers including Earthing Switch Assembly, as per specification, for indoor installation in the ASS Room, complete in all respects. The price shall also include the cost of

- Current transformer for measurement and protection, as per specifications
- Potential transformer, as per specifications.

The price shall cover the cost of padlocks/interlocks to be provided on these breakers, in accordance with specifications.

Item 2.2: Protection Circuit Breaker Panel (1250A), with CT complete

The price shall cover the cost of supplying 33kV GIS Circuit Breakers including Earthing Switch Assembly, as per specification, for indoor installation in the ASS Room, complete in all respects. The price shall also include the cost of

- Current transformer for measurement and protection, as per specifications

The price shall cover the cost of padlocks/interlocks to be provided on these breakers, in accordance with specifications.

Item 2.3: Transformer Protection Circuit Breaker Panel (630A), with CT complete

The price shall cover the cost of supplying 33kV GIS Circuit Breakers including Earthing Switch Assembly, as per specification, for indoor installation in the ASS Room, complete in all respects. The price shall also include the cost of

- Current transformers for measurement and protection, as per specifications

The price shall cover the cost of padlocks/interlocks to be provided on these breakers, in accordance with specifications.

Item 2.4: Protection Circuit Breaker Panel (630A), with CT and PT, complete

The price shall cover the cost of supplying 33kV GIS Circuit Breakers including Earthing Switch Assembly, as per specification, for indoor installation in the ASS Room, complete in all respects. The price shall also include the cost of

- Current transformer for measurement and protection, as per specifications
- Potential transformer, as per specifications.

The price shall cover the cost of padlocks/interlocks to be provided on these breakers, in accordance with specifications.

Item 2.5: Protection Circuit Breaker Panel (630A), with CT complete

The price shall cover the cost of supplying 33kV GIS Circuit Breakers including Earthing Switch Assembly, as per specification, for indoor installation in the ASS Room, complete in all respects. The price shall also include the cost of

- Current transformer for measurement and protection, as per specifications

The price shall cover the cost of padlocks/interlocks to be provided on these breakers, in accordance with specifications.

Item 2.6: Bus PT Panel

The price shall cover the cost of supplying 33kV Panel with a 33 kV Potential Transformer, as per specification, for being deployed at Loop-coupling ASS's or other locations as per SLD for indoor installation, complete in all respects.

The price shall cover the cost of padlocks/interlocks to be provided on these breakers, in accordance with specifications.

Item 2.7: Measuring and Protection Equipment

Under this item, the price of supplying all equipment, including all control and relay boards along with necessary control switches, indications, relay and meters and all associated components, terminals and fittings, shall be included. The price of current transformers and potential transformers shall not be included under this item and shall be included in the relevant sub-items 2.1 to 2.6.

The price shall essentially include, but not limited to, the following:

- Ammeter with Selector Switch
- Over-current and Earth fault relays, Line differential protection relays and Pilot wire cables for protection of all cables in scope of this contractor (the pilot wire relay shall be Supplied & installed at either end of the adjoining elevated station/Midshaft and underground station similarly the pilot wire between AMS and ASS on either side, are scope of this Tender) , Restricted Earth Fault Protection, Transformer Differential Protection.
- Control and relay panel
- Interfaces with SCADA equipment, including Marshalling box

(All the protection to be as per Para 11 of Chapter 8A of TS)

The Bidders shall ensure that all equipment, relays and interface equipment for achieving the protection arrangement specified in the tender document, are included under this item and detail of equipment etc., if any, other than those listed above, should be explicitly included hereunder, in the tender.

Item 3: Auxiliaries

Item 3.1: Control & monitoring (C&M)

The price shall include the cost of control, monitoring, protection, interlocking and automatic sequencing of the 33 kV installations in the ASS.

The price shall also include the cost of a separate Marshalling panel, to accommodate the control output relays and other field Signal terminations.

Item 3.2 : Aux. Feeding (DC-UPS, Battery, Battery Chargers, Protection)

The price shall cover the cost of supplying 1 set of Battery and 2 sets of Battery chargers, as per specifications. The price shall also include the cost of automatic change-over system for the battery chargers and all other protective devices.

Item 3.3: Cables from ASS equipments to RTU

The price shall cover the cost of supplying all control and monitoring cables, required for interconnection of the equipment's at the ASS to RTU. The prices of all connectors, terminals, clamps etc. required for the connections with RTU be included in this item.

Item 3.4: Cables from Switching Station equipments to RTU

The price shall cover the cost of supplying all C&M (SCADA) cables from ASS equipment/ ETS connected to RTU & pilot wire cables etc for ASS works. Control and monitoring cables, required for interconnection of the equipment's at the Switching Station. to RTU. The prices of all connectors, terminals, clamps etc. required for the connections with RTU be included in this item.

Item 3.5: All other Equipments

The price shall cover all other equipments required to make the 110 V DC and Low voltage Auxiliary AC Power Supply System complete and fit to the deliver 110 V DC and Low voltage Auxiliary AC Power Supply to the equipments located in the ASS, as well as to equipments located in Switching Stations, as required under Specifications.

Item 3.6 : Safety Equipment

The price shall cover the cost of supplying all safety equipment, as per specification/statutory regulations, in the ASS room. The indicative list of Safety equipment to be provided is as follows:-

- Fire protection equipment, such as fire buckets, sand buckets, portable fire extinguishers, wall-mounted or wheel-type fire extinguishers etc.
- Caution and warning notices
- First Aid charts and First Aid boxes
- Tool Board with safety tools
- Keyboard, Shock treatment Chart, Hand gloves, Stretchers
- Insulation mat for 33 kV HV panels, transformers, ACDB, DCDB, chargers.
- Any other statutory requirement as per IE/ CEA rules.

Fire detection and hydrant system for the room is not to be considered as it is included in station buildings works.

Item 4 : Wiring**Item 4.1.1: 33 kV Cable and Connections**

The price shall include the cost of supplying all medium voltage (33kV) cables , as per specifications from one ASS to the next ASS (to form ring main Auxiliary Network), from one corridor to another for interconnection of 33kV supply and inside

the ASS and all Cables for the Underground Section, . The price shall also include the cost of all necessary termination and jointing kit to make all connections, inside the ASS, from one ASS to the next ASS and so on, interlocking and also from the AMS to the nearest ASS, as per design. The price shall also include all the necessary termination and jointing kit including trefoil clamps, Bonding kits, SVL etc wherever required to make all connections.

Note : The Unit rate for this item shall be for 1 km of 33 kV cables, consisting of 3 single core cables and the terminations/ jointing required for all the 3 cores.

Item 4.1.2: 415V Cable and connection

The price shall include the cost of supply low voltage and control & monitoring cables as per specification, for laying inside the ASS & from nearest ASS, and along the alignment (at grade or viaduct/tunnel) in the cable ducts/cable trenches for the portion of work executed by this contractor.

The price shall also include all the necessary termination and jointing kit make the required connection.

Item 5: Earthing

The price shall cover the cost of providing the necessary earthing materials as per specification (see para 3.3.8 of chapter-8 TS) for

- Laying an Earth bus inside the ASS Room.
- Separately connecting the transformer neutral to the earth Station in accordance with specification.
- Connecting the metallic parts of equipment inside the ASS Room to the Earth bus (double earthing).
- Connecting the Earth bus inside the ASS Room to station earth, as required.

The price shall cover all necessary materials to provide an effective earthing system, as per specifications.

Item 6(a): Erection (other than 33kV Network Cable)

The price shall include the cost of

- foundations for transformers, panels etc as necessary
- erection, of all ASS equipments in each ASS's covered in the respective Bill
- Erection, including jointing and termination of all 33 kV cables and LT Control cable for the 33 kV inside each ASS's.

Item 6(b): Erection of 33kV Cables

The price shall include the cost of erection including jointing and termination of all 33 kV cables and LT Control cable from AMS right up to the ASS, and for 33kV Network in between the ASS's.

Item 7: Testing and Commissioning

The price shall include the cost of testing and commissioning, as per employers requirement of the entire Auxiliary Network ASS equipment and systems, in all ASS's and in between the ASS's.

Item 8: Manning of Commissioned ASS

The Contractor shall, if required by the Employer, provide skilled supervisors / skilled workers / unskilled workers in the ASS's / AMS already commissioned and handed over to the Employer, for manning the installations, before commencement of the Revenue operation of the line. The staff team deployed at the ASS's / AMS shall be thoroughly conversant and competent to operate the various switchgear and systems and shall be able to provide auxiliary power, if so desired by the Employer, to other Agencies working in the Station area or elsewhere and also to provide power shut-downs of the commissioned systems, if so directed by the Employer. The all-inclusive man-day charges shall be included against the relevant sub-item under this Item. For measurement purposes, a period of 8 hours of deployment of one staff will be considered as 1 man-day.

The all-inclusive man-day charges included herein shall take into consideration the minimum wages to be paid by the Contractor to the employers, as prescribed by the Ministry of Labour, State Government and/or Central Government, provisions of Minimum Wages Acts and other statutory provisions. The Contractor shall indemnify the JMRC by providing a suitable.

Item 9: Emergency Tripping System (ETS)

Contractor shall provide Emergency Tripping System to achieve an electrical tripping scheme to de-energize the OCS section during emergency condition. The supply and erection of ETS, cables and any other material to complete the work will be included in the price against this item. However the SCADA work including the supply and erection of the RTU/PLC will be done by other contractor as specified elsewhere in the contract.

ETS consists of ETS Boxes, ETS Cable. ETS boxes shall be provided at the end of each platform, station control room & cross passages in tunnel.

Note: ETS Cable shall comply with the requirement of NPA-130 and shall be capable of withstanding fire upto 950°C for 3 hrs.

The bidder shall inspect the site for understanding the scope of work before quoting the price and the price offered shall take in to account all contingencies.

Item 10: Modification to the existing Station

Item 10.1: At Chand Pole

The price shall cover all the items required for modification works as per clause 2.1 of chapter 8 part A

Item 11: SCADA Works of ROCS & ASS

Item 11.1: RTU for Underground ASS works:

The price shall include the cost of supplying the RTU, needed for the control, monitoring , protection and automatic sequences of the ASS at underground stations. The RTU shall be located in ASS room.

The price shall also include the cost of communication cables for linking RTU to TER or intermediate switch and earthing connection from MET to RTU.

Item 11.2: RTU for switching room

The price shall include the cost of supplying the RTU, needed for the control, monitoring , protection and automatic sequences of the switching station at underground stations. The RTU shall be located in traction switching station room.

The price shall also include the cost of OFC communication cables for linking RTU to TER or intermediate switch and earthing connection from MET to RTU.

Item 11.3: Testing & commissioning of SCADA system for ASS & ROCS.

The price shall include the cost of testing and commissioning, as per Employer's Requirements and Specifications, the entire C&M equipment, systems and Software, at ASS & SSP room.

Item 12: Installation, Testing and Commissioning of SCADA System at OCC, Mansarovar Depot

The price shall include the cost of installation, testing and commissioning of all SCADA equipments, as per Employer's Requirements and Specifications, the entire C&M equipment, systems and Software, at OCC for complete integration of controlled stations.

Item 13: Furniture for SSP room.

The price shall include the cost of supplying the desk and chairs, as per specifications at the SSP room.

Note that the Contractor will have to interface for the design and materials to be used.

Item 14: AMC cost for Line equipments

After completion of DLP, JMRC may enter into Annual Maintenance Contract upto a maximum period of 8 years as a supplementary agreement to be drawn at the option of JMRC with the bidder. The bidder shall quote the price for 1st year (after DLP) in the relevant price schedule. In case AMC period is extended for more than one year, the bidder shall be eligible for a price escalation @5% per annum for each year, after 1st year of AMC. Before commencement of AMC, the bidder shall submit a bank guarantee equal to 10% of the AMC charges as applicable and valid upto one month beyond the AMC period. The BG shall be released after completion of AMC.

The bidder shall provide 24X7 sufficient technical staff at Jaipur which is capable of attending SCADA faults. The faults shall not be allowed to persist so as to affect the normal train operation.

1.3 General Requirement

1.3.1 Training of Employer's staff

This item shall cover the Training of Employer's staff as specified in the chapter 6 of TS of Employer's requirement. The total man-weeks included therein shall be as follows:-

Item	Nos.
Off-shore (Man-weeks)	03
In India (Man-weeks)	05

It shall essentially include, but not limited to:

- Training plan
- Training tools and staff wages
- Training documentation

The price shall also include the cost of the training documents implementing as well as advises after the contract.

The price shall not include the travelling and accommodation cost of trainees.

1.3.2 Maintenance & Operations manuals

This item shall cover the Maintenance & Operations manuals as specified in the chapter-11 of GS & chapter 6 of TS of Employer's requirement

The Manuals shall include all Operations and Maintenance Manuals pertaining to all equipment/ systems which have been used/ deployed in the various sections of the corridor:-

The Manuals is meant to essentially include, but not limited to:

- Operation manuals
- Maintenance manuals, drawings and procedures

The price shall also include the Maintenance & Operations documents implementing as well as documents originals, copies, and electronic files cost.

The documents shall be supplied in the prescribed number of copies.

Interactive Manual

The contractor shall submit in English language Interactive Electronic Technical Manuals (IETMs) to manage technical documentation. IETMs shall compress volumes of text into DVDs which may include sound and video, and shall allow readers to locate needed information rapidly than in paper manuals.

This IETM shall follow the structure and format of a printed book, with indexes and table of contents that are hyperlinked into the content of the document. All figures, tables and section references shall be linked.

The data to be stored in a relational database, obtaining benefits of data integrity and removal of data redundancy. Relationships in the content that are presented as hyperlinks, are mapped directly to relations in the database scheme. The IETM shall be able to change the content dynamically based on users navigation and input through the content; the content may now be user specific.

1.3.3 Maintenance supervision

This item shall cover the Maintenance supervision for defect liability period as specified in the chapter 12 of GS of Employer's requirement.

The role of the relevant and experienced engineers will be to ensure that the maintenance during this period is carried out by the employer's staff properly and that the warranty/ guaranty obligations of the Contractor remain undiluted.

For this purpose the Contractor shall provide a Maintenance Supervision Organisation, consisting of 2 teams deployed as follows or as mutually agreed between the Employer and the Contractor.

Each Team shall, at the minimum, contain 1 experienced Engineer, 2 Senior Supervisors and 3 skilled staff. The rates to be quoted for each team months.

Contractor shall comply all labour laws irrespective of rates quoted.

1.3.4 Integrated testing & commissioning

These items shall cover the integrated testing & commissioning as specified in the chapter 4 of TS of Employer's requirement.

As explained in Chapter 4 of TS, the integrated testing and commissioning shall be performed for each section of the corridor, after the first 15 days of operation, during which the various actuation and operation situations (putting into service, normal actuation, failure tripping etc) shall be simulated.

The Integrated Testing & Commissioning shall essentially include, but not limited to:

- Integrated testing & commissioning plan
- Tools, instruments, tackles, and documents required;
- Providing attendance to the Employer's Representative, including during inspection by statutory Authorities, Ministry of Railways and Commissioner of Railway safety.
- Carrying out the appropriate integrated testing & commissioning functions.

1.3.5 Deleted

Spare parts

The price under this item shall include the cost of supplying spare parts, as listed in the chapter 7 of TS of the employer's requirements. **The price list of unit item of spares as per Chapter 7 of TS shall be included in the financial proposal.**

If however the Bidders feels that some more items or more quantities are required for the proper operation and maintenance of the installations supplied and erected by him, for a period of at least 2 years commencing from the expiry of the defect liability period, the Bidders shall in that case include such items in his bid and quote them in this very item. All conductor supplied as spare shall be in robust steel drums.

1.3.7 As Built Drawings

The price, under this item, shall include the cost of supplying at least one original and five copies of As-Built drawings related to the complete scope of work.

Under this item, the contractor shall prepare the following drawings:

- As built drawings depicting the completed works that have been certified as complete.
- Shop drawings containing information related to the permanent works.
- Working drawings containing the information related to the temporary works depicting the construction of permanent works.

1.3.8 Other drawings

The price shall include the cost of the other drawings to be prepared by the Bidders as specified in Technical Specification (TS) Volume 4 included in the scope.

BID TOTAL FOR ASS WORKS & GENERAL REQUIREMENT UNDER THE CONTRACT (PART 2)

(THIS DOCUMENT IS TO BE PREPARED AND COMPLETED BY THE BIDDERS)

In accordance with the accompanying and signed form of tender, we (the Bidders) offer to supply, install, test, commission, and remedy at any defects of the whole said works, in conformity with the said drawings, particular specifications, conditions of contracts and other contract documents of JP/EW/1B/E2 for the following sums:

S.No.	DESCRIPTION	Total brought from above Bills	
		Indian Rupees	Foreign Currency
1.	Auxiliary Line (Chand pole – Badi chaupar		
2.	GENERAL REQUIREMENT		
Grand Total for Auxiliary			
SUM IN WORDS, OF INDIAN RUPEES			
SUM IN WORDS, OF FOREIGN CURRENCY			

The Bills of Quantities consists of following Bills, as follows:

1. Auxiliary Line – (Chand pole to badi chaupar)

Auxiliary Line – (Chand Pole – Badi Chaupar)								Country of Origin
Item No.	Work Description	Unit	Qty.	Unit Rate		Total		
				Indian Rupees	In Foreign Currency	Indian Rupees	In Foreign Currency	
1.0	33 kV / 415 V Transformers							
1.1	33 kV / 415 V Transformers, 2500 kVA	Set	NIL					
1.2	33 kV / 415 V Transformers, 3150 kVA	Set	04					
2.0	33 KV GIS SWITCHGEAR							
2.1	Protection Circuit Breaker (1250A) panels, with CT and PT, complete	Set	08					
2.2	Protection Circuit Breaker (1250A) panels, with CT, complete	Set	2					
2.3	Transformer Protection Circuit Breaker (630A) Panels, with CT, complete	Set	4					
2.4	Protection Circuit Breaker (630A) panels, with CT and PT, complete	Set	0					
2.5	Protection Circuit Breaker (630A) panels, with CT, complete	Set	0					
2.6	Bus PT Panel	Set	2					
2.7	Measuring and Protection Equipment(Each ASS's)	Set	4					

3.0	AUXILIARIES							
3.1	Control and monitoring	Set	4					
3.2	Auxiliary Feeding (DC-UPS, Battery, Battery Chargers, Protection)	Set	4					
3.3	Cables from ASS equipments to RTU	Lot	4					
3.4	Cables from SSP equipments to RTU	Lot	1					
3.5	All other Equipments	Set	4					
3.6	Safety Equipment	Set	4					
4.0	WIRING							
4.1.1	33 kV Cables and connections							
4.1.1 a)	33 kV Cables (with 400 sq mm copper) and connections (FRLS-OH)	km	6					
4.1.1 b)	33 kV Cables (with 95 sq mm Copper) and connections (FRLS-OH)	km	0.080					
4.1.1 c)	33 kV Cables (with 400 sq mm Copper) and connections (FRLS)	km	0					
4.1.2	415 V Cables and connections	Set	4					
5.0	EARTHING							
5.1	Earth bus inside the ASS	Set	4					
5.2	Earthing Connections	Set	4					

6.0	Erection							
6.a	Erection of (other than 33kV Network cables) in one ASS's	Set	4					
6.b	Erection of 33kV Network Cables	Km	6					
7.0	Testing and Commissioning (4 ASS's)	Lot	1					
8.0	MANNING OF COMMISSIONED ASS's							
8.1	Skilled Supervisor	M-day	60					
8.2	Skilled Worker	M-day	900					
8.3	Unskilled Worker	M-day	900					
9.0	Emergency Tripping System	Set	20					
10	Modification to the existing Station							
10.1	At Chand Pole as per clause 2.1 of TS chapter 8A	Lot	1					

11	SCADA works of ROCS & ASS combined							
11.1	RTU for underground ASS works	No	4					
11.2	RTU for underground Switching Stations	No	1					
11.3	Testing & commissioning of SCADA system for ASS & ROCS	Lot	5					
12	Testing & commissioning of SCADA System at OCC, Mansarovar Depot as per Chapter 8D clause no 11.1	Lot	1					
13	Furniture for SSP room (clause no 3.5.1 of TS- ROCS)	Set	1					
14	AMC cost for all equipments under SCADA as per TS	Lot	1					
	Total Amount							

BILL NO. GENERAL REQUIREMENT								Country of Origin
WORK DESCRIP -TION	WORK DESCRIPTION	UNIT	Qty	Unit Rate		Total		
				Indian Rupees	In Foreign Currency	Indian Rupees	In Foreign Currency	
1.0	Training of Employer's staff							
	Off-Shore (Man Weeks)	M-W	3					
	In India (Man Weeks)	M-W	5					
2.0	Maintenance & Operations manuals (consisting of one original and five copies), to be supplied after 3 months of the vendor approval of major equipment.	Set	1					
3.0	Maintenance supervision as per clause 1.3.3 of BOQ (Man Month of each team)	Team month	24					
4.0	Integrated testing & commissioning	Set	1					
5.0	Spare Parts (The price list of unit item of spares as per Chapter 7 of TS is enclosed.)	Set	1					
6.0	As Built Drawings (One original and five copies) for complete scope under the contract.	Set	1					
	TOTAL BILL GENERAL REQUIREMENT							



**Procurement of Plant
Design, Supply and Installation
JAIPUR METRO RAIL CORPORATION LIMITED
BIDDING DOCUMENT
for
Procurement
of**

NCB No.-JP/EW/1B/E2

**DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION,
TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV
AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA
SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID
TRANSPORT SYSTEM PROJECT PHASE-1B**

PART-II REQUIREMENTS

Section 6 - Employer's Requirements (ERQ)

Volume – I General Specifications

JAIPUR METRO RAIL CORPORATION LTD.

**Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**

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CHAPTER 1**1. GENERAL****1.1 Application of the General Specification (GS)**

- 1.1.1 The provisions contained in the Technical Specification (TS) and the Employer's Drawings shall prevail over the provisions contained in this GS.
- 1.1.2 The provisions contained in the GS shall prevail over the provisions contained in International Standards, European Standards, British Standards, Indian Standards, British Standard Codes of Practice and similar standard documents stated in the Contract.
- 1.1.3 This GS shall be read in conjunction with the other documents constituting the Contract.

1.2 Abbreviations

Common abbreviations used in the GS and in the TSs shall have the following meanings:

ACB	: Air Circuit Breaker
AMS	: Auxiliary Main Sub Station
ASS	: Auxiliary Sub Station
BCC	: Backup Control Centre
BCU	: Bay Control Unit
BS	: British Standard
BEC	: Buried Earth Conductor
BMS	: Building Management System
CADD	: Computer Aided Design and Drafting
CAR	: Corrective Action Request
CMV	: Catenary Maintenance Vehicle
CNP	: Construction Noise Permits
COTS	: Commercial Off the Shelf
CPM	: Critical Path Method
CV	: Curriculum Vitae
DG	: Diesel Generator
DLP	: Defects Liability Period
DMRC	: Delhi Metro Rail Corporation
JMRC	: Jaipur Metro Rail Corporation
ECS	: Environment Control System
E&M	: Electrical & Mechanical
EMC	: Electromagnetic Compatibility

EMIP	: Environmental Mitigation Implementation Plan
EMP	: Environmental Management Plan
EMSD	: Electrical and Mechanical Services Department
EMU	: Electric Multiple Unit
EN	: Euro-Norm (European Standards)
EPD	: Environmental Protection Department
ETI	: Employer's Training Instructors
FAI	: First Article Inspection
FAT	: Factory Acceptance Test(s)
GCC	: General Conditions of Contract
GS	: General Specification (this document)
HV	: High Voltage
IEC	: International Electro-technical Commission
IEE	: The Institution of Electrical Engineers
IED	: Intelligent Electronic Device
IP	: Ingress Protection
IS	: Indian Standards
ISO	: International Standards Organisation
ITB	: Instructions To Bidders
ITU	: International Telecommunications Union
LV	: Low Voltage
MCB	: Miniature Circuit Breaker
MMI/ HMI	: Man/Human -Machine Interface
MTR	: Mass Transit Railway
NSR	: Noise Sensitive Receivers
OCC	: Operations Control Centre
OPC	: Overhead Protection Cable
OSR	: Operational Safety Report
OSR(S)	: Operational Safety Report (Software)
OHE	: Overhead Equipment (Flexible Catenary)
P3	: Primavera Project Planner
PLC	: Programmable Logic Controller
PPE	: Personal Protective Equipment
PS/TS	: Particular Specification/Technical Specification

PVC	: Polyvinyl Chloride
QA	: Quality Assurance
RAMS	: Reliability, Availability, Maintainability and Safety
RC	: Return Conductor Cable
ROCS	: Rigid Overhead Conductor System
RSS	: Receiving Sub Station
RTU	: Remote Terminal Unit
SAR	: Special Administrative Region
SAT	: Systems Acceptance Test(s)
SCADA	: Supervisory Control and Data Acquisition System
SCC	: Special Conditions of Contract
SIL	: Safety Integrity Level
SQAP	: Software Quality Assurance Plan
SRR	: Submission Review Request
SWA	: Steel Wire Armoured
T/C	: Time Chainage
TRIP	: Track Related Installation Programme
TSS	: Traction Sub Station
TVS	: Tunnel Ventilation System
UPS	: Uninterrupted Power Supply

Table 1-1 General Abbreviations

- 1.2.1 Further abbreviations may be defined within the body of the GS or TS where there is only local applicability. Where such abbreviations exist the Contractor shall exercise great care that the abbreviation is not used out of context when communicating with the Employer, the Employer's Representative or any Third Party.
- 1.2.2 Abbreviations of units of measurement used in the GS shall have the meanings as defined under the SI system of units.
- 1.3 Definitions**
- Words and phrases defined in the GCC or SCC shall retain the same meaning within the GS and TS unless specifically redefined within this GS or under the provisions of clause 1.1.1 above for the purpose of a particular clause or group of clauses.
- (1) "Access Dates" are dates that are to be achieved by other than the Contractor and which are considered to be essential to the successful completion of the Contract to the original planned schedule. A list of the activities completion of which are considered to give rise to an Access Date shall be provided at the time of award.
 - (2) "Commissioning" means the process of setting to work the complete transportation system through a series of integrated tests that demonstrate the installation and performance in accordance with the specified criteria.

- (3) "Day" means calendar day unless expressly stated otherwise.
- (4) "Defined Area" means an area within which Works Trains will be operated and the Employer's defined area working safety rules will apply.
- (5) "Factory Acceptance Tests" means the tests to be performed at the Contractor's factories prior to delivery to the Site to verify compliance with the Specification and quality standards
- (6) "Installation Tests" means the tests to be performed to verify the conformity of completion of an installation/assembly to the design documents previously reviewed without objection by the Employers Representative prior to the start of Commissioning. Installation Tests do not form part of the Tests on Completion to be performed by the Contractor in order to achieve Employer's Taking Over of the Works or any Section however they must be successfully completed before the Tests on Completion can commence.
- (7) "Key Dates" are dates which are to be achieved by the Contractor and which are considered to be essential to the successful completion of the project to the original planned schedule. A list of the activities, completion of which gives rise to a Key Date, is included in the TS.
- (8) "Partial Acceptance Tests" means the functional tests to be performed on components and parts of systems to meet the specified criteria. Partial Acceptance Tests form part of the Tests on Completion to be performed under the Contract in order to achieve Employer's Taking Over of the Works or any Section.
- (9) "Service Trial" means the phase after completion of the System Acceptance Tests where the training and operating procedures are validated through the running of the trains to the published timetable. Service Trial form part of the Tests on Completion to be performed under the Contract in order to achieve Employer's Taking Over of the Works or any Section.
- (10) "Quality Control Point" means a point in time when a notice or other document is to be submitted to the Employer's Representative in accordance with the Contract before the Contractor can commence, proceed with or terminate an activity
- (11) "Quality Hold Point" means a point in time when a notice of no objection by the Employer's Representative is required.
- (12) 'S' curve" means the graphical relationship between the planned (and actual where appropriate) quantity of completed work (or resources) and time. The curve produced is to be illustrated on an accumulative basis where the slope of the line indicates the rate of undertaking the work or rate of expenditure of the resources.
- (13) "Specification (the)" means the aggregate sum of the documents and any amendments thereto, issued to bidders by JMRC as part of the bid process before the final date for submission of bids. This shall include but not be limited to; Employer's
- (14) Requirements, Employer's bid Drawings, Preliminary Operating Plan and Clarification of bid Documents issued in accordance with the ITB but shall not include the ITB itself or any minutes of meetings.

- (15) "Specification (this)" means the particular document within which the reference is made.
- (16) "System Acceptance Tests" means those tests that demonstrate the performance of the installation/equipment to the specified requirements as detailed in the TS. SATs form part of the Tests on Completion to be performed under the Contract in order to achieve Employer's Taking Over of the Works or any Section.
- (17) "Integrated Testing and Commissioning" means those tests that demonstrate the integration of the complete transport system meeting the requirements of the Specification in an operating environment. Integrated Testing and Commissioning form part of the Tests on Completion to be performed by the Contractor in order to achieve Employer's Taking Over of the Works or any Section.
- (18) "Validation" means the process of confirmation by examination and provision of objective evidence that the application produced achieves the particular requirements specified.
- (19) "Verification" means the process of confirmation by examination and provision of objective evidence that the specified requirements have been incorporated.

1.4 Glossary of Terms

- 1.4.1 Words and expressions to which meanings are assigned in any paragraph of the GS shall have the same meanings in other paragraphs of the GS except when the context otherwise requires.
- 1.4.2 Utilities are electricity, lighting, traffic control, telephone and other communication cables, gas, water, sewage and drainage pipes and ducts, including all associated protection, supports, ancillary structures, fittings and equipment.

1.5 Submission for Review

- 1.5.1 Reference in the GS and TS to any submission made by the Contractor to the Employer's Representative having been reviewed without objection by the Employer's Representative shall mean the issue of a notice of no objection by the Employer's Representative issued in response to a submission made by the Contractor. Documents, drawings, specifications, calculations, technical papers, material samples, methods of construction and any other matters which have been reviewed without objection by the Employer's Representative shall not be changed without further submission for review to the Employer's Representative of the proposed changes.
- 1.5.2 Clause 4.2 below prescribes the process to be adopted for submissions of documents, material samples and any other items to the Employer's Representative. Schedules of items that are to be submitted to the Employer's Representative for review are contained within this GS and/or the TS.
- 1.5.3 Submissions for review shall be made in accordance with the dates (relative to the Works Programme) stated in the GS and/or the TS, or in accordance with Appendix 4 of this Specification. For items not specifically given a submission date in the Specification submissions shall be strictly in accordance with the agreed Submissions Programme or as directed by the Employer's Representative.

1.6 Standards, Codes of Practice

- 1.6.1 Unless otherwise stated in the Contract, reference in the GS to International Standards, European Standards, British Standards, British Standard Codes of Practice and similar standards shall be to that edition of the document stated in the TS, including all latest amendments issued by the relevant authority. In the event that no specific edition reference is given, the current edition as at the date of issue of the Letter of Acceptance shall apply.
- 1.6.2 Later editions of International Standards, European Standards, other national or international Standards or Codes of Practice and other similar standards, or standards which are considered to be equivalent, shall not apply unless reviewed without objection by the Employer's Representative. The Employer's Representative shall give or withhold his notice of no objection after the Contractor has provided him with a copy of the relevant standard for information. If a notice of no objection is given, the Contractor shall provide two copies of the document for use by the Employer's Representative.
- 1.6.3 Permanent Works, Temporary Works, Contractor's Equipment, hardware, firmware, software, apparatus of all kinds, and, where appropriate, materials and workmanship shall be in accordance with the Standards quoted in the Specification and the requirements identified in the TS or, where no Standard is identified, the Contractor shall make a proposal which shall be subject to review by the Employer's Representative.

1.7 Employer's Drawings

- 1.7.1 The Employer's Drawings assist in describing the scope of the Works in general and clarify constraints, interface arrangements and the conceptual nature of the finished structures/system outline.
- 1.7.2 The Contractor shall carefully check all Employer's Drawings and advise the Employer's Representative of discrepancies, omissions, errors or ambiguities should any be found.
- 1.7.3 The Contractor shall note that any drawings included but marked "For information only" do not form part of the Contract.
- 1.7.4 Dimensions shall not be obtained by scaling from the Employer's Drawings. Dimensions that are not shown or are not calculable from dimensions shown on Employer's Drawings shall be obtained from the Employer's Representative.

1.8 Specifications in Metric and Imperial Units

- 1.8.1 Specifications in imperial units shall not be substituted for specifications in metric units stated in the Contract without the prior consent of the Employer's Representative.
- 1.8.2 Conversion of metric units to imperial units and of imperial units to metric units shall be in accordance with the Standard International Practice.

1.9 System Safety**1.9.1 Safety philosophy**

- 1.9.1.1 Safety of passengers, staff and the general public is paramount for railway operation. Prime consideration shall be given to all issues that can have an effect on safety.
- 1.9.1.2 During the construction phase the safety of all staff involved in the Works and any members of the general public affected by the Works shall be the prime feature of all working methods, including storage and transport to site as well as all temporary works not incorporated into the final construction.

1.9.2 Safety Management

The Contractor shall implement the Contract Systems Safety Management Requirements, as referenced in the Project Safety Manual and elsewhere in the Specification, in consultation with the Employer's Representative.

1.9.3 Prescriptive Safety Criteria

1.9.3.1 The Contractor shall identify and list all applicable statutory and regulatory requirements and codes of practice relevant to the Works and to work within the constraints and limitations imposed by the requirements and codes.

1.9.3.2 The safety of the Contractor's supplied systems and equipment shall be developed by the Contractor in accordance with the requirements contained in clause 3.4.5 below and the TS.

1.10 Not used**1.11 Suitability for Purpose**

Jaipur Metro Rail Corporation (JMRC) shall be operating high-density passenger trains with high volume of traffic in the proposed corridors commensurate with the stage opening of the sections.

1.11.1 Interference and Compatibility

The Contractor shall ensure that all Works and Contractor's Equipment operate in a satisfactory manner without causing interference to other equipment and services including parties external to the Employer. The Contractor shall also ensure that the Permanent Works are physically and technically compatible with associated plant and in particular with that of other Contractors.

1.11.2 Planning for introduction to service

The Permanent Works shall be constructed in such a manner that they can be installed, tested and commissioned without adversely affecting the operation or safety of the Project. The Permanent Works shall be constructed so that, where appropriate, considering the operating procedures adopted by the Employer, they can be brought into operational use during non-traffic hours and if necessary during a single night following maintenance, repair or overhaul during the life of the Permanent Works, equipment and systems.

1.12 Climatic Condition / Operating Environment**1.12.1 General**

1.12.1.1 The following information on climatic conditions in Jaipur shall be taken into account by the Contractor when constructing any part of the Permanent Works. The Contractor shall ensure that due allowance is made for more severe local conditions when Permanent Works are required to operate, for example, with restricted ventilation that may lead to higher local ambient temperatures, and any other factors that may affect the operating environment in any way.

- (1) Unless specific figures are provided elsewhere, the Permanent Works will generally be required to function at its rated value with the values of ambient temperature and relative humidity appropriate to the location of the equipment within the classifications shown in Table 1-2. Certain parts of the Permanent Works may need to be rated for more or less onerous conditions as required by the TS.
- (2) Clause 1.12.2 below gives the different classifications of environment to be encountered. For any type of item, examples of which are installed in more than one environmental class, all examples of the type shall be suitable for

installation in the most severe environmental class conditions encountered by any example of the type.

- (3) The Contractor's attention is drawn to the more severe environmental conditions that may exist during the construction period and shall take adequate measures to protect the Permanent Works against any deleterious effects of such conditions during the time between installation and final completion of the Project.
- (4) Air throughout the Project will contain considerable moisture content and the atmosphere will be corrosive. The Permanent Works shall be tropicalised and vermin proof.
- (5) The indicative information on climatic conditions in Jaipur is derived from the India Meteorological Department publication
- (6) The data covers the period 1901 to 1980.

1.12.2 Classification of Equipment Environment

The locations at which equipment may be installed have been divided into four environmental classes as shown in Table 1-2. The classes of environment are considered to become more extreme from A to C.

CLASS	LOCATION of EQUIPMENT
A	Air Conditioned Offices, Computer and Equipment Rooms
B	Ventilated Equipment Rooms in buildings at the surface or at the underground station or structures.
C	Outdoors

Table 1-2 Classes of Environment

The following are the minimum requirements for equipment to be installed in each class of environment. Where any class does not have a value for a parameter the most extreme value quoted for the lesser class environments should be used.

1.12.3 Requirements for Class A

Minimum Temperature -	5°C
Ambient Temperature -	24 +-2 °C
Maximum Temperature -	35°C
Relative Humidity -	Minimum 0%, Nominal 65%, Maximum 95% (Non Condensing)
Electrical Noise -	High Frequency to 1MHz, 1kV damped to 50% after 6 cycles. Radio Frequency field strength 10 V/m, UHF & VHF bands.

1.12.4 Requirements for Class B

Ambient Temperature -	35°C
Maximum Temperature -	50°C
Relative Humidity -	Nominal 70%, Maximum 100% (Non Condensing)
Air Quality -	Polluted and dusty - SO ₂ : 80-120mg/m ³ Suspended Particulate Matter: 360-540mg/ m ³
Electrical Noise -	Impulse 1kV, 1.2/50 rise/decay, 500Σ source impedance, 0.5 J source energy. Radio & High frequency as Class A.

1.12.5 Requirements for Class C

1.12.5.1 Temperature

All equipment shall be tested in accordance with the given figured allowing a margin of at least 10% greater and 2°C less than the limits recorded. All equipment shall work within the enclosures proposed with the specified environment outside the enclosure; particular attention shall be paid to the possibility of solar gain as referred to in clause 0 below.

1.12.5.3 Wind Pressure

The system is to give satisfactory service for a wind pressure up to 150 kgf/m²

1.12.5.4 Sunshine

Monthly average sunshine hours can be obtained by placing a specific request to Meteorological Department.

1.12.5.5 Relative Humidity

Daily maximum and minimum average values during winter, summer and rainy season.

	Max	Min
Winter	72%	28%
Summer	48%	16%
Rainy	77%	35%

1.12.6 Electromagnetic Compatibility (EMC)

Electronic equipment in a railway environment shall be immunised against the usual electromagnetic influences to be expected from the rail operations. For this, the following EMC classification in accordance to IEC 801 or similar, for the equipment rooms shall be achieved:

1.12.6.1 Electrostatic discharge

The electronic equipment rooms shall be constructed in accordance to class 2 of IEC 801-2 or similar.

1.12.6.2 Electromagnetic fields

The electronic equipment rooms shall be constructed in accordance to class 2 of IEC 801-3 or similar.

1.12.6.3 Fast transient interference (Burst)

The electronic equipment rooms shall be constructed in accordance to class 2 of IEC 801-4 or similar.

1.12.6.4 High energy transient interference

The electronic equipment rooms shall be constructed in accordance to class 2 of IEC 801-5 or similar.

- 1.12.6.5S witching processes in high-voltage installations
- The location of computer systems in the neighbourhood < 1m of high-voltage installations, such as medium voltage or transformer stations as well as direct parallel exposure of power and data cables should be avoided.
- 1.12.6.6 Magnetic fields
- The following magnetic field strengths at the place of installation of cathode ray tube (CRT) based visual display units (VDU) should not be exceeded:
- DC fields: 10 A/m or 12 μ T
- AC fields: 1 A/m or 1,2 μ T
- If the image quality is impaired by values exceeding the above the Contractor shall provide any necessary shielding or alternative corrective measures to restore the picture quality. Note flat screen VDU using LED technology or similar may be acceptable if a sufficiently high resolution and image size can be obtained.
- 1.13 Survey and Site Investigations**
- 1.13.1 For reference to surveys external to the Contract, the Contractor shall refer all Levels to Mean Sea Level (MSL) Datum, which is that generally used throughout Jaipur.
- 1.13.2 The datum used for the Contract shall be Mean Sea Level Datum.
- 1.13.3 The Contractor shall carry out all further site investigations necessary for the construction of the Permanent Works and to enable the determination of the methods of construction and the nature, extent and design of Temporary Works.
- 1.13.4 The Contractor shall investigate environmental factors also to determine suitable methods of manufacture and installation, both for Temporary and Permanent Works. In particular the Contractor shall ensure that the dusty environment of Jaipur has no detrimental effect to the functionality, reliability or long term maintainability of the Permanent Works.

* End of Chapter *

CHAPTER 2

2. PLANNING, PROGRAMME AND PROGRESS MONITORING

2.1 Planning

2.1.1 The Contractor shall develop in detail, a logical method of executing the Works taking into account their complex nature and different phases and shall provide programmes which reflect the detailed planning undertaken.

2.1.2 The programmes, shall start with the Commencement Date of the Works as day one, are to be realistic, achievable and shall be accompanied by the detailed supporting Plans referred to in Chapter 3 below.

2.2 Programming General Requirements

2.2.1 Programme activities shall be discrete items of work, which when combined, produce definable elements, components, Milestones, Stages and Sections of the Works and clearly identify the completion obligations of the Contractor.

2.2.2 Access Dates and Key Dates shall be an integral part of all programmes and all activities, and sequencing and interrelationships required to achieve each completion obligation shall be shown. Milestones shall not impose constraints that in any way affect the programme logic and float or limit the achievement of Key Dates. Milestones shall not be introduced into any programme as constrained dates.

2.2.3 The critical path shall be clearly identified in the programme and fully described in the accompanying programme narrative.

2.2.4 Activity descriptions shall clearly convey the nature and scope of the Works. Programmes shall take into account the activities of precursor, concurrent, adjacent and follow on Project Contractors as well as utility service diversions, new utilities and connections and any other activity that may affect the progress of the Works.

2.2.5 The Contractor shall also incorporate the Employer's Representative's requirements for additional activities, to further explain or subdivide complex or long duration tasks, without affecting completion dates.

2.3 Progress Monitoring

The Contractor shall monitor its and its subcontractors' performance and against programmes to ensure its compliance with its obligations under the Contract. Monitoring of the Works shall include direct, daily monitoring of the progress of the Works and the preparation of written and computerised reports to be submitted to the Employer's Representative. The reports shall include all necessary supporting data to apprise the Employer's Representative of the status of the completion of the Works as described in clause 2.17 below.

2.4 Works Programme

The Works Programme to be submitted under the Contract shall be developed from the Outline Works Programme submitted and developed during the bid period. .

2.4.1 Submission Dates

2.4.1.1 Not Used

2.4.1.2 Within 60 days of the Commencement Date of the Works, the Contractor shall submit for review by the Employer's Representative the proposed full version of the Works Programme.

2.4.1.3 Should the Contractor fail to submit the in full versions of the Works Programme within the time scales nominated above the Employer may nominate the Outline Works Programme as the first issue of the Works Programme required under the Contract.

2.4.1.4 In the event that the Employer does nominate the Outline Works Programme as the first issue of the Works Programme under the Contract the Employer's Representative may include any amendments that he sees fit to change external constraining dates, duration of activities by parties other than the Contractor and subdivide the Contractors own activities to provide additional detail and links to other activities but without altering the duration or sequencing of the activities shown on the Outline Works Programme.

2.4.1.5 Final Works Programme resulting from a nomination by the Employer of the Outline Works Programme as amended shall be taken by the Contractor as his own work and any responsibility for further maintenance of the Works Programme as nominated shall remain the Contractor's.

2.4.2 Content

2.4.2.1 The Works Programme shall demonstrate by reference to its Sub-Programmes, Supplementary Programmes and associated Management Plans, the sequence and duration of activities and any restraints thereto, that the Contractor shall adopt to achieve Key Dates and to fulfil all Contract obligations. The Works Programme shall become the Employer's Representative's basis of administration of the time-related aspects of the Contract.

2.4.2.2 The Contractor shall provide the Employer's Representative with substantiation for each constraint whether target start, target finish or mandatory constraint entered by the Contractor into the Works Programme. The number of constraints shall be kept to an absolute minimum in order that the CPM networks developed can be freely analysed.

2.4.2.3 The Works Programme shall include activities for all the phases and stages of the Works, clearly showing all logical interdependencies and stages in the development of the Contractor's procurement, installation, commissioning and setting to work. As a minimum, it shall include:

- (1) all work comprising the Permanent Works;
- (2) preparation, submission and review of Documents showing all items where review by the Employer's Representative is required;
- (3) Intentionally left blank ;
- (4) procurement of all major materials and items of Contractor's Equipment for the Works, including the dates orders are to be placed, manufacture period and the expected delivery date to the Site for each item;
- (5) any software development requirements and Validation time frames;
- (6) all manufacture or prefabrication of materials or components;
- (7) intentionally left blank;
- (8) all activities associated with the securing of necessary permits and other statutory approvals for the Works;
- (9) access and availability dates for all Project Contractors;
- (10) all interfaces related to the Project that may affect the progress of the Works;

- (11) testing and commissioning activities which demonstrate an understanding of the interfaces and requirements of Chapter 9 below; and
 - (12) Training and Transfer of Technology.
- 2.4.2.4 The Works Programme shall be divided into Sub-Programmes of manageable sizes addressing in more specific detail, the content of the Management Plans as stated in Chapter 3 below. The Sub-Programmes shall be as follows:
- (1) Procurement and manufacturing programme;
 - (2) Installation Programme;
 - (3) Testing and Commissioning Programme; and
 - (4) Training and Transfer of Technology Programme
- 2.4.2.5 The submission of the full version of the Works Programme shall include the , Procurement and Manufacturing Programme and a preliminary version of the Installation Programme and the Testing and Commissioning Programme identifying all major installation, testing activities and associated interfaces.
- 2.4.2.6 In addition, the contractor shall submit any other programmes as required by the employer's Representative from time to time.
- 2.4.2.7 The Contractor's Works Programme shall comply with the following:
- (1) all programmes shall be computerised Critical Path Method (CPM) networks developed using the Precedence Diagramming Method (PDM), and submitted in both hard copy and electronic data format;
 - (2) all programmes shall be prepared using the latest version of CPM scheduling software Primavera Project Planner;
 - (3) unless consent is otherwise obtained from the Employer's Representative, all programmes shall be accompanied by a Programme Analysis Report as described in clause 2.19 below;
 - (4) a standard Gregorian calendar shall be used for planning and execution of the Works. All programme submissions shall include details of the Contractor's allowance for Public Holidays and non-work periods. If a Key Date or falls on a Public Holiday or non-work day, it shall be effective the next working day;
 - (5) the planning unit for the duration of all programme activities shall be the day. Any activity having a duration of more than thirty (30) days shall be divided into sub-activities that shall not exceed (30) days;
 - (6) CPM programmes shall reflect status using remaining duration and percent complete;
 - (7) all programmes shall be fully resource loaded as appropriate or required by the Employer's Representative covering all stages and aspects of the Contract and shall include, but not be limited to:
 - (a) major manpower for installation ;
 - (b) number of items of Contractor's Equipment ;
 - (c) number of drawings and other deliverables ;
 - (d) principle quantities of components or parts ;

- (e) principle quantities of bulk materials inclusive of cabling, pipe, ductwork and equipment items, etc.

2.4.3 All programmes constituting the Works Programme shall be organised in a logical work breakdown structure including work stages or phases. Each activity shall be coded to indicate, as a minimum, the work group or entity responsible for the activity, the area, facility or location in which the activity is included, from information provided in the BOQ. Key Dates and Access Dates shall be coded so as to be separately identifiable. The Contractor may be required to assign additional activity codes as required by the Employer's Representative.

2.5 Submission Programme

2.5.1 The Contractor shall, within 30 days of the Commencement Date of the Works, submit a Submission Programme covering all proposed submissions to the Employer's Representative.

2.5.2 The Submissions Programme shall include the proposals for vendor approvals and procurement activities of all sub-contractors and suppliers.

2.5.3 The Submissions Programme shall include each submission for every item listed in the Specification, as being required to be submitted.

2.5.4 The Submissions Programme shall ensure that all submissions are properly co-ordinated with the Contractor's overall Works Programme, particularly in respect of the following:-

- (i) progress of , manufacture, installation and testing work;
- (ii) co-ordination with other Contractors; and
- (iii) including due allowance for the Employer's Representative's review process to be undertaken, including the time needed for any re-submissions.

2.6 Procurement and Manufacturing Programme

2.6.1 Within 60 days of the Commencement Date of the Works, the Contractor shall submit for review by the Employer's Representative Procurement and Manufacturing Programme that shall be an integrated part of the overall Works Programme.

2.6.2 The Procurement and Manufacturing Programme shall show the interdependencies between engineering disciplines as well as between the Contractor and its sub-contractors and suppliers. This programme shall demonstrate compliance with the requirements of the Submissions Programme in clause 2.5 above. The procurement and Manufacturing Programme shall include the proposals for vendor approval. The contractor is required to submit proposals for vendor approvals for all equipments, assemblies, sub-assemblies spare parts, M&P and any other item required for the project. Inter alia the details should include design, manufacturing and testing facilities available with the vendor. Quality Assurance Plans adopted by the vendor and its sub-vendors shall also be submitted for employer's review. The contractor is also, required to submit the details of turnover of the vendor for last 5 years and turnover in respect of the equipment proposed to be supplied by the vendor. In case of off shore vendors the contractor is required to submit details regarding facilities available in India and the experience in transfer of technology of the vendor proposed. The proposal should also include training and other technical support to be provided by the vendor. In case of off shore vendors, the proposed scope of technology transfer shall also be included. The Contractor should ensure that the equipments/systems proposed for elevated/at-grade/ underground sections shall be, as far as possible, similar to the ones approved for Phase-I/ Phase-II lines. In case

this is not possible the proposed equipment/system should have been used for at least 5 years on any metro system.

- 2.6.3 The Contractor shall submit a weighted bar chart of the Contractor's, procurement and manufacturing activities. Each activity weight shall normally not be more than 5% of the total man-hour content or value of the respective work.
- 2.6.4 The Procurement and Manufacturing Programme shall include a separate breakdown, supported by the Material Control Schedule, which shall be a complete amplification of the Contractor's programme and equipment list, including those items which are subject to long lead time or component parts which are manufactured from countries outside the country of assembly and testing.
- 2.6.5 The Material Control Schedule shall be automated, and shall detail the following information for each permanent major and minor material and significant component. The format of such a schedule shall include:
- (1) name, description, supplier/sub-supplier details;
 - (2) drawing information (where appropriate), title, drawing status, submission dates, shop drawings/ fabrication drawing preparation, etc.;
 - (3) Employer's Representative's inspection, delivery schedules;
 - (4) Deleted
 - (5) Deleted
- 2.6.6 The Contractor shall continuously maintain this schedule and report upon the status of each item as part of the Contractor's regular progress reporting.
- 2.6.7 From this base data, the Contractor shall prepare an exception report detailing all components that are in delay. This report shall be annotated with the reason for the delay and indicate what action the Contractor is taking to recover the lost time.
- 2.6.8 The Contractor shall submit, as part of the, Procurement and Manufacturing Programme, a Factory Testing Programme that shall support all aspects of the Factory Testing Plan. This Programme shall clearly demonstrate the logic and include the topics listed in clause 3.5.1 below.
- 2.6.9 Deleted
- 2.6.10 Deleted
- 2.6.11 Deleted

2.7 Installation Programme

- 2.7.1 The Installation Programme shall be submitted as stated in the TS or as directed by the Employer's Representative. The Installation Programme shall comply with the requirements of clause 2.4.2.7 above.
- 2.7.2 The Installation Programme shall include detailed activities describing all aspects of the installation of the Works, to meet all Milestones and Key Dates given in the Contract. It shall be clearly linked to the Procurement and Manufacturing Programme and Testing and Commissioning Programme to form an integrated part of the Works Programme.
- 2.7.3 The Installation Programme shall be fully supported by the Construction and Installation Management Plan as specified in clause 3.6 below.

- 2.7.4 The Installation Programme shall indicate the physical areas to which the Contractor requires access, access date, duration required and the required degree of completion for civil or architectural finishes prior to the access date.
- 2.7.5 The Installation Programme shall take into account the requirements for arrival at port, delivery, storage, preservation and positioning of large items of Contractor's Equipment and Permanent Works and shall set out the Contractor's proposed delivery route for such items to the Site.
- 2.7.6 Installation Tests shall be clearly shown in the Installation Programme and shall include those interface tests required to be carried out by others to establish a timetable for these tests.
- 2.7.7 Activities that may be expedited by the use of overtime, additional shifts or by any other means shall be identified and explained.
- 2.7.8 In preparing the Installation Programme, the Contractor should note that the following conditions shall apply:
- (1) the Contractor shall not have exclusive access to any part of the Site except by the specific consent of the Employer's Representative;
 - (2) the Contractor shall take note that concurrent time allocations for certain areas may be given to more than one contractor. The Contractor shall co-ordinate the Contractor's work in such areas with that of Project Contractors through the Employer's Representative;
 - (3) the absence of a programme date or installation period for the Contractor in a specific area shall not prejudice the right of the Employer's Representative to establish a reasonable programme date or installation period for that area;
 - (4) the Contractor shall comply with the identified Key Dates. The Contractor shall also comply with the Access dates identified in the; and
 - (5) the Contractor shall deliver all Contractor's Equipment and Permanent Works for stations and ventilation shafts by road and via temporary access openings unless otherwise reviewed by the Employer's Representative.

2.8 Testing and Commissioning Programme

- 2.8.1 The Testing and Commissioning Programme shall be submitted as stated in the TS or as directed by the Employer's Representative and shall comply with the requirements of clause 2.4.2.7 above.
- 2.8.2 The Contractor shall submit the Testing and Commissioning Programme that shall fulfil all the on-Site testing and commissioning requirements of clause 9.3.2.2 below. The Testing and Commissioning Programme shall clearly demonstrate the logic and highlight the topics listed in the On-Site Testing and Commissioning Plan in clause 9.3.2.2 below.
- 2.8.3 The Testing and Commissioning Programme shall be fully detailed, with activities individually identifying all tests for which a certificate will be issued, and shall include activities for preparation, submittal and review of the test procedures.
- 2.8.4 The Testing and Commissioning Programme shall demonstrate the logical dependencies between the individual tests of the Works, and shall also show the interfaces and dependencies with all of the Project Contractors' tests required to commission the Works and support the Commissioning Plan.

2.9 Training and Transfer of Technology Programme

- 2.9.1 The Contractor shall, within 180 days of the Commencement Date of the Works, submit for review by the Employer's Representative, a Training and Transfer of Technology Programme covering all proposed formal training courses, delivery of training equipment and accesses by the Employer's personnel for informal 'hands on' technology transfer. The Training and Transfer of Technology Programme shall also detail specific Transfer of Technology features as required by the Specification and proposed by the Contractor.
- 2.9.2 The Training and Transfer of Technology Programme shall be developed to the Training and Transfer of Technology Plan as required under clause 3.7.4 below.
- 2.9.3 The Training and Transfer of Technology Programme shall be sufficiently detailed that the Employer can ensure the availability of staff for all the courses required under clause 10.1.6 below.
- 2.9.4 The Training and Transfer of Technology Programme shall include the requirements of Chapter 10 below, including the Training and Transfer of Technology activities of all sub-contractors and suppliers.

2.10 Not used**2.11 Not used****2.12 Not used****2.13 Track Related Installation Programme (TRIP)**

- 2.13.1 The Employer and the Employer's Representative shall, upon taking over the Permanent Works for works train running, maintain a co-ordination between the various contractors wishing to work in the section.
- 2.13.2 The Contractor and each other contractor will submit his requirements in a form similar to that required in the T/C in clause 2.12 above. The Site Co-ordination Team referred to in clause 9.5 below will maintain the TRIP and resolve conflicts between contractors by discussion at the weekly Works Train meeting to which the Contractor may send a representative.
- 2.13.3 The TRIP and associated safe working documentation issued by the Site Co-ordination Team shall be accepted by all contractors as limiting their areas of working. Any work carried out in contradiction to that allowed by the TRIP will be considered to be a breach of the site safety arrangements.

2.14 Programme Submissions

- 2.14.1 The Contractor shall submit all programmes described in this Chapter in conjunction with the Management Plans described in Chapter 3 below to the Employer's Representative for review.

2.15 Programme Review

- 2.15.1 The Employer's Representative shall, within 28 days of receipt of the initial submission of any programme for review, either give a notice of no objection or provide specific details as to why a notice of no objection is not given. If the Contractor is advised that the programme is not given a notice of no objection, the Contractor shall amend the programme taking into account the Employer's Representative's comments and/or requirements and resubmit the programme within 14 days.

2.15.2 In the case of further re-submittals, the resubmission time shall also be 14 days.

2.16 Works Programme Revisions

2.16.1 The Contractor shall immediately notify the Employer's Representative in writing of the need for any change in the Works Programme, whether due to a

change of intention or circumstances or for any other reason. Where such a proposed change affects the timely completion of the Works or any Section or Stage; the Contractor shall within 14 days of the date of notifying the Employer's Representative submit for the Employer's Representative's review his proposed revised Works Programme and accompanying Programme Analysis Report. The proposed revised Works Programme shall show the sequence of operations of any and all work related to the change and the impact of changed work or changed conditions on the Works and Project Contractors and their works.

2.16.2 If at any time the Employer's Representative considers the actual or anticipated progress of the work reflects a significant deviation from the Works Programme, he may request the Contractor to submit a proposed revised Works Programme. Upon receipt of such a request the Contractor shall submit within 14 days a revised Works Programme, together with an accompanying Programme Analysis Report and Narrative Statement, that shall demonstrate the means by which the Contractor intends to eliminate the deviation.

2.17 Monthly Progress Report

2.17.1 The Contractor shall prepare Monthly Progress Reports covering all aspects of the execution of the Works. Such Monthly Progress Reports shall be in writing and shall be delivered to the Employer's Representative by the 5th day of the month following the month of the Monthly Progress Report. The Monthly Progress Report shall take account of work performed up to and including the last day of the month to which the Monthly Progress Report relates.

2.17.2 The Monthly Progress Report shall include an executive summary and contain clear and concise statements in respect of every significant aspect of the Works including, without limitation, the requirements specified in Appendix 1 of this Specification.

2.17.3 The Monthly Progress Report shall contain evidence that documents and supports the progress of the Works, as stated in the Interim Payment Certificates, to the satisfaction of the Employer's Representative.

2.17.4 The reports, documents and data provided shall be an accurate representation of the current status of the Works and of the work to be accomplished and shall provide the Employer's Representative with a sound basis for identifying problems and deviations from planned work and for making decisions.

2.18 Programme Analysis Report

2.18.1 Deleted

2.18.2 Deleted

2.19 Key Date and Access Date Report

2.19.1 The Key Date and Access Date Report shall be prepared in a format reviewed by the Employer's Representative and identify and state the status of: -

- (1) all Key Dates and Access Dates that were planned to be achieved in the reporting period or earlier but have not been achieved;

- (2) all Key Dates and Access Dates that have been achieved in the reporting period;
 - (3) all Key Dates and Access Dates that are planned to be achieved in the next reporting period; and
 - (4) any future Key Dates and Access Dates that appear unlikely to be achieved on time.
- 2.19.2 The Key Date and Access Date Report shall identify, for all relevant Key Dates and Access Dates, the planned dates, the actual dates achieved, and where the original planned dates are forecast to be unachieved, the revised dates identified in the Contract, as the same may be revised from time to time in accordance with the Contract.
- 2.19.3 The Key Date and Access Date Report shall also provide an explanation for any deviation from the planned dates. Measures taken or required to recover programme delays shall also be identified.
- 2.20 Not used**
- 2.21 Progress Meetings**
- 2.21.1 The Employer/Engineer will chair progress meetings every month with the Contractor. These meetings will be held at dates and times to be advised by the Employer's Representative. Progress meetings shall not be later than 10 days after the issue of the Contractor's Monthly Progress Report.
- 2.21.2 The Employer's Representative may convene at his discretion, at any time upon reasonable notice to the Contractor, any meeting, either on or off the Site, to discuss and address any aspect of the Works or the Contract. The Contractor shall attend any such meetings convened by the Employer's Representative.
- 2.21.3 All meetings shall be convened in Jaipur unless directed otherwise by the Employer's Representative. Meetings shall be attended by senior personnel from the Contractor who shall arrive properly briefed for all aspects of the meeting and shall be empowered to make executive decisions in respect of the execution of the Works.
- 2.22 Quarterly Review Meetings**
- 2.22.1 The Employer's Representative may convene Quarterly Review Meetings in Jaipur at approximately three monthly intervals. The Employer's Representative will notify the Contractor the date of such Quarterly Review Meetings not less than 28 days before they are to be held.
- 2.22.2 Quarterly Review Meetings shall be held over a period of up to 3 days in order to review the overall progress of the Works in the context of the Project as a whole and to address and resolve any issues relevant to the execution and progress of the Works. Such Quarterly Review Meetings will be chaired by Senior official of the Employer or his delegate. The Contractor shall have in attendance one senior representative of Director level from each of the companies comprising the Contractor (together with the Managing Director of the company acting as leader or sponsor of the Contractor if it is a joint venture, consortium or partnership whenever necessary and required by the Employer's Representative).
- 2.22.3 The Contractor shall submit names of the persons whom the Contractor proposes to attend each Quarterly Review Meeting to the Employer's Representative for review not less than 7 days prior to each Quarterly Review Meeting.

*** END OF CHAPTER *CHAPTER 3**

3. MANAGEMENT PLANS AND SUBMISSIONS

3.1 General

3.1.1 In order to organise the various submissions required by the Employer's Representative, and to ensure the Contractor's understanding and compliance with the requirements of the Contract, a series of Management Plans shall be developed. These Management Plans will serve to structure the submittals in a manner that the Contractor can develop and prepare the submittals and the Employer's Representative can review and comment on a prescribed programme.

3.1.2 The Management Plans shall be configured as a family of "stand-alone" plans and associated documents each covering one of the subjects listed below.

The plans and documents shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combine together to assure that the Works truly meet the requirements of the Specification in respect of the subjects listed.

Unless otherwise stated in the TS, all plans and documents shall be submitted in preliminary form within 60 days of the Commencement Date of the Works followed by detailed plans within 60 days of the preliminary submission. Further submissions shall be made:

- (1) when required in accordance with the Works Programme;
- (2) whenever the development of the Contractor's planning allows the plan to be developed further;
- (3) in response to comments made by the Employer's Representative in accordance with clause 4.3.6 below;
- (4) whenever any change occurs that invalidates the information contained in the previously submitted and reviewed document, within 14 days of the occurrence of such change; and
- (5) when requested by the Employer's Representative from time to time.

3.2 General Organisation

3.2.1 The Plans listed below shall be developed and submitted by the Contractor for the Employer's Representative's review:

Project Management Plan

- **Contractor's Project Plan**
- **Interface Management Plan**

Systems Assurance Plans

- **Quality Plans**
- **Safety Plans**

Procurement and Manufacturing Plan

- **Factory Testing Plan**
- **Procurement, Manufacturing and Delivery Plan**

Construction and Installation Management Plan

- **Construction and Installation Plan**
- **Health and Safety Documentation**
- **Not used**
- Completion Management Plan**
- **Commissioning Plan**
- **Operation and Maintenance Manuals Plan**
- **Training and Transfer of Technology Plan**
- **Defects Liability Management Plan**

3.3 Project Management Plan

The overall management of the Works shall be the Contractor's responsibility. The organisation of the resources for the procurement, manufacture, delivery, installation, testing and commissioning, and setting to work is to be developed into a Project Management Plan. Each section of this plan shall fully describe the Contractor's understanding of the Works and management skills and structure required to achieve the same.

3.3.1 Contractor's Project Plan

3.3.1.1 The Contractor's Project Plan shall provide a clear overview of the Contractor's organisation, management systems and methods to be used for the complete execution of the Works.

3.3.1.2 The Contractor's Project Plan shall include a summary description of each and every stage of implementation of the Works, clearly showing the principal organisational interfaces both within the Contractor's own organisation (including sub-contractors of every tier) and with Other Contractors and Relevant Authorities, defining how each of these interfaces is to be managed and controlled. An organisation chart shall be produced to illustrate the subdivision of the work into elements for effective technical and managerial control, the reporting structure and the interface relationship among all parties involved. Names, addresses, telephone and fax numbers of all principal contacts shall be listed.

3.3.1.3 The Contractor's Project Plan shall contain structured organisation charts showing the hierarchical relationship of the Contractor's organisation (including sub-contractors of every tier). The organisation charts shall be produced as a "family" such that the basic chart shows the overall organisation structure supported by subsidiary charts detailing the internal structure of the various departments or sections of the overall organisation.

3.3.1.4 The Contractor's Project Plan shall include full details of the qualifications, experience, authority and responsibility of the personnel assigned to all key positions of the Contractor's organisation (including sub-contractors of every tier). As a minimum, this shall include all levels down to senior managers and shall include the personnel responsible for each individual department and functional group. A clear reference shall be given as to the location of staff (e.g. Site resident or factory based, etc.). Names, addresses, telephone and fax numbers of all principal contacts shall be listed.

3.3.1.5 The Contractor's Project Plan shall define the Contractor's management structure for the execution of the Works and for the control of the quality of the Works and shall, without limitation, identify and set out:

- (1) the procedure for audit;

- (2) the procedures for the control of receipt and issue of all Works related correspondence so as to ensure traceability;
- (3) the procedures for filing system to be implemented to maintain the Contractor's records during the course of the work. The filing systems used by the Contractor and sub-contractors of any tier shall be compatible as far as is necessary;
- (4) the procedures for the identification, production, verification, internal approval, review (when required) by the Employer's Representative, distribution, implementation and recording of changes to all drawings, reports and specifications;
- (5) the procedures for the evaluation, selection, engagement and monitoring of sub-contractors / suppliers together with the means of application of quality assurance to their work including audit and acceptance;
- (6) the procedure for the regular review and revision of each type of quality plan and its supplemental individual specific quality plans to ensure their continuing suitability and effectiveness, in addition to the method to be used for revision and issue of revised documentation;
- (7) the procedures for the control, calibration and maintenance of inspection, testing and measuring equipment;
- (8) the procedures for the selection, indexing, disposition and maintenance of project records for storage in the archives. A list of items to be archived including their periods of retention shall be submitted for review by the Employer's Representative;
- (9) the procedures for identifying training needs and for the provision of training of all personnel performing activities affecting quality; and
- (10) the procedures for the control of non-conformity.

3.3.1.6 Particulars of agent

- (1) The Contractor shall give and provide all necessary supervision during the execution of the Works as long as the Employer's Representative considers necessary for the proper fulfilment of the Contractor's obligations under the Contract.
- (2) The Contractor shall ensure that he is at all times represented on the Site by a competent and authorised English/Hindi speaking agent who shall be deemed to have been reviewed without objection by the Employer's Representative provided such agent is not expressly objected to by the Employer's Representative in writing within 14 days from the service of a notice upon the Employer's Representative by the Contractor of the appointment of such agent. Such agent shall be constantly on the Site and shall give his full time to the superintendence of the Works.
- (3) The Employer's Representative shall have the authority to withdraw his notice of no objection to the agent at any time. If such notice of no objection is withdrawn the Contractor shall remove the agent from the Site forthwith and shall not thereafter employ him again on the Site in any capacity and shall forthwith replace him by another competent English/Hindi speaking agent reviewed without objection by the Employer's Representative.
- (4) Such authorised agent shall receive on behalf of the Contractor directions and instructions from the Employer's Representative.

- (5) The following particulars of the proposed agent shall be submitted to the Employer's Representative for review:-
 - (i) name;
 - (ii) copy of Identity Card;
 - (iii) details of qualifications, including copies of certificates; and
 - (iv) details of previous experience.
- (6) The particulars of the agent shall be submitted 30 days before the agreed scheduled start of that part of the Works. Except in the case of a replacement agent (as provided for in clause 3.3.1.6.(3) above), in which case the said particulars shall be submitted forthwith.
- (7) The agent shall possess relevant academic or professional qualification and have at least 10 years experience in relevant engineering works. The Employer's Representative reserves the right to call upon the Contractor to prove such qualifications/experience to the satisfaction of the Employer's Representative.

3.3.2**Interface Management Plan**

- a) The Contractor shall interface and liaise with other Contractors in accordance with the requirements of clause 16.3 below.
- b) Within 60 days of notification from the Employer's Representative of the identity of each Other Contractor, the Contractor shall develop and submit to the Employer's Representative an Interface Management Plan that is mutually acceptable to both the Contractor and the other Contractors. The Interface Management Plan shall:
 - (1) identify the sub-systems as well as the civil works and facilities with interfacing requirements;
 - (2) define the authority and responsibility of the Contractor's and other Contractors' (and any relevant sub-contractors') staff involved in interface management and development;
 - (3) identify the information to be exchanged, together with the management and technical skills required for the associated development work, at each phase of the Contractor's and other Contractors' (and any relevant sub-contractors') project life-cycles;
 - (4) include considerations of the Interface Hazard Analysis;
 - (5) specify the configuration and version control procedures in accordance with the Contractor's and other Contractors' (and any relevant sub-contractors') quality management system; and
 - (6) address the supply, installation, testing and commissioning programme of the contracts to meet the key dates of each contract, and highlight any programme risks requiring management attention.
- c) Once the Interface Management Plan has been reviewed without objection by the Employer's Representative, the Contractor shall execute the Works in accordance with the Interface Management Plan. The Contractor shall advise the Employer's Representative immediately of any difficulty in developing a mutually acceptable Interface Management Plan.
- d) Within 90 days of notification from the Employer's Representative of the identity of each Other Contractor, the Contractor shall develop and submit to the

Employer's Representative for review a Detailed Interface Document for each Other Contractor that is mutually acceptable to both contractors. The Detailed Interface Document shall address in detail how the dates identified in the Interface Management Plan shall be achieved and shall identify the data required by the interfacing other Contractors to meet the requirements of the TS.

- e) The Detailed Interface Document shall specify the proposed method and schedule for verifying the interface integrity, the individual equipment/system performance and the combined system performance. The Detailed Interface Document shall include a programme of tests to demonstrate the performance and integrity of the integrated systems. The Interface Specification appended to the TS shall form the basis of the Detailed Interface Document, but does not relieve the Contractor's obligation to identify any new interface to meet the Contract requirements. Any revision to the Detailed Interface Document shall be mutually acceptable by contractors and submitted to the Employer's Representative for review.

3.4 Systems Assurance Plans

3.4.1 The Systems Assurance Plans shall submit for review to the Employer's Representative in Preliminary and Final forms.

3.4.2 The various plans shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combine together to assure that the Works truly meet the requirements of the Specification in respect of the subjects listed.

3.4.3 Configuration management of all hardware and software shall be in accordance with ISO 10007.

3.4.4 Quality Plans

The Contractor shall submit for review by the Employer's Representative quality plans in accordance with the requirements of clause 5.2 below.

3.4.5 Safety Plans

3.4.5.1 Site Safety Plan

3.4.5.1.1 The Contractor shall prepare a Site Safety Plan incorporating the requirements of the Project Safety Manual and designed specifically for the various sites (including storage and overseas sites) on which work under the Contract is carried out.

3.4.5.1.2 The Site Safety Plan shall form a part of the Health and Safety Documentation referred to in Chapter 18 below.

3.4.5.2 RAMS Plan

3.4.5.2.1 The Contractor shall implement a formal Reliability Plan and a formal Maintainability Plan in accordance with the TS and EN 50126 (Railway applications - The specification and demonstration of dependability, reliability, availability, maintainability and safety (RAMS)).

3.4.5.2.2 The Contractor's Reliability Plan and Maintainability Plan shall include Failure Modes, Effects and Criticality Analysis and the production of a Reliability Critical Items List.

- a) The Contractor shall submit for review by the Employer's Representative the Contractor's Systems Safety Plan. The System Safety plan shall address all the factors referenced in Appendix 2 of this Specification and as required by the TS.

- b) The Contractor shall submit for review by the Employer's Representative the Contractor's Reliability Plan and Maintainability Plan.

3.5 Procurement and Manufacturing Plan

The Procurement and Manufacturing Plan shall be configured as a family of "stand-alone" plans and associated documents each covering one of the subjects listed below. The plans shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combine together to assure that the Works fully meet the requirements of the Specification in respect of the subjects listed.

3.5.1 Factory Testing Plan

3.5.1.1 Deleted

The plan shall contain but not be limited to the following topics:

- (1) the plan for the production and submission of the inspection and test procedures to the Employer's Representative for review including the submission of the inspection and test reports and records; and
- (2) Type Tests, Routine Tests, First Article Inspections and any other tests constituting the Factory Acceptance Tests.

3.5.1.2 The Contractor shall arrange for all equipment and systems manufactured for incorporation into the Permanent Works to undergo a Factory Acceptance Test (FAT) before shipment from the place of manufacture. Any particular requirements for inspection and testing at the place of manufacture are prescribed in the TS.

3.5.1.3 The Contractor shall be responsible for re-inspecting and re-testing any failed inspection and Factory Acceptance Test including regression testing on previously passed items.

3.5.1.4 Inspections and tests that are to be witnessed by the Employer or the Employer's Representative shall be sensibly grouped and scheduled so that as many inspections and tests as possible may be witnessed during a single visit.

3.5.1.5 Type Tests as detailed in clause 9.2.6 below shall be performed on all items of equipment to be installed as part of the Permanent Works under the Contract.. The Type testing shall be based on the environmental class of the sites into which the equipment will be installed. Refer to clause 1.12.2 above for the different environmental classifications or otherwise as required in the TS.

3.5.1.6 For all production items a First Article Inspection shall be undertaken as detailed in clause 9.2.6.8 below. Routine production testing methods shall be detailed for review by the Employer's Representative. Routine testing shall ensure that all samples of a production item are within the tolerances required for complete interchangeability.

3.5.1.7 The Contractor shall prepare two copies of an inspection or test report immediately after the completion of each inspection or test whether or not witnessed by the Employer or the Employer's Representative. If the Employer or the Employer's Representative has witnessed the inspection or test, he will countersign the inspection or test report to indicate his review of the information and conclusions (i.e. whether or not the equipment being inspected or tested has passed satisfactorily) contained therein. If the Employer or the Employer's Representative has not witnessed the inspection or test (i.e. if a waiver has been granted, or the Employer or the Employer's Representative has not witnessed the inspection or test for some other reason in accordance with the Contract), the Contractor shall forward two copies of the inspection or test report without delay to the Employer's Representative. The Employer's Representative will countersign the report to indicate his review of the information and conclusions (i.e. whether or not the equipment being inspected or tested has passed satisfactorily) and return one copy to the Contractor. Where the

results of the inspection or test do not meet the requirements of the Specification, the Employer or the Employer's Representative may call for a re-inspection or re-test.

3.5.1.8 For standard equipment, which is serial or bulk manufactured, manufacturer's type test certificates (or equivalent) may, subject to review by the Employer's Representative, be accepted. It is to be ensured that type test should not be more than 5 years old.

3.5.1.9 Deleted

3.5.1.10 Materials and equipment shall not be released for shipment until all applicable inspections and tests including Factory Acceptance Tests have been satisfactorily completed.

3.5.2 Procurement, Manufacturing and Delivery Plan

3.5.2.1 The Contractor shall prepare procurement, manufacturing and delivery plans in respect of all items and goods. Separate parts of the plan shall be prepared for Contractor or sub-contractor off-Site activities. Each plan shall identify the scope of work to be applied. In relation to such scope of work, it shall, without limitation, define:

- a) the purchasing of items and goods and ensuring they comply with the requirements of the Specification, including (without limit) purchasing documentation and specific Verification arrangements for Contractor/Employer's Representative inspection of material or manufactured product prior to release for use;
- b) the manufacturing process so as to ensure compliance with the design;
- c) the manufacturing process so as to ensure clear identification and traceability of material and manufactured parts;
- d) the inspection and testing of incoming materials, in process and final product so as to ensure specified requirements for the material and/or manufactured product are met;
- e) the identification of the inspection and test status of all material and manufactured products during all stages of the manufacturing process to ensure that only products that have passed the required inspections and tests are dispatched for use and/or installation;
- f) review and disposal of non-conforming material or product so as to avoid unintended use;
- g) the assessment and disposal of non-conforming material and manufactured product and approval for reworking or rejection as scrap;
- h) the identification of preventive action so as to prevent recurrence of similar non-conformance; and
- i) the handling, storage, packaging, preservation and delivery of manufactured product.

3.5.2.2 Deleted

3.5.2.3 Deleted

3.5.2.4 Once the inspection and any required remedial actions are completed to the satisfaction of the Employer's Representative, the Employer's Representative shall give a notice of no objection for unit shipment. The Employer's Representative will not withhold his notice of no objection for shipping unreasonably, provided all pre-delivery assembly and testing has been successfully completed.

- 3.5.2.5 Any unit delivered without the Employer's Representative's notice of no objection shall be rejected at the Site and all expenses thereby incurred shall be borne by the Contractor.

3.6 Construction and Installation Management Plan

The Construction and Installation Management Plan shall be configured as a family of "stand-alone" plans and associated documents each covering one of the subjects listed below.

The plans shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, sequencing of activities, etc. and shall show how these combine together to assure that the Works truly meet the requirements of the Specification in respect of the subjects listed.

3.6.1 Construction and Installation Plan

- 3.6.1.1 The Contractor shall prepare plans for the construction and installation activities on and off the site, as referenced in clause 14.1.1 below, and shall ensure that these are properly related to the subsequent testing and commissioning activity.

- 3.6.1.2 Separate parts of the plan shall be prepared for other contractor(s) or sub-contractor(s) off-site activities.

- 3.6.1.3 Each construction plan shall identify the scope of activity to be controlled. In relation to such scope of activity, it shall, without limitation, define:

- (1) Deleted
- (2) Deleted
- (3) the interfacing or co-ordination required with the Contractor's other related plans;
- (4) the specific methods of construction and installation to identify any relevant method statements and develop those method statements to a sufficient degree of detail reviewed by the Employer's Representative;
- (5) a detailed method statement which shall include but not be limited to:
 - a) description of main operations and sub-operations;
 - b) sequence of sub-operations;
 - c) quantities of the work and production rates to be achieved;
 - d) resources to be employed; and
 - e) quality checks to be carried out, supervision being exercised and safety precautions to be employed;
- (6) the list of procedures and work instructions to manage and control the quality of construction and installation works, including without limitation:
 - a) Deleted
 - b) Deleted
 - c) the construction processes including Temporary Works so as to ensure compliance with drawings and Specification. In addition, any software to be used in the construction, installation and commissioning process shall be identified and details of the Verification and Validation processes for the software application shall be given;
 - d) the construction and installation process so as to ensure clear identification and traceability of material and manufactured product;
 - e) the identification of the inspection and test status of all material and manufactured products during all stages of the construction and installation

process to ensure that only products that have passed the required inspections and tests are despatched for use and/or installation;

- f) review and disposition of non-conforming material or product so as to avoid unintended use/installation;
 - g) the assessment and disposition of non-conforming material and product and approval for reworking or rejection as scrap;
 - h) the identification of preventive action so as to prevent recurrence of similar non-conformance; and
 - i) the handling, storage, packaging, preservation and delivery of product; and
- (7) the security control of the Site and the works area for Contractor's accommodation, storage, car park and other works facilities, etc. in accordance with clause 15.10 below.

3.6.1.4 Deleted

3.6.1.5 Where all or part of the Works is within the JMRC Protection Zone, the Contractor shall follow the guidelines issued by the Employer's appropriate authority. The Contractor shall submit to the Employer's Representative for review his construction method statement and detailed design of any Temporary Works proposed to be erected within this zone adjacent to JMRC properties.

3.6.1.6 The following particulars shall be submitted to the Employer's Representative for review within 14 days of the Commencement Date of the Works:

- (i) drawings showing the layout within the Site of the Employer's Representative's and Contractor's accommodation, Project signboards, access roads and major facilities required early in the Contract;
- (ii) drawings showing the layout and the construction details of the Employer's Representative's accommodation; and
- (iii) drawings showing the details to be included on Project signboards.

3.6.1.7 Drawings showing the location of stores, storage areas, work areas and other major facilities shall be submitted to the Employer's Representative for review as early as possible, but in any case not later than 28 days before construction of the facilities.

3.6.2 Health and Safety Documentation

3.6.2.1 The Contractor shall submit Health and Safety Documentation to fully comply with the requirements of the Project conditions and proposed work activities in accordance with Chapter 18 below.

3.6.2.2 The Contractor shall submit to the Employer's Representative the Health and Safety Documentation for review within 30 days of the Commencement Date of the Works.

3.6.3 Not used

3.7 Deleted

3.7.1 Deleted

3.7.2 Commissioning Plan

3.7.2.1 The Contractor shall ensure the timely preparation of the Commissioning Plan in a format and to a level of detail in accordance with clause 9.3 below. The Contractor shall submit the first draft of the Commissioning Plan to the Employer's Representative within 180 days of the Commencement Date of the Works.

3.7.2.2 The Commissioning Plan shall consist of the following:

- a. Deleted

b. On-Site Testing and Commissioning Plan**(i) Installation Tests Schedule**

The Contractor shall submit to the Employer's Representative a comprehensive schedule of Installation Tests as required by clause 9.4.3 below and the TS and in accordance with the Installation Programme as stated in clause 2.7 above. The schedule shall be submitted within the period of time laid down in the TS, or, if none is given, not later than two months in advance of the date for the commencement of the Installation Tests.

(ii) Partial Acceptance Tests Plan

The Contractor shall submit to the Employer's Representative a comprehensive Partial Acceptance Tests Plan including all requirements detailed in clause 9.4.4 below and the TS. The plan shall be submitted within the period of time laid down in the TS, or, if none is given, not later than four months in advance of the date for the commencement of the Partial Acceptance Tests.

(iii) System Acceptance Tests Plan

The Contractor shall submit to the Employer's Representative a comprehensive System Acceptance Tests Plan including all requirements detailed in clause 9.4.5 below and the TS. The plan shall be submitted within the period of time laid down in the TS, or, if none is given, not later than four months in advance of the date for the commencement of the System Acceptance Tests.

(iv) Integrated Testing & Commissioning Plan

The Contractor shall submit to the Employer's Representative a comprehensive Integrated Testing & Commissioning Plan including all requirements detailed in clause 9.4.6 below and the TS. The plan shall be submitted within the period of time laid down in the TS, or, if none is given, not later than four months in advance of the date for the commencement of the Integrated Testing & Commissioning.

3.7.3 Operation and Maintenance Manuals Plan

3.7.3.1 The Contractor shall develop an Operation and Maintenance Manuals Plan to suit staged commissioning of the system and to ensure the timely preparation of the Contractor's Operation and Maintenance Manuals and the 'As-Built' drawings in a format and to a level of detail reviewed without objection by the Employer's Representative and in accordance with Chapter 11 below.

3.7.3.2 The Contractor shall submit the Operation and Maintenance Manuals Plan by the date stated in the TS, or, if none is given, not later than nine (9) months prior to the issue of the Taking Over Certificate for the Works and according to staged commissioning of the proposed systems.

3.7.4 Training and Transfer of Technology Plan

3.7.4.1 The Contractor shall ensure the timely preparation of the Contractor's Training and Transfer of Technology Plan in a format and to a level of detail reviewed without objection by the Employer's Representative and fulfilling the requirements of clause 10.1 below.

3.7.4.2 The Contractor shall submit the Training and Transfer of Technology Plan by the date stated in the TS, or, if none is given, not less than six (6) months prior to the issue of the Taking Over Certificate for the Works and also to suit the staged commissioning of the relevant systems.

3.7.5 Not Used**3.7.6 Defects Liability Management Plan**

The Contractor shall submit for review by the Employer's Representative a Defects Liability Management Plan to repair, replace and perform any remedial item upon the Works identified by the Employer's Representative during the Defects Liability Period (DLP). The first submission of this plan is required upon issuance of the Taking Over Certificate for the Works. The Contractor shall:

- (a) endeavour to complete all necessary work in a timely responsible manner;
- (b) not proceed with any remedial work without the consent of the Employer's Representative;
- (c) submit a plan that details the methods and timing of any proposed work; and
- (d) update the plan monthly, showing progress of the work and the time to completion.

3.7.7 Not used

* End of Chapter *

CHAPTER 4

4. DOCUMENTS SUBMISSION AND REVIEW

4.1 Documents, Submissions and Correspondence

Copies of correspondence relevant to the execution of the Works and not of a confidential nature received from or despatched to Government departments, utility undertakings and Project Contractors employed by the Employer shall be submitted to the Employer's Representative for information as soon as possible but in any case not later than 7 days after receipt.

4.2 Submissions to the Employer's Representative

4.2.1 General requirements

4.2.1.1 All submissions shall be made to the Employer's Representative in a format reviewed without objection by the Employer's Representative and in accordance with the requirements in:

- (1) the Contract;
- (2) the Computer Aided Design & Drafting (CADD) Manual; and
- (3) the Document Submittal Instructions to Consultants and Contractors.

4.2.1.2 Paper and drawing sizes shall be "A" series sheets as specified in BS 3429.

4.2.1.3 The following software (versions quoted or higher) compatible for use with Intel-Windows based computers shall be used, unless otherwise stated, for the various electronic submissions required:

<u>Document Type</u>	<u>Electronic Document Format (latest versions of)</u>
Text Documents	MS Word
Spread Sheets	MS Excel
Data Base Files	MS Access
Presentation Files	MS PowerPoint
Programmes	Primavera for Windows
AutoCAD Graphics	CorelDraw / AutoCAD
Photographic	Adobe Photo Shop
Desktop Publishing	QuarkXPress
CADD Drawings	Micro Station

Media for Electronic File Submission

All submittal shall be accompanied with a CD containing the submittal.

Internet File Formats/Standards

Deleted

4.2.1.4 Deleted

4.2.1.5 If required, two copies of all internal and external orders placed by the Contractor for equipment or materials required for the Works shall be forwarded to the Employer's Representative at the time of issue. All orders shall state the Employer's Representative's requirements for inspection and testing, shall bear the Contract reference, Contractor's name and address and shall indicate, where applicable, the sub-section of the Works for which the equipment or material is required.

4.2.1.6 Deleted

4.2.1.7 The Contractor shall have the obligation to upgrade, at his own cost, all the relevant software to the latest version upon instruction by the Employer's Representative, after the new version of the relevant software has been launched for more than six months in Jaipur.

4.2.1.8 The Contractor shall submit a drawing register to the Employer's Representative in electronic copy and hard copy with each submission of drawings and at an interval agreed by the Employer's Representative. The drawing register shall be in a format submitted for review and agreed without objection by the Employer's Representative and shall include each document reference number, version, date, title and data-file name.

4.2.1.9 Specific additional requirements in respect of the numbering scheme shall be as defined in the TS.

4.2.2 Content

4.2.2.1 Unless otherwise specified or permitted by the Employer's Representative, each submission shall comprise:

- (1) for drawings - one A1 master on vellum (signed by the contractor), one A1 copy on vellum, one paper A1 copy, six paper A3 copies and an electronic data copy of all drawings; and
- (2) for documents - the unbound original, six bound copies and an electronic copy when applicable.

4.2.2.2 The A3 copies of drawings shall be produced as reduced versions of the A1 original.

4.3 Records and Reports

4.3.1 Reports and records that are to be submitted to the Employer's Representative shall be in a format reviewed by the Employer's Representative. Reports and records shall be signed by the Contractor's agent or by a representative authorised by the Contractor.

4.3.2 Within 28 days of the Commencement Date of the Works, the Contractor shall submit a Project document control procedure to the Employer's Representative for review, which shall include but not be limited to the following:

- (1) a document approval system which shall specify the level of authority for approval of all documents and material before submission to the Employer's Representative;
- (2) a system of issuing documents to ensure that pertinent documents are issued to all appropriate locations;
- (3) a document change or re-issue system to ensure that only the latest revision of a document can be used; and
- (4) a submission identification system which identifies each submission uniquely by the following:
 - (a) contract number;
 - (b) discipline;
 - (c) submission number; and
 - (d) revision indicator.

4.3.3 Project records will eventually be used by the Employer to manage, operate and maintain the Works after the completion of the Project under construction and for future reference.

4.3.4 The Contractor shall submit the documents as required by the Employer's Representative as Project records in full and on time. The Employer's Representative shall determine the adequacy of the Project record.

4.3.5 Submission and review procedure

4.3.5.1 Except where specific procedures are given for certain items, all submissions shall be submitted and reviewed according to the procedure laid down in the following clauses.

4.3.5.2 Each submission shall be accompanied by a brief introduction to explain which sub-system, part or Section of the Works to which the submission refers, listing the documents enclosed with the submission, and describing in outline how all relevant requirements of the Specification are achieved by the proposals.

4.3.5.3 For each stage of submittal, the Contractor shall prepare a Submission Review Request (SRR) carrying the date of submission, the submission reference number as defined in clause 4.3.2.(4) above, the submission title, the stage of submission, and the authorised signature of the Contractor's responsible engineer in the format shown in Appendix 3 of this Specification, to confirm that, in the opinion of the Contractor, the submission:

- (1) complies with all relevant requirements of the Specification;
- (2) conforms to all interface requirements;
- (3) contains, or is based on auditable and proven or verified calculations. ;
- (4) has been properly reviewed by the Contractor, according to the Contractor's QA system, to confirm its completeness, accuracy, adequacy and validity; and
- (5) has taken account of all requirements for approval by statutory bodies or similar organisations, and that where required, such approvals have been granted.

4.3.5.4 The Employer's Representative's response to the submission will normally be made within 30 calendar days of receipt of the submission, provided that the submission is made no later than the date shown on the Submissions Programme described in clause 2.5 above. The Employer's Representative may extend the review period depending on the amount of documentation accompanying the submission.

4.3.5.5 The Contractor shall record all of the Employer's Representative's observations and any agreed actions resulting from the Employer's Representative's review meeting and shall address each of these fully before submission of the respective documents for formal review.

4.3.5.6 If, in the Employer's Representative's opinion, following receipt of a submission there is benefit to be gained from a meeting with the Contractor to clarify or discuss any of the contents of the submission, he will notify the Contractor accordingly with not less than 5 days advance notice, and the Contractor shall attend at the time and place appointed by the Employer's Representative.

4.3.5.7 No submission may be made by the Contractor in respect of the Works or any sub-system, part or Section thereof unless a notice of no objection has been received for the previous stage of the same Works or any sub-system, part or Section thereof.

4.3.6 Employer's Representative's Response

4.3.6.1 The Employer's Representative will respond in one of the following three ways:

- (1) "Reviewed without Objection"
- (2) "Reviewed without Objection, Subject to"

(3) "Rejected"

- 4.3.6.2 If the Employer's Representative, having reviewed the submission, has not discovered any non-compliance with the Contract, the SRR will be returned endorsed with the Employer's Representative's signature and the words "Reviewed without Objection". Receipt of such notice of no objection does not in any way imply the Employer's Representative's approval of the submission, nor does it remove any responsibility from the Contractor for complying with the Contract. Issue of a "Notice of No Objection" entitles the Contractor to proceed to the next stage of the programme of work.
- 4.3.6.3 If the Employer's Representative discovers minor non-compliance, discrepancies, omissions, etc. that, in his opinion, are not of a fundamental nature, he may return the SRR endorsed with the Employer's Representative's signature and the words "Reviewed without Objection Subject to", and including a list of the features that are required to be amended, included or improved to comply with the Contract. Issue of a "Notice of No Objection Subject to" entitles the Contractor to proceed to the next stage of the programme of work provided that all of the Employer's Representative's comments are taken into account fully and implemented exactly.
- 4.3.6.4 If the Employer's Representative issues a "Notice of No Objection Subject to", the Contractor shall resubmit the affected parts of the submission, clearly demonstrating how the Employer's Representative's comments have been taken into account and resubmit amended or corrected material within 10 working days of issue of the Employer's Representative's comments, using the process described in clause 4.3.5 above.
- 4.3.6.5 If the Employer's Representative discovers major non-compliance, discrepancies, omissions, etc. that, in his opinion, are of a fundamental nature, he may return the SRR endorsed with the Employer's Representative's signature and the word "Rejected", and including a list of the features that are required to be amended, included or improved to comply with the Contract. Issue of a "Notice of Rejection" does not entitle the Contractor to proceed to the next stage of the programme of work until all of the Employer's Representative's comments are fully taken into account and a satisfactory re-submission has been made (i.e. one which results in a "Notice of No Objection" or "Notice of No Objection Subject to").
- 4.3.6.6 If the Employer's Representative issues a "Notice of Rejection", the Contractor shall resubmit the complete submission, clearly demonstrating how the Employer's Representative's comments have been taken into account and resubmit amended or corrected material within 10 working days of issue of the Employer's Representative's comments, using the process described in clause 4.3.5 above.

4.4 Records

- 4.4.1 The Contractor shall establish and maintain a place for the storage and archiving of all the documents relating to the Works and not required to be submitted to the Employer's Representative under clause 4.1 above which shall be:
- (1) the same place or office where the Contractor is performing the work and storing documents reviewed by the Employer's Representative, or;
 - (2) at the Site or elsewhere in Jaipur, a records office, which contains all other, documents that the Contractor is required to maintain in accordance with the Contract.
- 4.4.2 All documents shall be filed, indexed and suitably stored to permit easy identification and necessary audits.
- 4.4.3 The Contractor shall maintain in Jaipur his archive of all documents in connection with and arising out of the Contract, until 28 days after the issue of the Final Certificate or until final settlement of all Disputes, whichever is later.

* End of Chapter *

CHAPTER 5

5. QUALITY MANAGEMENT

5.1 Introduction

5.1.1 The Contractor shall maintain and implement a Quality Management System that shall remain in effect during the execution of the Works. The Contractor's Quality Management System shall be based on the International Standard ISO 9001/9002:2000 "Model for quality assurance in design, development, production, installation and servicing." The Contractor shall submit its Quality Management System documentation for the Employer's Representative's review as specified in this Chapter.

The Quality Management System documentation shall include, but shall not be limited to the following:

- (1) quality manual;
- (2) quality procedures and work instructions;
- (3) quality plans; and
- (4) inspection and test plans.

5.1.2 The Contractor shall plan, perform and record all quality control activities to ensure that all work is performed in accordance with the requirements of the Contract and is detailed in the quality plans which are required under this Chapter. Such activities shall include, without limitation, the inspections and/or tests expressly or implicitly required by the Contract.

5.1.3 Without prejudice to such requirements, the Employer's Representative may from time to time instruct the Contractor in relation to such further or other inspections and/or tests as are in his opinion appropriate.

5.1.4 Quality audits will be conducted by the Employer's Representative to verify the Contractor's implementation and compliance with the quality management system as specified herein.

5.2 General Requirements

5.2.1 All quality system documents and plans to be submitted shall embrace all activities of the Contractor and sub-contractors of any tier, including its suppliers.

5.2.2 Quality Plans

5.2.2.1 The quality plans to be submitted by the Contractor shall comprise of:

- (1) a Management Quality Plan, for the control of all management related activities;
- (2) Deleted;
- (3) Manufacturing Quality Plan and Site Quality Plan, for the control of activities within each category of work or discrete element of procurement, manufacturing, delivery, construction and installation of the Works, including Temporary Works.

5.2.3 Within 30 days of the Commencement Date of the Works, the Contractor shall submit for review by the Employer's Representative:

- (1) a quality manual;
- (2) the quality system procedures and any associated system instructions and/or forms which he proposes to use for the Works; and
- (3) Deleted

5.2.4 The Contractor shall submit separate Manufacturing Quality Plan and Site Quality Plan covering all elements of the Works. These shall be in accordance with the specific requirements of this Chapter and shall be submitted to the Employer's Representative for review 60 days prior to the commencement of the manufacturing and construction works covered by the quality plans. In addition, the Contractor shall prepare inspection and test plans for the management and control of the inspection and/or testing by the Contractor of the Works identified in each quality plan.

5.2.5 The Contractor shall promptly supply the Employer's Representative with two (2) controlled copies of his quality manual, quality plans, inspection and test plans and related procedures/instructions/forms upon such documents being reviewed without objection by the Employer's Representative. The Contractor shall maintain such controlled documents throughout the duration of the Contract. For any amendment to quality system documentation, the Contractor shall as soon as reasonably practicable prepare and submit the proposed amendment for review by the Employer's Representative. In addition, the Employer's Representative may request further copies of the quality system documents and these documents shall reach the Employer's Representative's office within fourteen (14) days of notification.

5.2.6 The Contractor shall appoint (a) suitably qualified and experienced person(s) as Quality Manager(s), who shall be directly responsible to senior management level and is able to discharge his duties without hindrance or constraint, and provide such other resources as may be required to ensure effective implementation of the Quality Management System and all quality plans. Details of the qualifications, experience, authority and responsibility of the proposed Quality Manager(s) shall be submitted for review by the Employer's Representative within 30 days of the Commencement Date of the Works.

5.2.7 During the Contract period, upon receipt of a Corrective Action Request (CAR) or similar document issued by the Employer's Representative as a result of quality audits, the Contractor shall submit a proposed corrective and preventive action plan within 14 days to the Employer's Representative for review.

5.3 Management Quality Plan

5.3.1 The Management Quality Plan shall define the Contractor's management structure for the execution of the Works and for the control of the quality of the Works and shall, without limitation, define:

- (1) 5.3.1.1 the appointment of a Quality Manager in accordance with clause 5.2.6 above;
- (2) 5.3.1.2 the organisation of the Contractor's managerial staff with particular reference to any joint venture partners and main sub-contractors. An organisation chart shall be produced to illustrate the sub-division of the Works into elements for effective technical and managerial control, the reporting structure and the interface relationship between all parties involved;
- (3) 5.3.1.3 the hierarchy of the overall quality management system documentation to be applied to the Works;

- (4) 5.3.1.4 the quality management system of the Contractor in monitoring and controlling sub-contractors and suppliers; and
- (5) 5.3.1.5 the list of quality system procedures and work instructions to be applied to manage the quality of the Works.

5.4 Not used

5.5 Site Quality Plan

5.5.1 The Contractor shall prepare a Site Quality Plan for its construction and installation works. The Site Quality Plan shall, without limitation, define:

- (1) the organisation of the Contractor's staff directly responsible for the day-to-day management of the construction and installation activities on or off the Site;
- (2) the specific allocations of responsibilities and authorities given to identified personnel or sub-contractors for particular construction and installation work;
- (3) the hierarchy of quality management system documentation for managing and controlling construction and installation works, including construction and installation works of sub-contractors of any tier; and
- (4) the list of procedures and instructions to be applied to manage and control the construction and installation works together with the procedures and instructions that have not been previously submitted for review.

5.5.2 The Contractor shall also prepare inspection and test plans to manage and control any test and inspection activities in accordance with clause 5.6.1 below.

5.6 Inspection and Test Plans, Records and Reports

5.6.1 Inspection and test plans shall be produced for every activity requiring test and/or inspection. Each inspection and test plan shall identify the quality objectives and include, without limitation:

- (1) the personnel responsible for undertaking and certifying the inspection and/or test;
- (2) the procedure or instructions for the inspection and/or test;
- (3) the test method or a reference to the relevant standard of testing;
- (4) the inspection and/or test required prior to commencement of an activity;
- (5) the inspection and/or test during an activity and its frequency;
- (6) the inspection and/or test required to complete an activity;
- (7) all Quality Control Points, Quality Hold Points and any notices or other documents to be given to the Employer's Representative in relation to Quality Control Points and Quality Hold Points;
- (8) the compliance criteria;
- (9) the method of analysis of test data;

- (10) the procedure for correction or disposal of any work which fails the compliance criteria;
- (11) examples of the documentation to be used for reporting the results of inspections, tests and analysis of test data;
- (12) examples of the documentation to be used for recording the status of inspections and tests in accordance with clause 5.8.1 below; and
- (13) the procedure for the distribution, filing and storage of inspection reports, test reports and reports on analysis of test data.

5.6.2 Each report of the inspection and/or test shall be prepared in accordance with clause 9.6.6.1 below.

5.6.3 The Contractor shall ensure that a signed copy of each report of inspection and test is filed in his filing system within 3 (three) working days of the date of inspection and test.

5.6.4 In relation to all Quality Control Points and Quality Hold Points involving inspection and/or test by the Contractor, the Contractor shall give the Employer's Representative notice of when the relevant work will be inspected and/or tested in accordance with clause 9.8.1 below.

5.7 Review, Verification & Audit

5.7.1 The Contractor shall continuously monitor the performance of each quality plan related to the execution of the Works and shall include in each Monthly Progress Report the status of all quality system documentation, an up-to-date audit schedule and status and an up-to-date non-conformity register providing the status of all non-conformities identified by the Employer's Representative and the Contractor. The Contractor shall make an appraisal of such performance and identify in particular any non-conformities or other shortcomings in the quality management system, the actions being taken to dispose of these non-conformities, any necessary corrective action taken or proposed to be taken to prevent the re-occurrence of these non-conformities or shortcomings and, any other items as instructed by the Employer's Representative.

5.7.2 The Contractor shall ensure that audits of all the activities in each quality plan are carried out at quarterly intervals, or at such other intervals as the Employer's Representative may require, to ensure the continuing suitability and effectiveness of the quality management system. Reports of each such audit shall be submitted promptly for review by the Employer's Representative.

5.7.3 The Contractor shall ensure that the requirements for supervision and verification of work by the Contractor and/or his sub-contractors of any tiers are identified in the quality plans and adequate resources and trained personnel are provided for these activities.

5.7.4 The Contractor shall submit for review by the Employer's Representative details of the authority, qualifications and experience of personnel assigned to review, verification and to audit activities.

5.7.5 The Employer's Representative may, by notice to the Contractor, require external audits of the Contractor's quality management system to be carried out either by the Employer's staff or by his representative. In such case, the Contractor shall afford to such auditors all necessary facilities and access to the records to permit this function to be performed.

5.8 Quality Control Register

5.8.1 The Contractor shall provide and maintain at all stages of the Works a quality control register or registers to identify the status of inspections, sampling and testing of the work and all certificates. Such registers shall be updated by the Contractor to show all activities in previous months and shall reach the Employer's Representative's office before the 7th working day of each month. Each register shall:

- (1) list the certificates received for each batch of goods and materials incorporated in the Works and compare this against the certification required by the Contract and the Contractor's quality plans;
- (2) list the inspection and testing activities undertaken by the Contractor on each element of the Works and compare these activities against the amount of inspection and testing required by the Contract and the Contractor's quality plans;
- (3) show the results of each report of inspection and/or test and any required analysis of these results and compare these results against the pass/fail criteria; and
- (4) summarize any actions proposed by the Contractor to overcome any non-conformity identified in clauses 5.8.1.(1),(2) & (3) above.

5.9 Summaries of Inspection and/or Test

The Contractor shall submit to the Employer's Representative for his information summaries based on quality control register in accordance with the Summaries of Inspection and/or Test described in clause 9.6.11 below.

5.10 Notification of Non-conformities

5.10.1 If, prior to the issue of the Taking Over Certificate for the Works or the relevant Section, the Contractor has used or proposes to use or repair any item of the Works which does not conform to the requirements of the Contract, he shall immediately submit to the Employer's Representative such proposal, supplying full particulars of the non-conformity and, if appropriate, of the proposed means of repair which shall include any calculation analysis or other documentation to support the repair or acceptability of the non-conformity.

5.10.2 If the Employer's Representative issues non-conformity reports or similar documents to notify the Contractor of any item of the Works which he considers to constitute a non-conformity and which has not been reported in accordance with clause 5.10.1 above, the Contractor shall promptly investigate the matter and, within 14 days of notification by the Employer's Representative, submit to the Employer's Representative for review the remedial measures to be taken and stating the reasons for such measures.

* End of Chapter *

CHAPTER 6

6. SOFTWARE MANAGEMENT AND CONTROL

6.1 Prescriptive Framework

All software to be developed or modified (re-engineered software) shall follow the normative requirements of EN50128 (Railway Applications: Software for Railway Control and Protection Systems). The Software shall be designed, developed and tested according to the Software Quality assurance Plan, Software Integrity Level (SIL) and the Software Lifecycle. The Contractor shall define within the Software Quality Assurance Plan what techniques and measures are to be applied for software development. In addition to the requirements of the Software Quality Assurance Plan, justification, which shall be reviewed without objection by the Employer's Representative, shall be required in respect of any highly recommended EN50128 Annex A normative clauses which are not to be applied to software development and supply.

6.2 Software Framework

As defined in EN50128, all software produced or supplied for the project shall be subject to a defined quality framework. The Contractor shall use a Quality Assurance System which is compliant with CENELEC specifications, with EN29000 series and others and meet the requirements as stipulated in the TS. ISO 9000-3 is considered appropriate for Safety Integrity Level 0 or 1 software.

6.3 All Control & Monitoring Software has to be provided to the Employer in the following formats

- i) Source Code
- II) Detailed Programme With explanation of key functions, protection schemes and safety requirement.
- III) System description and layout module wise.
- IV) Troubleshooting of hardware & software including that in communication with SCADA.

6.4 System should generate non- conformity statements with classification of severity of the non-conformity. The daily reports should be updated.

6.5 This will form part of the submittals.

* End of Chapter *

CHAPTER 7

7. MATERIALS AND EQUIPMENT

7.1 Materials and Equipment Provided by the Employer

- 7.1.1 Materials and equipment which are to be provided by the Employer will be as stated in the Contract.
- 7.1.2 Materials and equipment provided by the Employer shall be collected by the Contractor from the locations stated in the Contract and delivered by the Contractor to the Site. The Contractor shall inspect the materials and equipment before taking receipt and shall immediately inform the Employer's Representative of any shortage or damage.
- 7.1.3 Materials or equipment provided by the Employer which are damaged after collection shall be repaired by the Contractor and submitted to the Employer's Representative for review. Materials or equipment which are lost or which in the opinion of the Employer's Representative are not capable of being or have not been repaired satisfactorily shall be replaced by the Contractor.
- 7.1.4 The Contractor shall dispose of crates and containers for materials or equipment provided by the Employer.
- 7.1.5 Equipment / materials provided by the Employer, surplus to the requirements of the Works shall be returned to the locations stated in the Contract.
- 7.1.6 The Contractor shall protect and maintain equipment provided by the Employer while it is on the Site and shall provide operatives, fuel and other consumables required to operate the equipment.

7.2 Materials

7.2.1 General

- 7.2.1.1 Materials for inclusion in the Permanent Works shall be new unless otherwise stated in the Contract or having been reviewed without objection by the Employer's Representative.
- 7.2.1.2 Certificates of tests by manufacturers, which are submitted to the Employer's Representative, shall relate to the material delivered to the Site. Certified true copies of certificates may be submitted if the original certificates cannot be obtained from the manufacturer. A letter from the supplier stating that the certificates relate to the material delivered to the Site shall be submitted with the certificates.
- 7.2.1.3 Materials, which are specified by means of trade or proprietary names, may be substituted by materials from a different manufacturer, provided that the materials are of the same or better quality and comply with the specified requirements and have been reviewed without objection by the Employer's Representative.
- 7.2.1.4 In addition to any special provisions in the Contract for the sampling and testing of materials, the Contractor shall submit samples of all materials and goods which it propose to use or employ in or for the Works. Such samples, if having been reviewed without objection, shall be retained by the Employer's Representative and shall not be returned to the Contractor or used in the Permanent Works unless reviewed by the Employer's Representative. No materials or goods of which samples have been submitted shall be used in the Works unless and until the Employer's Representative shall have reviewed such samples without objection.
- 7.2.1.5 The Employer's Representative may reject any materials and goods which in his opinion are inferior to the samples previously reviewed and the Contractor shall promptly remove such materials and goods from the Site.
- 7.2.1.6 If any material required for this Contract is not available in metric specifications from any known sources, at the time the material is required for the Contract, the Employer's Representative may, upon application from the Contractor, give permission to the use of an equivalent material in imperial specifications as a substitute, provided that:

- (1) no statutory specification shall be altered except in accordance with relevant legal provision, if any;
- (2) the Employer's Representative is satisfied that the Contractor has made every reasonable effort to obtain the material in metric specifications;
- (3) in the opinion of the Employer's Representative, the substitute material is suitable for the Works in all respects;
- (4) in the opinion of the Employer's Representative, the substitute material complies with all the specifications for the material substituted, allowing minor discrepancies between the specified metric measurements and the corresponding imperial measurements of the substitute, provided that such discrepancies can be effectively and satisfactorily compensated for by the provision of extra quantity of the material; and
- (5) the Contractor shall be responsible for all extra quantities of the material required for meeting specification requirements of the Works due to the use of the substitute.

7.2.1.7 Hardwood shall not be used for Site Hoardings, shoring of trenches and pits, false work or form work.

7.2.2 Notice of place of manufacture and/or source of supply

The Contractor shall notify the Employer's Representative of the places of manufacture and/or the source of supply of all goods and materials previously reviewed without objection by the Employer's Representative to be incorporated into the Permanent Works. The Contractor shall give reasonable notice (which shall not in any event be less than 56 days) to the Employer's Representative before the start of any manufacturing and/or the supply of goods and materials.

7.2.3 Certificates for Manufactured Goods or Materials

The Contractor shall obtain certificates for each batch of goods and materials incorporated into the Permanent Works. Each certificate shall certify that the materials comply with the requirements of the Contract and shall include all reports of inspections and/or tests carried out at the place of manufacture.

7.3 Equipment

7.3.1 Identification labels

7.3.1.1 Each and every individual item of equipment forming part of the Permanent Works shall be fitted with permanent identification labels in accordance with a system based on the contract identification. In this respect, the term "individual item of equipment" refers to a complete assembly of components and to each removable sub-module within the complete assembly.

7.3.1.2 The proposed labelling system shall be submitted for review by the Employer's Representative at least 3 months before the scheduled date for the shipment of the first item of equipment to site.

7.3.1.3 The identification label shall be permanently attached in such a way that it shall not become detached or illegible during the lifetime of the system from any cause including wear and tear, environmental effects (such as rain, direct sunlight, etc.) or any other influence. Preference shall be given to embossed or engraved metallic labels mechanically fastened by riveting or similar means to the item to which they refer.

7.3.1.4 All labels shall be easily cleaned to remove dirt and debris (including grease and oil) without disturbing the legibility properties.

7.3.1.5 All labels shall incorporate the inscription "Property of JMRC".

7.4 Electronic Control Racks & Cabinets

7.4.1 Racks & Cabinets

- 7.4.1.1 Electronic control equipment shall be housed in racks suitably enclosed in metal cabinets.
- 7.4.1.2 The equipment shall be of modular construction to facilitate maintenance, repair and replacement of parts. Standard commercial parts shall be utilised to the maximum extent possible.
- 7.4.1.3 Cubicles, Equipment Racks, cable and wiring Termination Racks shall not be filled to greater than 80% of their capacity at the completion of the works.
- 7.4.1.4 Deleted
- 7.4.1.5 The equipment shall be suitable for the environment in which it is to be used and it shall be to prevent ingress of all vermin and to minimise the ingress of moisture, dust and dirt.
- 7.4.1.6 **Unless otherwise specified in TS , indoor equipments shall have a minimum IP rating of IP54 and out door equipment shall have IP rating of IP 65 under IEC 529.**
- 7.4.1.7 No item of equipment, which is removable, as part of routine maintenance procedures shall be mounted at more than 2.0m above floor level.
- 7.4.2 Cables**
- 7.4.2.1 No joints or splices shall be permitted in cables or wires except at recognised termination points.
- 7.4.2.2 Not used
- 7.4.2.3 All cable cores shall be terminated including all spare conductors.
- 7.4.2.4 Each cable core shall be uniquely numbered and identified with a label giving details of the circuit carried.
- 7.4.2.5 Terminals carrying voltages exceeding 50 volts shall be uniquely identified and protected against accidental contact by persons, test equipment or other unintended physical contact. Similarly all bus bars shall be suitably identified and protected.

* End of Chapter *

CHAPTER 8

8. PACKAGING, STORAGE, SHIPPING AND DELIVERY

8.1 Storage of Equipment

8.1.1 The Contractor shall provide and maintain acceptable storage facilities for the Permanent Works, equipment and materials of all kinds intended for use in carrying out the Works or for incorporation into the Works.

8.1.2 The Contractor shall prepare, protect and store in an agreed manner all Permanent Works, Contractor's Equipment, equipment and materials so as to safeguard them against loss or damage from repeated handling, from climatic influences and from all other hazards arising during shipment or storage on or off the Site.

8.1.3 Secure and covered storage shall be provided by the Contractor for all Permanent Works, Contractor's Equipment, equipment and materials which are other than those having been reviewed without objection by the Employer's Representative as suitable for open storage.

8.2 Crating

8.2.1 Deleted

8.3 General Precautions

8.3.1 Spare parts shall be tropicalised in their packing for prolonged storage in accordance with BS 1133 or other equivalent International /Indian standard and shall be suitably and individually labelled to indicate:

- (1) shelf life and date of manufacture;
- (2) type or condition(s) of storage and special handling information;
- (3) description of item and relevant part number;
- (4) serial number, if applicable;
- (5) inspection/test certificate number and batch number; and
- (6) Contract number, variation order number and item number.

8.3.2 Deleted

8.3.3 Deleted

8.3.4 Deleted

8.3.5 Deleted

8.3.6 Appropriate precautions in accordance with the Contractor's safety regulations, the regulations of the Employer, and statutory regulations shall be taken in respect of all hazardous, toxic, inflammable, etc. materials.

8.4 Packaging Procedures

- 8.4.1 All required inspection/test certificates shall be supplied and packed together with individual material. All packaging materials and procedures shall be subject to review by the Employer's Representative.
- 8.4.2 All empty cases, crates or packages, whether or not returnable, shall be removed from the Site by the Contractor or stored by the Contractor in such a way that they do not interfere with the progress of the works of Project Contractors.

8.5 Shipping

- 8.5.1 The Contractor shall notify the Employer's Representative ten days in advance of any expected shipment date and give further notification of the actual shipment date and routing when such information is subsequently established. This shall complement the inspection requirements prior to delivery as specified herein.
- 8.5.2 Two copies of packing lists and quality certificates shall be attached to each case or package to be shipped. One copy shall be placed inside the package and the second copy shall be enclosed in a watertight enclosure on the outside of each case or package. A copy of packing lists and quality certificates shall be sent to the Employer's Representative after each package of the Works, the equipment, spare parts and other items to be shipped have been shipped.
- 8.5.3 Without prejudice to any other provisions of the Contract, the Contractor shall be responsible for all legal requirements, duties, dues, taxes and other such requirements and expenditures required for the importation of the Works, the equipment, spare parts and other items to be supplied under the Contract into Jaipur.
- 8.5.4 The Contractor shall clear the Works, the equipment, spare parts and other items to be supplied under the Contract through Jaipur customs/Indian sea port in accordance with all Government of India Enactments.

8.6 Delivery

- 8.6.1 The Contractor shall deliver the Works and all items to be supplied under the Contract to the Site.
- 8.6.2 The Contractor shall unload the Works and all items to be supplied under the Contract at the designated delivery point and positioning or storing them.
- 8.6.3 Any part of the Works or any item to be supplied under the Contract that is damaged in transit shall not be considered as delivered until repairs or replacements have been made and all necessary spare parts or items have been delivered to the Site.
- 8.6.4 All documents, manuals, drawings and other deliverables shall be delivered to an address in Jaipur to be designated by the Employer's Representative in writing.
- 8.6.5 The Contractor shall store and secure the Works, equipment, spare parts and other items until the same have been inspected and are considered delivered at the designated point by the Employer's Representative.
- 8.6.6 The Contractor shall remove temporary fittings required for shipment and re-assembly of equipment and shall complete this prior to the equipment or parts thereof being inspected and before they are considered delivered.
- 8.6.7 An item shall be considered delivered when all damage have been repaired and all documentation and post delivery preparation have been completed to the satisfaction of the Employer's Representative.

* End of Chapter *

CHAPTER 9

9. TESTING AND COMMISSIONING

Testing and Commissioning shall comply with all the requirements of the GCC supplemented, amplified, modified or superseded as applicable by SCC ,this Specification and the TS.

9.1 General

9.1.1 Deleted.

9.1.2 Deleted

9.1.3 Deleted.

9.1.4 The Employer and the Employer's Representative will bear their own costs for attendance at witnessed inspections or tests (other than re-tests) scheduled in accordance with the agreed Works Programme and subject to notice in accordance with the Specification.

9.2 Manufacturing Test Plan

9.2.1 The Manufacturing Test Plan is the Contractor's plan for carrying out the necessary procedures to ensure that the items presented for acceptance by the Employer and the Employer's Representative are in compliance with the requirements of the Specification.

9.2.2 During the process of procurement and manufacture of the system components the Contractor shall undertake such testing and inspection as is required by the Quality Plan referred to in clause 5.4 above **5.6**.

9.2.3 The Employer and the Employer's Representative will not become involved in the Contractor's Manufacturing Tests except in respect of the following:

- **Type Tests**; and
- **First Article Inspection**.

9.2.4 Before shipment of any items to Site the Contractor shall present the items for the first stage of Acceptance according to the Commissioning Plan as detailed in clause 9.3 below.

9.2.5 Inspection

9.2.5.1 The Contractor shall be wholly responsible for all inward inspection of items to be incorporated into the system as a whole.

9.2.5.2 Equipment issued by the Employer shall not be subject to **Type Tests** or **First Article Inspection** however the Contractor shall undertake Inspection as referenced in clause 7.1 above. Should the Employer's issued equipment be subsequently incorporated into another manufactured item then the whole item shall be subject to both **Type Tests** and **First Article Inspection**.

9.2.6 Type Tests

9.2.6.1 Deleted.

9.2.6.2 Deleted

9.2.6.3 Deleted

9.2.6.4 Type tests are not required if previously independently witnessed tests have been successfully carried out. Where only some of the required tests have been carried out, the Employer's Representative may agree to selected type tests being carried out individually rather than as part of a sequence.

9.2.6.5 Deleted

9.2.6.6 Deleted

9.2.6.7 For each test, the Employer's Representative will determine whether the item under test has passed or failed. In general, the test will be considered to have failed if either:

- The result of the test is not in accordance with the expected result described in the test procedure, or
- The result of the test is in accordance with the expected result described in the test procedure, but some other unexpected or unexplained event occurred which the Employer's Representative considers to be a fault.

9.2.6.8 If during Type Tests, any failure occurs or the equipment is changed, it shall be reported to the Employer's Representative who may, at his discretion, require repetition of the previous tests at the Contractor's cost.

9.2.7 First Article Inspection

9.2.7.1 FAI shall be performed jointly by the Employer and the Employer's Representative and the Contractor on all major equipment items or sub-systems identified by the Employer's Representative.

9.2.7.2 Equipment shall be shipped from the point of manufacture only after a FAI has been completed or the requirement waived in writing by the Employer's Representative.

9.2.7.3 The Contractor shall provide a minimum of 15 working days notice to the Employer's Representative before any FAI.

9.2.7.4 At least 15 days prior to each FAI, the latest drawings, inspection and test procedures, specifications and quality documentation required for adequate inspection of the equipment under inspection shall be submitted to the Employer's Representative. The drawings shall be complete to the lowest level replaceable unit.

9.2.7.5 The Contractor shall ensure that he and his subcontractors are prepared for all FAIs. The Contractor shall not schedule more than one FAI on the same day without prior notice of No Objection by the Employer's Representative.

9.2.7.6 Deleted

9.2.7.7 Deleted

9.2.7.8 The Contractor shall be responsible for the cost and scheduling, to the Employer and the Employer's Representative's convenience, of any repeat testing of items which fail FAI.

9.2.8 Factory Acceptance Test

9.2.8.1 Before shipment all manufactured items or systems shall undergo FAT in accordance with the requirements of the PS / TS.

9.3 Commissioning Plan

9.3.1 The Commissioning Plan is the Employer and the Employer's Representative's tool for managing and co-ordinating the Testing, Commissioning, Training and Service Trial activities. The Commissioning Plan will be divided into the following sub-plans:

- (1) Factory Testing Plan (see clause 3.5.1 above and PS / TS)
- (2) On-Site Testing and Commissioning Plan

9.3.2 Testing and Commissioning Phases

9.3.2.1 Testing and Commissioning activities shall be undertaken in the following phases:

- (1) **Factory Acceptance Test** (which requirements are specified in clause 3.5.1 above);
- (2) **Installation Tests;**
- (3) **Partial Acceptance Tests;**
- (4) **System Acceptance Tests;**
- (5) **Integrated Testing & Commissioning;** and
- (6) **Service Trial.**

9.3.2.2 Items (3), (4), (5) and (6) as required by the PS / TS constitute the Tests on Completion referred to in the GCC.

9.4 On-Site Testing and Commissioning Plan

9.4.1 The Contractor shall prepare and submit for review by the Employer's Representative the Contractor's On-Site Testing and Commissioning Plan detailing and explaining how the Contractor will plan, perform and document all tests and inspections that will be conducted to verify and validate the Works on Site. The On-Site Testing and Commissioning Plan shall consist of a narrative description supported by graphics, diagrams and tabulations as required.

9.4.2 The On-Site Testing and Commissioning Plan shall contain, but not be limited to, the following topics:

- (1) the Contractor's strategy for testing and commissioning all constituent parts of the Works and how this relates to the sequence of construction and installation;
- (2) Deleted
- (3) the interdependency and interaction with other Contractors and their commissioning programmes; the type and extent of testing and commissioning to be undertaken and the parts of the Works to be proven by that testing; the objective of each test, what particular operating criteria the test or inspection will prove and how the success of the test will be demonstrated or measured;
- (4) Deleted
- (5) the plan for the production and submission of the testing and commissioning procedures to the Employer's Representative for review including the submission of the testing and commissioning reports and records; and
- (6) the On-Site Testing and Commissioning Plan shall be organised and submitted in the stages described in clauses 9.3.2 above, 9.4.3 below & 9.4.7 below.

9.4.3 Installation Tests

9.4.3.1 The Installation Tests phase is defined as being the final stage of assembly/installation before the start of commissioning itself. The Installation Tests are to be performed by the Contractor under the Contract and may be witnessed by the Employer or the Employer's Representative. During this phase, the Contractor

shall perform static testing of components and/or systems in preparation for Partial Acceptance Testing.

9.4.3.2 The particular requirements for Installation Tests are prescribed in the TS. Where performance across interfaces to other Contractors or to other parties is required to be verified, the Contractor shall liaise with the interfacing party to co-ordinate the test procedures and programme in the manner prescribed in clause 3.3.2 above.

9.4.3.3 The Contractor shall prepare three copies of a test report immediately after the completion of each test whether or not witnessed by the Employer or the Employer's Representative. If the Employer or the Employer's Representative has witnessed the test, he will countersign the report to indicate his agreement to the information and conclusions (i.e. whether or not the equipment being tested has passed satisfactorily) contained therein. If the Employer or the Employer's Representative has not witnessed the test (i.e. if a written waiver has been granted), the Contractor shall forward three copies of the test report without delay to the Employer's Representative.

9.4.3.4 The Employer's Representative will countersign the report to indicate his agreement to the information and conclusions (i.e. whether or not the equipment being tested has passed satisfactorily) and return one copy to the Contractor. Where the results of the test do not meet the requirements of the Specification, the Employer or the Employer's Representative may call for a re-test.

9.4.3.5 Test equipment and instrumentation shall be subject to calibration test within a properly controlled calibration scheme, and signed calibration certificates shall be supplied to the Employer's Representative in duplicate. Such calibration checks shall be undertaken prior to testing and, if required by the Employer or the Employer's Representative, shall be repeated afterwards.

9.4.3.6 The Contractor shall submit to the Employer's Representative a comprehensive schedule of tests as required by the TS giving full details and procedures for each test to be carried out under the Contract and including the pass / fail criteria (i.e. the standards or limits to be achieved).

9.4.4 **Partial Acceptance Tests**

9.4.4.1 Partial Acceptance Tests are defined as the performance of functional tests of sections, areas, or stages of a system. The Partial Acceptance Tests are part of the Tests on Completion to be performed by the Contractor under the Contract in order to achieve Employer's Taking Over of the Works. During this phase, an energy source shall be introduced to enable functional testing to be performed. On satisfactory completion of the Partial Acceptance Tests, the tested items will be considered available for Systems Acceptance Testing.

9.4.4.2 The particular requirements for Partial Acceptance Tests prescribed in the PS / TS are indicative only.

9.4.4.3 The Contractor shall submit to the Employer's Representative a comprehensive Partial Acceptance Tests Plan including all requirements detailed in the PS / TS. The plan shall be submitted on a logical section-by-section basis, using a "top-down" approach describing the testing and commissioning strategies and processes clearly showing how these serve to provide the full verification of the systems and equipment.

9.4.4.4 The Partial Acceptance Tests Plan shall identify a comprehensive list of specifications, standards, method statements, procedures, pass/fail criteria, sample records, resources to be made available, drawings and records to be submitted to the Employer's Representative, and a programme showing the dates for testing and for submission of each test procedure.

9.4.4.5 Test procedures shall be carefully planned to ensure that the work can be executed in the time available. If the available time is restricted, this planning shall include contingency plans to be implemented if testing proceeds slower than anticipated or if defects are discovered that necessitate rectification and subsequent repeat testing, etc.

- 9.4.4.6 If any working equipment is relocated or altered by the Contractor during the execution of the Works, thorough re-testing shall be performed to verify that the equipment remains fully functional and operates safely according to its specification. The testing to be performed shall be no less rigorous than the procedures used for the original testing and commissioning of the equipment.
- 9.4.4.7 The Contractor shall submit to the Employer's Representative by the date laid down in the PS / TS (or if none is given, no later than two months before the commencement of the commissioning work whichever is earlier), 3 copies of its proposed Partial Acceptance Tests records. The records shall be appropriately sub-divided to make provision for the various parts of the systems and equipment covered by the Contract and shall cover all tests (mechanical, electrical or otherwise), positive identification of equipment, assemblies and sub-assemblies by serial number, drawing and specification reference numbers (and issue reference) and any other data to be certified by the Employer or the Employer's Representative during the course of commissioning.
- 9.4.4.8 The Contractor shall during the execution of the Works prepare such reports and records of, manufacture, installation, erection and testing as may be required in order that any relevant licences or approvals (including any statutory approvals) may be issued or granted. Such records shall be adequate to enable the system or its respective part to be commissioned and to meet the requirements of the licensing authority or statutory body.
- 9.4.4.9 Immediately following the successful Partial Acceptance Testing of the system or any constituent part, the Contractor shall complete the appropriate Partial Acceptance Tests records in the agreed format and submit 3 signed copies to the Employer's Representative.
- 9.4.4.10 The Contractor shall include a complete schedule of all Partial Acceptance Tests records and their current status within the Monthly Progress Report.
- 9.4.5 **System Acceptance Tests**
- 9.4.5.1 System Acceptance Tests are defined as the tests undertaken to demonstrate that the Works in its entirety is capable of functioning in accordance with the specified requirements in the Contract in all respects. The System Acceptance Tests are part of the Tests on Completion to be performed by the Contractor under the Contract in order to achieve Employer's Taking Over of the Works. The System Acceptance Tests may commence before remote operations capability (if any) is fully functional, however, the system must be satisfactorily tested remotely (if specified to have such capability) before the System Acceptance Tests can be considered to be completed. On satisfactory completion of the System Acceptance Tests, the tested items will be considered available for Integrated Testing & Commissioning.
- 9.4.5.2 The particular requirements for System Acceptance Tests are prescribed in the PS / TS are indicative only.
- 9.4.5.3 The Contractor shall submit to the Employer's Representative a comprehensive System Acceptance Tests Plan including all requirements detailed in the PS / TS. The plan shall be submitted on a section by section basis to demonstrate how the System Acceptance Tests are to be carried out. The plan shall adopt a top down approach and describe the system completion strategy and process.
- 9.4.5.4 System Acceptance Tests shall comprise comprehensive testing of the assembled installation to ensure that it operates in accordance with the requirements of the PS / TS.
- 9.4.5.5 The tests shall include, but not be limited to, the following:
- (1) tests of all functional and performance requirements for the system;
 - (2) tests of behaviour under failure conditions, e.g. changeover to redundant hardware; initiation of re-configuration functions or reverse modes of operation; and recovery of the equipment and system from failure.

- 9.4.5.6 The System Acceptance Test Plan shall identify a comprehensive list of specifications, standards, method statements, procedures, pass / fail criteria, sample records, resources to be made available, drawings and records to be submitted to the Employer's Representative, and programme showing the dates for testing and for submission of each test procedure.
- 9.4.5.7 Test procedures shall be carefully planned to ensure that the work can be executed in the time available. If the available time is restricted, this planning shall include contingency plans to be implemented if testing proceeds slower than anticipated or if defects are discovered that necessitate rectification and subsequent repeat testing, etc.
- 9.4.5.8 Immediately following the successful acceptance testing of the system, the Contractor shall complete the appropriate commissioning records in the agreed format and submit 3 signed copies to the Employer's Representative.
- 9.4.5.9 The Contractor shall include a complete schedule of all System Acceptance Test records and their current status within the Monthly Progress Report.
- 9.4.6 Integrated Testing & Commissioning**
- 9.4.6.1 Integrated Testing & Commissioning are defined as the final tests to be undertaken before the commencement of Service Trial. The Integrated Testing & Commissioning are part of the Tests on Completion to be performed by the Contractor under the Contract in order to achieve Employer's Taking Over of the Works. The Integrated Testing & Commissioning shall demonstrate the full compatibility between all interfacing systems. On satisfactory completion of the Integrated Testing & Commissioning, the tested items will be considered available for Service Trial.
- 9.4.6.2 The particular requirements for Integrated Testing & Commissioning are prescribed in the TS are indicative only.
- 9.4.6.3 The Contractor shall submit to the Employer's Representative a comprehensive Integrated Testing & Commissioning Plan as required by the TS. The plan shall be submitted on a logical section-by-section basis, using a "top-down" approach describing the testing and commissioning strategies and processes clearly showing how these serve to provide the full verification of the systems and equipment in context of the complete railway system.
- 9.4.6.4 The Contractor shall co-ordinate with the Employer and the Employer's Representative and with all interfacing parties to ensure that the proposed test programme and schedule truly demonstrate that the full specified performance requirements are achieved.
- 9.4.6.5 The tests shall include, but shall not be limited to the following:-
- (1) test of all functional and performance requirements for the system;
 - (2) test to demonstrate compliance with all interface specifications; and
 - (3) test of behaviour under failure conditions (e.g. changeover to redundant hardware, initiation of re-configuration functions or reversionary modes of operation, recovery of systems and equipment from failure, demonstrations of planned emergency procedures, etc.).
- 9.4.6.6 The Integrated Testing & Commissioning Plan shall identify a comprehensive list of specifications, standards, method statements, procedures, pass/fail criteria, sample records, resources to be made available, drawings and records to be submitted to the Employer's Representative, and a programme showing the dates for testing and for submission of each test procedure.
- 9.4.6.7 Test procedures shall be carefully planned to ensure that the work can be executed in the time available. If the available time is restricted, this planning shall include contingency plans to be implemented if testing proceeds slower than anticipated or if

defects are discovered that necessitate rectification and subsequent repeat testing, etc.

9.4.6.8 Immediately following the successful Integrated Testing & Commissioning of the system or any constituent part, the Contractor shall complete the appropriate commissioning records in the agreed format and submit 3 signed copies to the Employer's Representative.

9.4.6.9 The Contractor shall include a complete schedule of all Integrated Testing & Commissioning records and their current status within the Monthly Progress Report.

9.4.7 Service Trial

9.4.7.1 Service Trial is defined as the final test of the fixed equipment, the rolling stock, and the operational procedures including the final elements of the Tests on Completion to demonstrate that the system in its entirety can operate satisfactorily. The Service Trial is performed by the Employer with attendance by the Contractor under the Contract in order to achieve Employer's Taking Over of the Works. During this phase, the system will be run to the published timetable but without fare-paying passengers. This phase also allows for Validation of the training procedures in a real time environment.

9.4.7.2 The Commissioning Team in conjunction with the Employer will develop the Service Trial Plan. Operations Department and will serve to organise and co-ordinate all on-Site activities.

9.4.7.3 The particular requirements for tests to be undertaken during the Service Trial are prescribed in the PS / TS.

9.4.7.4 The Contractor shall provide special and general attendance to the Employer and the Employer's Representative during the Service Trial period as required by the PS / TS.

9.4.7.5 The Contractor shall co-operate with the Employer and the Employer's Representative and with all interfacing parties to ensure that the proposed Service Trial programme and schedule truly demonstrates that the full, specified performance requirements and operating parameters are achieved.

9.4.7.6 The Contractor shall review and comment on the Employer's Representative's Service Trial Plan and shall identify specifications, standards, method statements, procedures, pass / fail criteria, to the Employer's Representative for inclusion in the Plan.

9.4.7.7 The Contractor shall not interfere with the Service Trial tests and Validations in any manner. Any need for remedial works required to be performed by the Contractor shall be co-ordinated with the Employer and the Employer's Representative in advance.

9.4.7.8 Immediately following the successful tests of the system or any constituent part during Service Trial the Contractor shall complete the appropriate commissioning records in the agreed format, submit 3 signed copies to the Employer's Representative and may then apply for the Taking Over Certificate in accordance with the requirements of the GCC.

9.4.7.9 The Contractor shall include a complete schedule of all Service Trial records and their current status within the Monthly Progress Report.

9.5 Activity of the Employer and the Employer's Representative

9.5.1 The Employer and the Employer's Representative will establish a Commissioning Team and a Site Co-ordination Team at appropriate stages of the Project. These teams will comprise representatives of all interested parties including not more than two representatives of the Contractor, subject to review by the Employer and the Employer's Representative. In accordance with the Commissioning Plan, the Commissioning Team shall advise and plan to co-ordinate the activities of the Contractor to ensure the Employer and the Employer's requirements are met.

- 9.5.2 The Contractor shall participate in the activities of the Commissioning Team and Site Co-ordination Team in addition to its own testing and commissioning or as directed by the Employer or the Employer's Representative.

9.6 Records and Reports

- 9.6.1 The Contractor shall submit to the Employer's Representative for review not less than six (6) months before commissioning activities commence his proposed format for the commissioning records. The records shall be appropriately sub-divided to make provision for the various parts of the Permanent Works covered by the Contract.
- 9.6.2 The format of the records shall cover all mechanical and electrical tests, provide positive identification by serial number for assemblies and sub-assemblies of the Permanent Works and show modifications to Employer's Drawings and diagrams or "as built" data to be certified by the Employer or the Employer's Representative in the course of installation, testing and setting to work of the Works.
- 9.6.3 The Contractor shall, during the execution of the Works, prepare such reports and records of manufacture, installation and testing as may be required in order that a licence may be issued or statutory requirements may be met or approval given. Such reports or records shall be adequate to enable each part of the Permanent Works to be commissioned and to meet the requirements of the licensing authority or any standing statutory regulations, and shall be reviewed by the Employer and the Employer's Representative.
- 9.6.4 The Contractor shall obtain reports of each inspection and/or test. Such reports shall show the results of all the inspections and/or tests carried out and shall certify that the work has been inspected and/or tested in accordance with the requirements of the Contract and that the work complies with the requirements of the Contract.
- 9.6.5 Any analysis of the results required to confirm that the work complies with the requirements of the Contract shall be compiled and reported to the Employer's Representative in accordance with Chapter 4.
- 9.6.6 A representative of the Contractor who has been allocated the required authority under the relevant quality plans shall sign each report of inspection and/or test.
- 9.6.6.1 Each report of inspection and/or test shall include the appropriate details of:-
- (1) the description of the item or goods subjected to the test or inspection;
 - (2) if applicable, the batch from which the samples were taken for test, the size and description of samples and the method of sampling;
 - (3) the place of testing;
 - (4) the date and time of tests;
 - (5) the environmental conditions;
 - (6) the technical personnel supervising or carrying out the test or inspection;
 - (7) the properties tested or inspected;
 - (8) the method of testing or inspection;
 - (9) all relevant checklists and work sheets used during the inspection and/or test, including the readings and measurements taken during the tests; and
 - (10) the test results, including any calculations and graphs.

- 9.6.7 After Commissioning of a part of the Works, the Contractor shall complete each commissioning record in the agreed format and shall forward copies of the record to the Employer's Representative for review.
- 9.6.8 The Contractor shall submit within its Monthly Progress Report a complete schedule of his commissioning records showing completion dates, target completion dates and status.
- 9.6.9 Timing for Reports of Inspection and/or Test**
- The Contractor shall ensure that a signed copy of each report of inspection and test is filed in his filing system within 3 (three) working days of the date of inspection and test.
- 9.6.10 Quality Control Register**
- The Contractor shall provide and maintain at all stages of the work a quality control register or registers to identify the status of inspections, sampling and testing of the work and all certificates in accordance with Quality Control Register in Chapter 5.
- 9.6.11 Summaries of Inspection and/or Test**
- The Contractor shall submit to the Employer's Representative for his information summaries based on each quality control register showing the type and amount of certification received and the inspection and/or testing undertaken on each element of the Works. Such summaries shall reach the Employer's Representative's office before the 7th working day of the month. The summaries shall identify and demonstrate the compliance of such certification, inspection and/or testing with the requirements of the Contract and shall identify any item which does not conform to the requirements of the Contract.
- 9.7 Test Equipment and Facilities**
- 9.7.1 The Contractor shall provide all equipment and services required for testing, including, but not limited to:
- i. Laboratory test instruments.
 - ii. Special test equipment, emulators, simulators and test software, to permit full testing of System functions and performance.
 - iii. Other items of the System, specified elsewhere as being part of the Contractor's supply, even if not part of the Subsystem under test.
 - iv. Consumables.
- 9.7.2 All test instruments shall be subject to routine inspection, testing and calibration by the Contractor.
- 9.7.3 Details of all test instruments shall be submitted for review by the Employer's Representative and, if required by the Employer or the Employer's Representative, shall be calibrated at the expense of the Contractor by an independent standards laboratory.
- 9.7.4 All test equipment must be capable of operating from the mains supply (230V AC 50Hz).
- 9.7.5 All test software shall be subject to formal quality assurance requirements stipulated elsewhere in the Specification.
- 9.7.6 The Contractor shall ensure that all inspection and test equipment is calibrated in accordance with the specified standards or, if such standards are not applicable to

certain test and inspection equipment, with systems and programmes of calibration which have been reviewed without objection by the Employer's Representative.

- 9.7.7 The Contractor shall ensure that documented evidence of instrument calibration is maintained and made available to the Employer or the Employer's Representative on request.

9.8 Witnessing by the Employer and the Employer's Representative

9.8.1 Notice for Trial, Inspection and/or Test to the Employer's Representative

- 9.8.1.1 In relation to all Quality Control Points and Quality Hold Points involving inspection and/or testing by the Contractor, the Contractor shall give the Employer's Representative notice of when the relevant work will be inspected and/or tested using the form in Appendix 6 of this Specification. The period of notice shall be as stated in the TS or such period as in the opinion of the Employer's Representative is reasonable and notified to the Contractor. In the absence of any such statement or notice, a reasonable period of notice shall be given by the Contractor provided that:

- (1) in the case of on-Site work, such notice shall be given not less than 72 hours of normal working time before the work is to be inspected and/or tested;
- (2) in the case of work carried out off-Site in Jaipur, such notice shall be given not less than 5 days before the work is to be inspected and/or tested; and
- (3) in the case of work carried out outside Jaipur, such notice shall be given not less than 14 working days before the work is to be inspected and/or tested.

- 9.8.1.2 In relation to all inspection and/or testing notified by the Contractor, the Employer and the Employer's Representative may elect to witness such inspections and/or tests but the Contractor may proceed with the inspections and/or tests notwithstanding the absence of the Employer or the Employer's Representative or of any response to the said notice.

- 9.8.1.3 If the Contractor is in any doubt whether inspection and/or testing by the Employer's Representative is required as a Quality Hold Point, the Contractor shall request that the Employer's Representative clarifies his requirements prior to submitting the relevant inspection and testing plan for review, and in any event not later than 30 days.

9.8.2 Timing for Inspection and/or Test by the Employer and the Employer's Representative

- 9.8.2.1 The Contractor shall allow the Employer and the Employer's Representative a reasonable time to carry out any inspection and/or testing and to assess the result of any inspection and/or test before proceeding with the Works.

- 9.8.2.2 Unless the Employer's Representative's prior review without objection has been obtained, all inspections and/or tests to be carried out or witnessed by the Employer and the Employer's Representative shall be carried out between 0800 and 1800 hours.

9.8.3 Failure to Notify the Employer's Representative

The Employer or the Employer's Representative may reject the test and test results in question, and require the test to be repeated in the event of any failure by the Contractor to notify the Employer's Representative in accordance with clause 9.8.1.1 above.

9.9 Failures

- 9.9.1 The Contractor shall correct all faults found during testing, and shall arrange for the relevant tests to be repeated. The relevant tests shall only be repeated when the fault has been remedied and the equipment demonstrated to function correctly.
- 9.9.2 Where remedial measures involve significant modifications that might, in the Employer's Representative's opinion, affect the validity of earlier tests, the Contractor shall repeat the earlier tests and obtain results satisfactory to the Employer and the Employer's Representative before repeating the test in which the fault was first identified.
- 9.9.3 The Employer or the Employer's Representative shall have the right to order the repeat or abandonment of any test in the event that results demonstrate that the equipment is significantly non-compliant with the Contract.
- 9.9.4 The Employer or the Employer's Representative shall have the right to suspend any test in the event that errors or failures have become unacceptable. The Employer or the Employer's Representative shall also have the right to suspend any test if a fault was detected by the Contractor but not reported to the Employer's Representative within 24 hours of the detection. In this event, the suspension shall remain in effect until reporting has been brought up to date to the satisfaction of the Employer and the Employer's Representative.

9.10 Repeat Tests

- 9.10.1 The Contractor shall correct and re-test every fault detected during the tests.
- 9.10.2 If the test, results in a failure of the item under test the provisions of GCC Clause 7 shall apply.

9.11 Fault Categories

- 9.11.1 Deleted

9.12 Fault Log

- 9.12.1 The Contractor shall maintain a fault log throughout each series of tests. Every fault detected during the tests will be entered in the log, together with the actions taken to clear and re-test the fault.
- 9.12.2 The fault log will be retained as part of the permanent quality assurance record for the system and be subject to regular inspection by the Employer's Representative.

9.13 Hardware Failure Reports

- 9.13.1 For each hardware failure that occurs at any stage of testing, the Contractor shall investigate the failure and prepare a report on its cause(s) and implications, if any, resulting from such failure. The report shall clearly show:
- (1) the observed symptoms;
 - (2) the most likely cause of the failure;
 - (3) the fault category
 - (4) an analysis of any stress that may have been caused to other components of the equipment being tested as a result of the failure;
 - (5) whether the failure is a result of any component operating outside its range; and
 - (6) whether any design changes should be made to avoid further failures.

9.13.2 All such reports will be retained as part of the permanent quality assurance record for the system, which shall be subject to inspection by the Employer's Representative.

9.14 Software Failure Reports

9.14.1 For each software failure that occurs, once the software has been reviewed without objection for inclusion into the system and is subject to configuration control, the Contractor shall generate a software failure report.

9.14.2 All such reports will be retained as part of the permanent quality assurance record for the system, which shall be subject to inspection by the Employer's Representative.

9.14.3 The report shall clearly show:

- (1) the observed symptoms;
- (2) the likely cause;
- (3) the fault category (from Table 9.1); and
- (4) the operator input.

9.14.4 The report shall also clearly show the following information which shall be entered when the failure has been investigated:

- (1) the actual cause of the failure;
- (2) the corrective action taken; and
- (3) all software modules affected at the location
- (4) all similar software modules used in the project.

* End of Chapter *

CHAPTER 10

10. TRAINING & TRANSFER OF TECHNOLOGY

10.1 Training Requirements

10.1.1 The Contractor shall provide comprehensive training to the Employer's staff to enable all of the systems and equipment supplied, installed or modified as part of the Works to be operated and maintained in the designed manner safely and efficiently so as to achieve the maximum reliability and economy, and to meet the requirements of the Employer's programme.

10.1.2 To achieve the objective, it will be necessary to train the Employer's staff, including Employer's Training Instructors (ETI). The Contractor shall submit to the Employer's Representative for review and critique the range of staff for which training is recommended and a Training Plan to be proposed for the Employer in accordance with clause 3.7.4 above.

10.1.3 The recommendation shall include details of training equipment necessary and appropriate to achieve the training objectives.

10.1.4 The Training Plan shall provide a structured training programme to educate and train the personnel of the Employer in all aspects of the system operation and maintenance and shall include, but not be limited to, the following:

- (1) schedule of training courses;
- (2) objective, syllabus, format, class size and duration of each training course;
- (3) training facilities to be provided by the Employer;
- (4) list of training materials and documentation to be included with the training course;
- (5) method of pre- and post- testing to be utilised;
- (6) qualifications and experience level necessary for the trainees;
- (7) instructor's qualifications; and
- (8) course evaluation methods.

10.1.5 Courses offered shall be suitable for operations and maintenance staff classified below as distinct from engineering staff:

- (1) first line and second line maintenance staff undertaking recovery/corrective and routine/preventive maintenance;
- (2) third line (high skill level) maintenance staff specialised in workshop repair and overhaul of equipment; and
- (3) technical support staff specialising in fault analysis and investigation techniques associated with the particular type of equipment.

10.1.6 Training shall, as a minimum, impart the following techniques to the Employer's staff of the appropriate grades:

- (1) all planned maintenance and overhaul of the systems and equipment supplied, installed or modified under the Contract;
- (2) fault finding and rectification techniques for the systems and equipment supplied, installed or modified under the Contract. These shall be developed from the Contractor's previous experience with similar equipment and also from the fault tree analysis and other analyses carried out as part of the reliability engineering studies undertaken by the Contractor;
- (3) normal and degraded modes of operation of the systems and equipment supplied, installed or modified under the Contract;
- (4) all rules, regulations, practices and procedures necessary for the safe and efficient operation of the systems and equipment supplied, installed or modified under the Contract; and
- (5) all contingency plans necessary to recover speedily and safely from any mishaps or emergencies that may arise with the systems and equipment supplied, installed or modified under the Contract.

10.1.7 Training shall be carried out in the medium of the English language and supplemented, if necessary, in the Hindi language.

10.2 Training Method

10.2.1 Training shall consist of classroom (theory) training, computer based interactive multi-media training (CBT) and practical (hands on) training.

10.2.2 The training shall take place in Jaipur, unless there are prohibitive reason(s), and shall be related to Permanent Works that are to be or are being installed on the Project.

10.2.3 The training in Jaipur shall be supplemented, where appropriate, by training at the Contractor's own premises and the premises of the major sub-contractors during the manufacturing and factory testing phases of the Works. Maximum use shall be made of the opportunities presented during equipment testing phases of the Contract to demonstrate and practise fault finding and diagnostic techniques.

10.2.4 To meet this need, the Contractor shall supply competent trainers/instructors to carry out training to a high degree of proficiency in areas where the Contractor has the specialised knowledge.

10.2.5 In order to ensure that satisfactory standards are met, the Employer's relevant Operations/Maintenance Department in liaison with the Training Department will monitor all training.

10.2.6 During the Defects Liability Period, when the Contractor is responsible for faultfinding and repair, he shall provide practical hands on training to the Employer's maintenance staff to facilitate the successful hand over of this function.

- 10.2.7 Where applicable, the Employer will pay all of his staff's salaries, travelling, subsistence and other related allowances.

10.3 Employer's Instructor Training

- 10.3.1 The Contractor shall provide training courses and training materials to train the Employer's Training Instructors (ETI) to a level of competence to allow the ETIs to subsequently train the Employer's staff in all aspects of operation and maintenance of the systems and equipment supplied, installed or modified as part of the Works.

- 10.3.2 For Maintenance Instructors, this shall include specific training in the use of maintenance documentation, all faultfinding guides and any special gauges, instrumentation or test equipment required in any maintenance or fault finding and analysis.

- 10.3.3 For Operations Instructors, this shall include training in the operation of the equipment and the various systems/sub systems under both normal and fault conditions.

10.4 Training Plant & Equipment

- 10.4.1 With the prior review of the Employer's Representative, the Contractor may use the Permanent Works being erected, tested or commissioned for the training of the Employer's staff. In general, the Contractor shall not use Contract Spare parts for this purpose.

- 10.4.2 Training course notes shall be entirely compatible, and, where appropriate, cross-referenced to the manuals supplied by the Contractor as part of the Operation and Maintenance documentation.

- 10.4.3 The Contractor shall provide such written or printed matter, functional equipment, samples, models, cutaway equipment, slides, films and other instructional materials as may be necessary for training. Such equipment and material shall remain the property of the Employer and shall be sufficient both for the persons trained by the Contractor and for those to be subsequently trained by the ETI.

- 10.4.4 The Contractor shall provide an instructor's guide for each training course. The guide shall include the course agenda, objectives, list of resources and facilities required, detailed lesson plans, presentation notes, discussion guides, training aids and job aids, test papers, criteria and methodology for testing and assessment, and all other things that will enable the ETI to carry out repeat or refresher courses in the future.

- 10.4.5 Not used

- 10.4.6 All training course notes and instructor's guides shall be in a form that allows for easy reproduction.

- 10.4.7 All training course notes and instructor's guides shall be in a standard format as set out by the Employer.

10.5 Testing and Assessment

- 10.5.1 The Contractor shall, at the conclusion of each training course, issue questionnaires to, and/or set practical tests for all trainees directed at determining the level of satisfaction with the course content and to assess the level of knowledge and understanding of the course content by each trainee.
- 10.5.2 The Contractor shall review the responses to questionnaires and the trainees' test results and forward a summary to the Employer's Representative.
- 10.5.3 If the Employer's Representative considers that the course has not achieved the required objectives, he will advise the Contractor who shall then organise and implement appropriate re-training.

10.6 Training Records

- 10.6.1 The Contractor shall, at the completion of each training course:
- (1) provide the Employer's Representative with a consolidated training record listing the training course title, date of training, name of all trainees, training result and other relevant information; and
 - (3) issue an appropriate certificate to each trainee who has successfully completed the course.

10.7 Transfer of Technology

- 10.7.1 Bidder shall submit the detailed plan of transfer of technology along with MOU with suitable Indian companies or company having proven track record and working in related areas for major systems / subsystems in accordance with clause 10.7 of GS.
- 10.7.2 TOT shall be essential and shall include system assembly, installation, maintenance and software modification / customisation and training of Employer's personnel to cover the systems/subsystems as specified in Particular Specifications:
- 10.7.3 TOT shall essentially include the following aspects as a minimum:
- Engineering or extensions and up gradations of the system.
 - Re-engineering to suit changed traffic conditions.
 - Incorporation of optional facilities.
 - Any other configuration/programmes required for maintenance/ up gradation of hardware/software.
- 10.7.4 The Transfer of Technology shall require involvement of Employer's personnel in each of sub-systems during the contract period. The sponsored engineers shall be under the technical administrative control of the contractor. It is tentatively proposed to deploy 2 No. Employer's personnel for this purpose.
- 10.7.5 The contractor shall undertake to supply or make arrangement with the original manufacturer to supply additional equipment required for replacement or expansion of the network in future.
- 10.7.6 The contractor shall undertake to provide, if required during the life of the equipment ordered, technical assistance in the form of additional drawings, maintenance practices and technical advice.

* End of Chapter *

CHAPTER 11

11. OPERATION AND MAINTENANCE DOCUMENTATION

11.1 General

- 11.1.1 The Contractor shall supply Operation and Maintenance documentation in respect of the systems and equipment supplied or installed or modified under the Contract in accordance with the requirements of the following clauses, except where expressly specified otherwise in the Contract.
- 11.1.2 All Operation and Maintenance Manuals produced by the Contractor shall conform to the requirements of the Employer. The Contractor shall interface with the Employer for the requisite format.
- 11.1.3 The Contractor shall supply all documentation, including Operation and Maintenance Manuals and “as-built” drawings, necessary for operating, maintaining, repairing and modifying the systems and equipment supplied, installed or modified under the Contract.
- 11.1.4 Except where otherwise stated, the Contractor shall provide one electronic copy, eight bound copies and one unbound copy of all documentation. The unbound copy will be used by the Employer for reproduction purposes. All documentation shall be in the English language.
- 11.1.5 The Operation and Maintenance Manuals shall be provided in the English language.
- 11.1.6 The Contractor shall fully co-ordinate and cross-reference interfaces and areas associated with interconnecting equipment and systems within the Contract. The Operation and Maintenance Manuals shall fully describe the overall operation of all systems incorporating all equipment.
- 11.1.7 The Operation and Maintenance Manuals shall contain no irrelevant or ambiguous information and shall relate specifically to this Contract.
- 11.1.8 The Contractor may use manufacturer's data and handbooks for individual items of E&M equipment that are a sub-component of the overall system, including printed circuit boards, providing they meet the intent of the Specification, and are integrated by the Contractor into the description of his equipment, and are indexed accordingly in his own general index. All such documentation shall be contained in similar binders.
- 11.1.9 Where a sub-assembly item is of such a nature that local repairs in Jaipur/India cannot be made and it is necessary to be returned to the manufacturer as a unit for overhaul, the specific information concerning its repair and breakdown into component parts shall be provided.
- 11.1.10 The document shall be collated and numbered in proper order and correspond to the contents and index tables. Nomenclature or references to any items of equipment, diagrams, figure numbers or units shall be consistent throughout the text. In order to comprehend the text, diagrams, drawings, sketches and actual photographs shall be added where necessary. All manufacturers' literature identification codes or stamp markings shall be omitted. Precautions and warnings regarding the safety of life and equipment shall be included where applicable.

11.2 Arrangement and Format of Manuals

11.2.1 The Contractor shall arrange all documentation in accordance with the Employer requirements.

11.2.2 The Contractor shall provide documentation for all hardware and software for computer systems and other associated electronic equipment to meet the following requirements. Such documents shall include but not be limited to:

- (1) manufacturers' documentation supplied as standard with the equipment;
- (2) hardware configuration with details of expansion capabilities and options;
- (3) programme loading instructions, including runtime environment configuration;
- (4) programme listing including comprehensive 'comment statements' in hard copy and soft format for source code, compilers and development tools necessary to modify and recompile software;
- (5) flow charts, data flow diagrams and state diagrams as appropriate;
- (6) description of software modules including purpose, linkage with other modules, error routines and any special considerations;
- (7) memory maps for both internal and peripheral memory showing description of all programmes, data files, overlay areas, memory available for expansion and the like;
- (8) loading and operating instructions for diagnostic programmes and specifically developed debugging tools; and
- (9) programming manuals relevant to operating systems, languages, development tools, etc.

11.2.3 The documentation shall in all respects be entirely sufficient to allow any competent software programming organisation to undertake programme and/or system modifications without recourse to the Contractor. These requirements shall apply in respect of microprocessor based equipment and 'firmware'.

11.3 Drawings

11.3.1 The Contractor shall submit such drawings as may be required for the operation and maintenance and repair of the Permanent Works by the Employer.

11.3.2 Information contained on the drawings shall include but not be limited to:

- (1) arrangement drawings for all sub-systems and individual items of equipment;
- (2) installation and fixing drawings for all sub-systems and individual items of equipment;
- (3) interface drawings for all sub-systems and individual items of equipment;
- (4) schematic drawings for all electrical, pneumatic, hydraulic, water and drainage systems;
- (5) sizes, material and finish of all fixtures and threads;

- (6) manufacturer's code, drawing and reference numbers;
- (7) wiring diagrams to BS EN 60617, BS 3939 and BS 376 including internal wiring of sealed unit items;
- (8) setting dimensions and tolerances; and
- (9) bill of materials.

11.3.3 Where instructed by the Employer's Representative, drawings shall be supplied with Hindi language notation in addition to English. The Employer's Representative will supply such Hindi notation to the Contractor.

11.4 Submissions

11.4.1 The Contractor shall deliver all documentation to the Employer's Representative by the date stated in the TS, or, if none is given, not later than six (6) months prior to the issue of the Taking Over Certificate for the Works (for the final draft version), and one (1) month prior to the issue of the Taking Over Certificate for the Works (for the final version). The delivery shall include a copy of the software and licence to operate the software to modify the manuals together with one set of CAD drawing files. The final manuals shall incorporate comments made by the Employer's Representative on the draft manual.

11.4.2 Drawings shall be submitted to the Employer's Representative as stated in the TS. The submission shall be in accordance with stage commissioning requirements specified in the Works Programme and shall include two 35mm microfilms and/or Compact Discs (CD) for each drawing.

11.4.3 Following the Employer's Representative's review, the Contractor shall make a final submission of the complete Operation and Maintenance Manuals and as-built drawings in a form and in a quantity specified in the TS. The final submission shall be made not later than the date set by the Employer's Representative. The type of binder used to bind the Operation and Maintenance documentation shall be of a design, which will permit all changes and additions to the said documentation to be readily collated therein. The Contractor shall make such amendments to his submissions as may prove necessary during commissioning of the Permanent Works and the Defects Liability Period. Amendments found necessary during commissioning shall be completed within two months after the issue of the Taking Over Certificate for the Works. Subsequent amendments shall be completed two months prior to the issue of the Defects Liability Certificate.

11.5 Operation and Maintenance Manuals

The Employer shall have the right to reproduce any part or the whole of any Operation and Maintenance Manual as he wishes for his O and M requirements.

* End of Chapter *

CHAPTER 12

12. SUPERVISION AND PLANNING OF MAINTENANCE

12.1 Scope

- 12.1.1 The Contractor shall be responsible for the supervision of maintenance of the equipment supplied under the Contract after the Employer's Taking Over of the Works or Part of the Works. The maintenance personnel shall be provided by the Employer.
- 12.1.2 The responsibility for the provision of supervision of maintenance shall be based on the number of man-months identified during the Bid period and incorporated into the Contract. The actual utilisation of these man-months shall be at the Employer's discretion and may be at any time up to six months after the Employer's Taking Over of the whole of the Works or the last part of the Works or the date of issuing of the Performance Certificate whichever shall be the later.
- 12.1.3 The scope of maintenance activities shall include all scheduled and unscheduled maintenance required including all routine inspections and service overhauls at trackside, on trains and in workshops. Maintenance work shall include faultfinding following report of incidents and repair of items of equipment changed out in the course of fault rectification but excluding any Contractor's liability for work to be carried out under the requirements of the Defects Liability Period.

12.2 Maintenance Planning & Management Staff

- 12.2.1 The Contractor shall undertake the necessary tasks in planning the maintenance activities to ensure that the reliability of the operating railway is upheld including but not limited to:
- (i) Provide recommendations in respect of philosophy and procedures for repairs of electronic systems, including PCBs, and the scale of facilities required to be set up in the Depot and Workshops for this purpose.
 - (ii) Preparation of detailed operational plan for the routine servicing of any equipment which requires such service. The plan shall ensure that all items in use receive maintenance within the required time cycle by suitably trained and qualified staff and under the personal safety regime appropriate to the location of the equipment being maintained.
 - (iii) Preparation of a detailed staffing for each and every different inspection, overhaul and repair activity. The plan shall also identify and quantify resources required by staff and groups of staff in terms of tools, tackle, protective clothing, etc..
 - (iv) Preparation of a detailed quality plan, covering all maintenance activities. Based on the plan it shall be possible for the maintenance organisation to obtain ISO-9002-2002 certification.
 - (v) Preparation of a computer based Stores management Plan, which shall assist the management, ensuring a timely availability of spares, tools and consumable materials with a low level of inventory.
 - (vi) Setting in position a computerised defects and failure analysis and documentation system, based on FMEA principles for all systems, sub-systems and components including individual PCBs.
 - (vii) Efficient supervision of the maintenance, overhaul and repair activities of maintenance staff to ensure high quality work and productivity. This shall also include planning and supervision of ongoing training and re-training as required in the correct procedures using the training materials and courses supplied under the Contract. Where the supplied training courses are insufficient the Contractor shall develop additional training

courses, manuals and materials to make good the deficiency as part of his Defects Liability responsibilities.

12.3 Supervisory Staff

- 12.3.1 The Contractor shall provide supervisory maintenance staffs who are experts in the first and third line faultfinding, maintenance and repair of the various systems supplied under the Contract:
- 12.3.2 The experts provided for supervision of maintenance shall have adequate qualifications and experience in the relevant discipline in the maintenance depots / workshops of existing metro type undertakings.
- 12.3.3 The deployment of the experts may not be continuous and they may be required to supervise the maintenance in short periods at the discretion of the Employer.
- 12.3.4 The experts shall be available in Jaipur at short notice to supervise the Employer's staff at any time during the Normal Operating hours and by arrangement to undertake extended investigations during Non-Revenue hours.

* End of Chapter *

CHAPTER 13

13. SUPPLY OF SPARE PARTS, SPECIAL TOOLS AND TEST EQUIPMENT**13.1 Details of supply**

13.1.1 Deleted

13.1.2 Deleted

13.1.3 The Contractor shall submit to the Employer's Representative for review, in the format of a contract spares schedule, in accordance with Chapter 4 above, a list of:

- (a) the Spare Parts to be supplied by the Contractor as part of the Works to suit stage, categorised into individual parts or sealed units; and
- (b) the Special Tools and Test Equipment to be supplied by the Contractor as part of the Works to suit stage.

Such list shall be an amplification and confirmation of the list supplied with the bid, as may have been subsequently modified during the bid period, and shall be amended as necessary to reflect changes that may have occurred since the date of the Letter of Acceptance.

13.1.4 The Contractor shall use separate sets of contract spares schedules for different sub-assemblies of the main assembly / equipment.

13.1.5 The information supplied in respect of each spare part or special tool shall include, but not be limited to, the following:

13.1.5.1 core data - main assembly/equipment

- (i) manufacturer / brand name
- (ii) manufacturer's type/model number
- (iii) rating
- (iv) serial number if applicable
- (v) total number of the main assembly/ equipment supplied under the Contract

13.1.5.2 core data - sub-assembly of main assembly/equipment

- (i) manufacturer / brand name
 - (ii) manufacturer's type/model number
 - (iii) rating
 - (iv) serial number, if applicable
- (if items (i) to (iv) above are different from those of the main assembly/equipment)
- (v) total number of sub-assembly in the main assembly/equipment supplied under the Contract

13.1.5.3 individual item of main/sub assembly/equipment

- (i) manufacturer order number

- (ii) parts description - a full description of the Spare Part, including a note as to whether it is a sealed unit or whether it is an assembly or sub-assembly which can be broken-down into component parts
- (iii) manufacturer / brand name
- (iv) the manufacturer's part number (if different from the ordering number)
- (v) the sub-contractor's ordering part number/reference, if applicable
- (vi) recommended quantity
- (vii) unit of measurement
- (viii) unit price CIF to Jaipur including delivery to designated location amount (quantity multiplied by unit price)
- (ix) total number of the Spare Part in the sub-assembly of the main assembly/equipment supplied under the Contract
- (x) total number of the Spare Part in all the sub-assemblies of all the main assemblies/ different equipment supplied under the Contract

The Contractor shall ensure that the ordering part numbers specified shall enable the Employer to procure the exact item in future without reference to the Contractor.

13.1.5.4 primary data

- (i) parts catalogue number/cross reference (illustrated parts catalogues to be submitted together with the contract spares schedules to the Employer's Representative)
- (ii) drawing number

13.1.5.5 secondary data

- (i) lead times stating whether for ex-stock or for product manufactured upon receipt of order.
- (ii) delivery schedule(s).
- (iii) supplementary information:
 - a) special handling instruction, e.g. for fragile materials, hazardous substances, radioactive materials, etc.
 - b) storage requirement, e.g. overall dimensions including special packing (if any) for bulky materials, materials with limited shelf life, etc.
 - c) statutory requirements, e.g. licences, test certificates, etc.
 - d) interchangeability information
 - e) tailor-made product for the Contract or a standard bought-in product
 - f) the source of the Spare Part or Special Tool and Test Equipment, including the manufacturer's name and address together with that of his agent

- g) Supplementary sheets to be used for detailed information that is important to the Employer's future procurement.

13.2 Manufacture and delivery of Spare Parts

- 13.2.1 The Spare Parts to be supplied under the Contract shall be manufactured at the same time as the Permanent Works. All Spare Parts shall be manufactured, works tested and inspected in accordance with the relevant quality system, suitably packed and labelled in accordance with Chapter 8 above, and delivered to the Employer by the Contractor. Before the Spare Parts are delivered to the Employer, the Contractor shall submit to the Employer's Representative a shipment advice notifying details such as date of despatch, date of arrival, vessel name, etc. as well as a packing list to indicate the contract number, variation order number, the lot size, quantity and weight. The Spare Parts shall be consigned to the Employer and delivered in accordance with The Employer's Representative's instructions to a programme which shall ensure that sufficient Spare Parts are delivered to facilitate normal routine maintenance of the Permanent Works by the Employer at all stages of completion. The Spare Parts shall be supplied in total not later than the date set out for stage commissioning of the system.
- 13.2.2 Spare Parts shall be fully interchangeable with their corresponding part. All Spare Parts shall be configured to the latest revision during the Defects Liability Period. For Spare Parts such as electronic components, lamps, fuses and other consumable and high-use items, the Contractor shall ensure that a minimum of two alternative sources of supply are available.
- 13.2.3 An adequate supply of Spare Parts shall be available throughout the design life of the Works, from the date of the Employer's Taking Over of the Works. The Contractor undertakes to notify the Employer at least 6 months prior to deleting any item used in the Works from general availability.
- 13.2.4 For any Spare Parts that the Contractor is unable to supply throughout the design life of the Works, or where the Contractor ceases availability support of that item before the end of such design life or if the Contractor ceases trading, the Contractor undertakes to transfer the relevant intellectual property rights, design rights and technology to the Employer and the Employer shall have the full right to manufacturing drawings, schedules, software and any other information needed to manufacture the relevant item. Such rights shall give the Employer complete freedom to manufacture the item in Jaipur or anywhere else world-wide. The Contractor shall also undertake to notify the Employer two years in advance of the intended cessation of spares availability of any item.
- 13.2.5 If any Spare Part is rendered obsolete by a design change or material change during the design life of the Works supplied under the Contract, the Contractor shall design a replacement item to match the identical mechanical and electrical interfaces as the former item.
- 13.2.6 If, as a result of changes in technology, any Spare Part is not completely interchangeable with the original item, or the performance of any Spare Part is different from the original item, then the Contractor shall purchase the same from the Employer, at a price agreed between the parties, such quantities of the obsolete Spare Part as the Employer may possess.
- ## **13.3 Contract Spares**
- 13.3.1 Notwithstanding the quantities defined in the the quantity of Spare Parts shall be sufficient for the full operation of the Permanent Works for the first-5 years following the expiry of the Defects Liability Period for the works ("Contract Spares").

13.3.2 The Contractor shall supply and deliver the Contract Spares on or before completion of the Systems Acceptance Test.

13.3.3 Deleted

13.3.4 Deleted

13.3.5 Deleted

13.3.6 Deleted

13.4 Commissioning Spares

13.4.1 In addition to the Contract Spares, the Contractor shall keep on the Site under his own custody throughout the installation, erection and commissioning periods, sufficient stocks of Spare Parts to enable immediate replacement of any item in the Permanent Works found to be defective or in any way in non-conformance with the Specification during the installation, erection and commissioning period ("Commissioning Spares").

13.4.2 The Contractor shall supply and deliver the Commissioning Spares on or before the commencement of any Partial Acceptance Tests (PAT) or as defined in the TS.

13.4.3 Deleted

13.4.4 The Contractor shall not be entitled to use any of the Contract Spares to replace any item in the Permanent Works during the installation, erection and commissioning periods.

13.5 Defects Liability Spares

13.5.1 In addition to the Contract Spares, the Contractor shall keep sufficient stocks of Spare Parts, in his own custody in an off-site location in Jaipur throughout the Defects Liability Periods to enable rapid replacement of any item in the Permanent Works found to require replacement as part of the Contractor's obligations during the Defects Liability Periods ("Defects Liability Spares").

13.5.2 The Contractor shall submit to the Employer's Representative for review a list of all Defects Liability Spares that shall be maintained by the Contractor during the Defects Liability Periods.

13.5.3 The Contractor shall not be entitled to use any of the Contract Spares to replace any item in the Permanent Works during the Defects Liability Periods.

13.6 Special Tools and Test Equipment

13.6.1 The Special Tools and Test Equipment (together with the relevant calibration certificates) required to carry out all the functions described in the Operation and Maintenance Manual or as required by the TS shall be suitably packed and identified in accordance with Chapter 8 above, consigned to the Employer by the Contractor and delivered to the Employer in accordance with the Employer's Representative's instructions not later than the date scheduled for stage commissioning. The extent of supply shall include protective carrying cases as may be appropriate for the storage and use of each item.

13.6.2 All Special Tools and Test Equipment shall be supplied with Operation and Maintenance Manuals, complete diagrams, schematics, assembly and connection drawings, calibration instructions and circuit diagrams/descriptions for future maintenance.

- 13.6.3 Where the Contractor has used the Special Tools and Test Equipment for installation and commissioning of the Permanent Works, he shall refurbish and re-calibrate each item to the satisfaction of the Employer's Representative prior to handover to the Employer, accompanied by the Certificate of Calibration traceable to a recognised International or National standard.
- 13.6.4 Where any item of Special Tools and Test Equipment is provided by the Contractor, it shall be accompanied by drawings, manuals and full operating instructions to enable them to be used by suitably skilled (but not necessarily specially trained) personnel in a non-hazardous manner and to achieve the desired result in terms of accuracy and quality.
- 13.6.5 The Contractor shall provide the means and instructions which describe the parameters of each item of Special Tools and Test Equipment that are critical to their proper methods of use and which enable the Employer's staff using the Special Tools and Test Equipment to achieve the proper performance and operation. Such means and instructions shall include, but not be limited to, any routine checking or re-calibration needs for the Special Tool and Test Equipment itself.
- 13.7 Coding and Tagging of Spare Parts and Special Tools and Test Equipment**
- 13.7.1 All Spare Parts and Special Tools and Test Equipment to be delivered to the Employer shall each carry a tag suitably marked, bar-coded (as directed by the Employer's Representative) and numbered.
- 13.7.2 The numbers on the tags shall correspond with those on the coding system developed by the Contractor for all E&M components, parts and equipment's. See also clause 7.3.1 above.

* * End of Chapter *

CHAPTER 14

14. THE WORKS AND CARE OF THE WORKS

14.1 Methods of Construction

- 14.1.1 The Contractor shall, as stated in the TS and in any case not less than 12 weeks before starting the construction of the Works on Site, submit to the Employer's Representative the Construction and Installation Plan as specified in Chapter 3 above.

14.2 Temporary Works

Upon receiving a written application from the Contractor, the Employer's Representative may at his absolute discretion consent to certain Temporary Works of a minor nature being exempted from the requirements of this Chapter. Such exemption shall not relieve the Contractor of any of his obligations under the Contract.

14.3 Normal Working Hours

- 14.3.1 Normal working hours shall be defined as the period between 0700 hours and 1900 hours on all days excluding General Holidays. Work outside normal working hours shall not be carried out unless reviewed without objection by the Employer's Representative and unless the Contractor has obtained any necessary permission or approval from Relevant Authorities.
- 14.3.2 The Contractor shall inform the Employer's Representative 24 hours, or such shorter period reviewed without objection by the Employer's Representative, in advance of any occasion when work outside normal working hours is proposed.

14.4 Drawings and Schedules

Detailed manufacturing drawings for the Permanent Works will not normally be required to be submitted to the Employer's Representative for review but shall be available on the Contractor's or his sub-contractor's premises if required. The Contractor shall also maintain at the Site a comprehensive and up-to-date set of drawings properly indexed and catalogued, which shall include complete sets of detailed working and, where applicable, manufacturing drawings and shall permit free access to such drawings by the Employer's Representative at any reasonable time.

14.5 Notification and Inspection of Works

- 14.5.1 The Works will be the subject of a formalised system of written applications for inspection.
- 14.5.2 Work that is carried out without being appropriately sanctioned by the Employer's Representative could be classified as defective work.

14.6 Construction Restraints

- 14.6.1 The Contractor shall design and implement Temporary Traffic Management (TTM) in accordance with the provisions of the Enactment.
- 14.6.2 The Contractor shall ensure that the , construction and performance of all Temporary Works and the and construction of all Permanent Works shall be such that any ground movements in and around the Site will not result in settlement and/or subsidence of the ground that will cause damage to any buildings, structures, rail, roads, footpaths, slopes or utilities.
- 14.6.3 The Contractor shall ensure that the method of installation of any part of the Permanent Works (prior to dewatering and excavation) minimises settlements in the

adjacent ground or buildings. Dewatering of an excavation will not be permitted unless a closed perimeter of impermeable wall is complete.

14.7 Protection from Water

14.7.1 Deleted

14.7.2 Deleted

14.7.3 Deleted

14.7.4 Measures shall be taken to prevent flotation of new and existing structures.

14.8 Protection from Weather

14.8.1 Work shall not be carried out in weather conditions that may adversely affect the work unless protection by methods reviewed without objection by the Employer's Representative is provided.

14.8.2 The Permanent Works, including materials for the Permanent Works, shall be protected by methods reviewed without objection by the Employer's Representative from exposure to weather conditions which may adversely affect the Permanent Works.

14.9 Protection of Work

Finished work shall be protected damage that could arise from the execution of adjacent work. Work shall be carried out in such a manner that work carried out by others, including Government departments, utility undertakings, Relevant Authorities and Project Contractors, is not damaged.

* End of Chapter *

CHAPTER 15

15. SITE ESTABLISHMENT AND ATTENDANCE

15.1 Use of the Site

- 15.1.1 The Site shall not be used by the Contractor for any purpose other than for executing the Works or carrying out other work which is associated with the Works and having been reviewed without objection by the Employer's Representative.
- 15.1.2 Deleted
- 15.1.3 All materials and equipment stored on Site shall be adequately protected against loss or damage due to any cause such as climatic effects, vandalism, shock and vibration, etc. according to the nature of the articles stored and the local Site condition.
- 15.1.4 The particular use to which the Site is put shall be submitted to the Employer's Representative for review with the following particulars:
- (1) drawings showing the layout within the Site of the Employer's Representative's and Contractor's accommodation, access roads and major facilities required early in the Contract;
 - (2) drawings showing the layout and the construction details of the Employer's Representative's accommodation; and
 - (3) proposals for the Employer's Representative's Site accommodation (if applicable) as defined by clause 15.4 below.

15.2 Survey of the Site

On or before the Contractor is granted access to a certain portion of the Site, the Contractor shall carry out a survey jointly with the Other Contractors executing works on that portion of the Site. The Contractor shall advise the Employer's Representative of the date of the joint survey at least 1 week in advance of the date.

15.3 Fences and Signs on the Site

- 15.3.1 Hoardings, fences, gates and signs on and at the Site shall be maintained in a clean, stable and secure condition.
- 15.3.2 Project signboards stated in the Contract shall be erected not more than 28 days, or such other period reviewed without objection by the Employer's Representative, after the Commencement Date of the Works. Other advertising signs shall not be erected on the Site unless reviewed by the Employer's Representative.
- 15.3.3 The permission of the Employer's Representative shall be obtained before hoardings, fences, gates or signs are removed. Hoardings, fences, gates and signs which are to be left in position after Employer's Taking Over of the Works shall be repaired and repainted as instructed by the Employer's Representative.

15.4 The Contractor's Site Accommodation

- 15.4.1 The Contractor's offices, sheds, stores, mess rooms, latrines and other accommodation on the Site shall be maintained in a clean, stable and secure condition. Living accommodation shall not be provided on the Site unless stated in the Contract or having been reviewed without objection by the Employer's Representative. The Contractor's personnel shall not be allowed to live on the Site.
- 15.4.2 The Contractor shall provide and maintain all necessary offices, sheds, stores, mess rooms, latrines and other accommodation and remove the same from the Site on the

Employer's Taking Over of the Works. These shall be to the satisfaction of the Employer's Representative and shall be kept in a clean and sanitary condition. No structure shall be erected by the Contractor within the Site without the written consent of the Employer's Representative and such consent will not relieve the Contractor of the responsibility of siting temporary structures clear of the Works.

15.4.3 A copy of the plan showing the extent and position of all offices, stores, sheds, etc. shall be prepared by the Contractor and retained for inspection in the Site office.

15.4.4 Deleted

15.4.5 The Contractor shall not erect or operate canteen and kitchen facilities on the Site except with the consent of the Employer's Representative and, where appropriate, the Relevant Authorities. Any such facilities shall, in particular but without limitation, conform to all regulations and standards to the extent required by the concerned city authorities of GoR.

15.5 Site Utilities and Access

15.5.1 Temporary clean drinking water, wash room with water, electricity, telephone, emergency transportation (Passenger vehicle) sewerage and drainage facilities shall be provided for the Employer's Representative's accommodation and for the Contractor's use in carrying out the Works. The Contractor shall make all arrangements with and obtain the necessary approvals from the Relevant Authorities for the facilities.

15.5.2 If, under the Contract, the Contractor is provided with Site utilities and access by any Other Contractor under the attendance of the same or another Other Contractor, the Contractor shall ensure that all requirements in terms of use of such facilities, their upkeep and maintenance, etc. are properly observed. If the facilities provided under such attendance are insufficient for the Contractor's bona fide needs, the Contractor shall be solely responsible for providing such additional facilities he may require for the execution of the Works.

15.5.3 Access roads and parking areas shall be provided within the Site as required and shall be maintained in a clean, passable and stable condition.

15.6 Site Facilities for the Employer's Representative

15.6.1 The Contractor will be required to provide suitable accommodation for Employer's representative in Contractor's site office/work site as per Appendix-7.

15.6.2 The accommodation for Employer's Representative shall include furniture, fan, air conditioner, drinking water facilities and suitable communication facilities.

15.6.3 In case of emergency the Contractor will be required to provide emergency transport facilities.

15.6.4 Office facilities and equipment provided for the use of Employer's Representative shall be maintained in a clean and suitable condition and all containers shall be replenished if required.

15.6.5 If any facility is to be removed/curtailed, the permission of the Employer's Representative shall be obtained.

15.6.6 The accommodation to be provided for the Employer's Representative can be used for the Contractor's staff associated with the Project, if necessary.

15.6.7 All accommodation and equipment for the Employer's Representative shall be provided throughout the course of the Works and for so long a period of time during the Defects Liability Period as the Employer's Representative may require.

15.6.8 The Contractor's proposals for the construction of the offices shall be submitted for review by the Employer's Representative within 14 days of the Commencement Date of the Works and erected within 42 days of the Commencement Date of the Works.

15.6.9 The Contractor shall, when advised in writing by the Employer's Representative, remove the accommodation and equipment, leaving the Site in a clean and tidy condition.

15.7 Clearance of the Site

Temporary Works, which are not to remain on the Site after the Employer's Taking Over of the Works, shall be removed on the Employer's Taking Over of the Works or at such other time(s) as instructed by the Employer's Representative. The Site shall be cleared and reinstated to the lines and levels and to the same condition as existed before the Works started except as otherwise stated in the Contract.

15.8 Attendance

15.8.1 Offices for the Employer or the Employer's Representative

Unless otherwise stated in the Contract, the Employer or the Employer's Representative may supply his own temporary accommodation on the Site at locations indicated in the Contract or in writing. The Contractor shall afford, provide and maintain free and unhindered access to such Employer or the Employer's Representative's Site offices and parking areas and for the Employer or the Employer's Representative's Site officers, contractors and workmen as may be necessary for installation, inspection, maintenance, repair and removal of the aforesaid Employer or the Employer's Representative's Site offices and the services thereto.

15.8.2 Attendance on the Employer or the Employer's Representative

The Contractor shall provide all necessary assistance to the Employer or the Employer's Representative, including adequate and safe means of access to all parts of the Site to assist him in carrying out his duties and responsibilities under the Contract. Such assistance shall not include the provision of full-time attendance upon the Employer or the Employer's Representative.

15.8.3 Attendance on the Commissioner of Metro Rail Safety or other inspecting authorities.

15.8.3.1 The Contractor shall afford all necessary attendance upon the Commissioner of metro Rail Safety or other inspecting authorities Inspectorate during their inspections including adequate and safe means of access to appropriate parts of the Site.

15.8.3.2 The Contractor shall provide all documents necessary for inspection as are requested by the above authorities.

15.8.4 Not used

15.8.5 Attendance on Other Contractors

15.8.5.1 The Contractor shall provide general and special attendance on Other Contractors who will be carrying out the execution of electrical and mechanical and other works on the Site. Reference shall be made to the TS to determine the full extent of such attendance.

15.8.5.2 General attendance shall include but not be limited to providing for accepting deliveries, unloading and storing materials for the Other Contractors on the Site and allowing the Other Contractors space for their site offices, and all reasonable access and facilities for the proper execution of their work including the free use of access roads, craneage, scaffolding, ladders, stores, mess rooms, sanitary and welfare facilities provided that these facilities are normally available on the Site at the time.

15.8.5.3 Intentionally left blank

15.8.5.4 Special attendance shall include but not be limited to cutting of holes and other openings, forming chases, providing built-in sleeves, grouting in bolts, anchors, brackets, base plates, frames and the like, including making good to the disturbed work and cleaning after completion of the disturbed work.

15.8.6 Attendance by Other Contractors

15.8.6.1 Where provided for under the Contract, the Contractor shall receive attendance from Other Contractors. The Contractor shall ensure that by receiving such attendance, it does not hinder, obstruct or otherwise frustrate the Other Contractor that is providing the attendance in any way.

15.9 Contractor's Equipment

The Employer's Representative reserves the right to order the immediate removal and replacement of any Contractor's Equipment that, in his opinion, is unsatisfactory for its purpose.

15.10 Security

15.10.1 The Contractor shall be responsible for the security of the works area for Contractor's accommodation and shall provide and maintain fencing.

15.10.2 The Contractor shall provide adequate training to its security staff to ensure that they are able to discharge their security duties properly.

15.10.3 The Contractor shall establish and maintain contingency plans to cope with emergency situations such as fire, flooding, serious damage to the Works, etc.

15.10.4 The Employer's security staff will conduct inspections and security audits on the Site and the works area for Contractor's accommodation from time to time. The Employer's Representative will give recommendations for improvement arising from the inspections and security audits to the Contractor. However, managing the security of the Site and the works area for Contractor's accommodation remain the Contractor's responsibility.

* End of Chapter *

CHAPTER 16

16. LIAISON WITH OTHERS

16.1 Liaison with Others

16.1.1 The Contractor shall make all necessary arrangements with and obtain the necessary approvals from Government departments, utility undertakings and other duly constituted authorities for the execution of the Works.

16.1.2 The Contractor shall maintain close liaison with Other Contractors and other contractors employed by the Employer, utility undertakings or other authorities who are carrying out work on or adjacent to the Site. The Contractor shall ensure as far as possible that the progress of the Works is not adversely affected by the activities of such other entities.

16.2 Work by Other Contractors

16.2.1 The contractor shall keep note of the works which may be proceeding on various adjacent areas by others include, but is not limited to, those listed in the TS. The Employer's Representative will keep the Contractor informed of forthcoming work by Other Contractors in the proximity of the Site.

16.2.2 The Contractor shall provide reasonable access to such contractors and any other adjacent contractors and shall where necessary liaise with the appropriate contractors, utility undertakings and other duly constituted authorities on details of interdependent phasing. The Contractor shall notify the Employer's Representative and other concerned entities at least 14 days in advance should he wish to alter these access arrangements during the course of the Works.

16.3 Interface Management

16.3.1 The Contractor shall co-ordinate with Relevant Authorities and Other Contractors in the execution of the Works.

16.3.2 The Contractor shall interface and liaise with Other Contractors to ensure the effective and compatible co-ordination of all aspects of the installation and testing of the Works. The Employer's Representative shall be kept fully informed at all stages of the Works.

16.3.3 The Contractor shall assign a person as the interface contact for each Other Contractor to actively manage the progress of each interface to ensure adherence to the jointly developed Interface Management Plan.

16.3.4 Throughout the process, the Contractor shall liaise with Other Contractors to develop interface designs in conjunction and co-operation with the designers of interfacing systems. Interfacing systems include, but are not limited to, those listed in the PS / TS. These interface designs will be monitored and reviewed by the Employer's Representative but the Contractor shall work directly with the Other interfacing Contractors to develop designs which are mutually acceptable to all parties. The Employer's Representative will provide details of the Other Contractors as contracts are awarded.

16.3.5 The Employer's Representative may, at his discretion, attend the Contractor's meetings with Other interfacing Contractors. The Contractor shall give the Employer's Representative a minimum of 7 days notice of all meetings to be held with any Other interfacing Contractors, or 14 days notice if the meeting is to be outside Jaipur. If insufficient notice is given to the Employer's Representative, he may require the meeting to be postponed to a later date to enable him to attend.

- 16.3.6 The Contractor shall provide the Employer's Representative with two copies of the minutes of all meetings within 14 days of each meeting and also two copies of all correspondence with any Other Contractor.
- 16.3.7 The Contractor shall attend co-ordination meetings chaired by the Employer's Representative at no greater than monthly intervals to discuss and ensure that designs are correct and that conflicts in E&M services requirements between the Contractor and Other Contractors are identified and resolved.
- 16.3.8 The Contractor shall co-ordinate his installation activities with the Other Contractors. The Contractor shall ensure that there is no interference to the work of the Other Contractors and shall maintain close co-ordination with Other Contractors working on or adjacent to the Works to ensure that their work can progress in a smooth and orderly manner.
- 16.3.9 The Contractor shall be given access to the various parts of the Site by the dates relative to the Works Programme defined in the ITB and the TS as Access Dates. The ITB and the TS specify certain Key Dates by which the Contractor shall complete certain parts of his Works to enable work to be undertaken by the Other Contractors. These dates may be subject to adjustment by the Employer's Representative in consultation with the Contractor and the Other Contractors to ensure the progress of the Project.
- 16.3.10 The Contractor's responsibility shall include provision of and receipt from Other Contractors or the Employer's Representative of information required for construction of the Works and the installation of the Works and Contractor's Equipment, insofar as that requirement is specified in or can reasonably be inferred from the Contract. Where the execution of work by a Other Contractor depends upon the Contractor's Site management or upon information to be given by the Contractor, the Contractor shall provide the Other Contractor with either the required services or the correct and accurate information required to enable the Other Contractor to meet his programme for the construction or installation of his works.
- 16.3.11 In the event of any disagreement as to the extent of services or information required to be exchanged between the Contractor and another Contractor, the Employer's Representative shall determine the requirements and this determination shall be final and binding on the Contractor and the Other Contractor.
- 16.3.12 The Contractor shall co-ordinate his testing and commissioning activities with the Other Contractors. The Contractor shall ensure that there is no interference to the work of the Other Contractors and shall maintain close co-ordination with Other Contractors working on or adjacent to the Works to ensure that their testing and commissioning work can progress in a smooth and orderly manner.

* End of Chapter *

CHAPTER 17

17. THE SITE

17.1 Access to Site

The Contractor will be given access to the Site in accordance with following conditions.

17.2 Site Restrictions

17.2.1 The particular use to which the Site is put shall be submitted to the Employer's Representative for review within 14 days of the Commencement Date of the Works and the Contractor shall:

- (1) confine his use of the areas of the Site to purposes having been reviewed without objection by the Employer's Representative who reserves the right to extend, amend or restrict the uses to which areas of the Site will be put;
- (2) where required under the Contract, provide and maintain fencing and lighting around and within the areas of the Site when or where necessary for the safety and convenience of the public or others or as directed;
- (3) refrain from depositing rubbish or causing nuisance or permitting nuisance to be caused and, except where reviewed without objection by the Employer's Representative, depositing earth on or removing earth from areas of the Site;
- (4) Deleted
- (5) refrain from obstructing manholes, utility access points and the like; and
- (6) Deleted

17.2.2 Work other than that necessary for completion of the Works shall not be carried out on the Site.

17.2.3 While the Contractor is being given access to the Site, he shall provide means of distributing loads imposed by Contractor's Equipment and prevent damage to utility services.

17.2.4 Except where otherwise provided, the Contractor shall not permit any person to reside on the Site.

17.2.5 Unless otherwise stated, the Contractor shall pay all rates and charges of any nature whatsoever arising out of his use of the Site and all work areas provided therein under the Contract. The location and size of stockpile material, including excavated material within the Site, shall be submitted to the Employer's Representative for review. All stockpiles shall be maintained at all times in a stable condition.

17.2.6 The Contractor shall not allow animals to be brought onto or kept on the Site.

17.2.7 The Contractor's attention is drawn to the Waste Disposal Regulation currently prevalent in Jaipur, regarding storage, transportation and disposal of chemical waste. The Contractor's proposed methods and chemicals to be used in cleaning shall be submitted for review by the Employer's Representative.

17.2.8 No rock crushing or screening facilities shall be set up on Site unless reviewed by the Relevant Authorities and reviewed without objection by the Employer's Representative.

17.3 Site Services

17.3.1 Deleted

17.3.2 The Contractor shall provide such services for use solely in connection with the proper execution of the Works. The Contractor shall comply with all regulations of the utility companies and Government departments concerned. The Contractor shall provide and maintain installations associated with such services and in relation thereto and shall take all reasonable precautions to safeguard the safety and health of all persons and the security of the Site. The Employer's Representative may demand the immediate disconnection or alteration of such installations or portions thereof he considers as being prejudicial to safety, health or security. As soon as any or all of the Contractor's installations are no longer required for the execution of the Works, they shall be entirely removed to the satisfaction of the Employer's Representative.

17.3.3 Deleted

17.3.4 The Employer's Representative will instruct the Contractor as to the requirements for Site services to be connected to the Employer's Representative's portable Site accommodation at any given location and the Contractor shall provide and maintain these services during his use of the Site.

17.4 Site Cleanliness

17.4.1 Deleted

17.4.2 Deleted

17.4.3 Deleted

17.4.4 Deleted

17.4.5 Deleted

17.5 Prevention of Mosquito Breeding

17.5.1 Measures shall be taken to prevent mosquito breeding on the Site. The measures to be taken shall include the following:

- (1) empty cans, oil drums, packing and other receptacles which may retain water shall be deposited at a central collection point and those not required for future use shall be removed from the Site regularly;
- (2) standing water shall be treated at least once every week with an environmental acceptable oil which will prevent mosquito breeding; and
- (3) Contractor's Equipment and other items on the Site that may retain water shall be stored, covered or treated in such a manner that water will not be retained.
- (4) Anti mosquito breeding sprays should be done in the area during the rainy season at frequent intervals.

17.5.2 Posters in both English and Hindi drawing attention to the dangers of permitting mosquito breeding shall be obtained from the Rajasthan Government and displayed prominently on the Site, to the requirement of the Enactments. These posters shall be removed on Employer's Taking Over of the Works.

17.6 Deleted

17.7 Deleted

17.8 Deleted

17.9 Access to the Site by Other Contractors

17.9.1 Due to the multi-discipline nature of the Project, several different parties may require access to the same portion of the Site during the construction phase for the installation, erection and testing of the Works. To facilitate the organisation and co-ordination of access and occupation requirements, including the use of Works Trains, if any, the Employer's Representative will issue and maintain a TRIP as referred to in clause 2.13 above.

17.9.2 The TRIP will be developed from the declared requirements of all Project Contractors and others having need of access and occupancy, at the weekly Works Train Meeting. The TRIP will be subject to revision and updating to reflect changing circumstances during the progress of the Project.

17.9.3 The Contractor shall work in accordance with the arrangements prescribed by the TRIP.

17.9.4 The Contractor shall ensure that his working arrangements on the Site conform to the agreements made with the Employer's Representative during establishment of the TRIP requirements. In particular, the Contractor shall ensure that his occupancy does not extend either physically or chronologically beyond the agreed boundaries.

17.10 Transportation to Site

17.10.1 The Contractor shall use such routes and rights of entry to the Site as may be decided by the Employer's Representative from time to time. Routes for very large or very heavy loads shall be discussed with the Employer's Representative in advance of the need arising and all arrangements therefor shall be submitted for review by the Employer's Representative.

17.10.2 In this context, the definition of the terms "very large" and "very heavy" refer to articles that cannot be transported by normal road vehicles or be handled by readily available methods. Where doubt exists, it shall be the responsibility of the Contractor to notify and discuss the nature of the load in question with the Employer's Representative in accordance with clause 17.10.1 above.

17.10.3 The Contractor shall comply with the requirements of the Commissioner of Transport and /or the Commissioner of Police and / or any other Relevant Authority regarding any special traffic arrangements that may be necessary. The Contractor's attention is drawn to the Road Traffic (Regulation and Licensing of Vehicles) Regulations and the Road Traffic (Construction and Use) Regulations currently in use at Jaipur.

17.10.4 Extraordinary traffic may be moved from docks and between areas of the Site over public highways only by police escort and on a route and at a time determined by the Relevant Authority. The Contractor shall be responsible for obtaining permission from the Relevant Authorities to move extraordinary loads and traffic and for arranging police escorts as necessary.

17.10.5 The Contractor shall make all arrangements and assume full responsibility for transportation to the Site of all Contractor's Equipment, materials and supplies needed for the proper execution of the Works.

17.10.6 While travelling to and from the Site, the Contractor shall observe all posted speed limits, traffic regulations, stop signs, etc., and adherence to the access route indicated

on the Employer's Drawings or as instructed by the Employer's Representative. No employee of the Contractor shall trespass into any part of the Employer's premises other than the Site or the designated route of access.

17.10.7 The Contractor shall ensure that all roads and pavements, etc. leading to and around the Site are kept free from obstructions and shall not cause inconvenience or hindrance to traffic or persons either by its vehicles or by its workmen, scaffolding, plant, materials, equipment, etc.

17.10.8 The Contractor shall repair damage to existing roads, footpaths, steps, cables, sewers, live drains, etc. and shall reinstate any damage caused by the Contractor's actions.

17.11 Contractor's Own Rolling Stock

17.11.1 Where the Contractor is to provide rolling stock (either self-propelled or trailing) for use during the installation and testing of the Works, the requirements of clause 17.12 below shall apply. All the Contractor's own rolling stock shall not exceed the Construction Vehicle Load Gauge as shown in the Specification Drawings except with the Employer's Representative's written consent.

17.11.2 The Contractor shall submit full details of any rolling stock that is to be used during the installation and testing of the Works to the Employer's Representative for review within 90 days of the Commencement Date of the Works. Such details shall include a full description and drawings of the rolling stock, details of axle load, stopping distance, fail-safe braking system, kinematic envelope, and operating and maintenance instructions.

17.11.3 Deleted

17.11.4 Prior to use, and following each maintenance examination, the Contractor's qualified engineer shall certify the Contractor's own rolling stock as fit-to-run. Thereafter, the Contractor's qualified engineer shall issue a registration tag. The expiry date, i.e. the date of the next inspection, shall be shown on the registration tag. The Contractor's own rolling stock shall not be used without a valid registration tag.

17.11.5 Deleted

17.11.6 If the Contractor's own rolling stock is found to be operating in an unsatisfactory or unsafe condition, it shall be immediately removed until it has been restored to an acceptable condition to the satisfaction of the Employer's Representative.

17.12 Defined Area Working and Works Train Operations

17.12.1 When the Project under construction has been made available for track related electrical and mechanical installation works, the area will be classified as a Defined Area within which Works Trains will be operated.

17.12.2 All persons whose duties require them to work within a Defined Area must observe safety rules and procedures to be provided by the contractor and reviewed without objection by the Employer's Representative. It shall provide procedures and guidance for the safety of all persons in the Defined Area.

17.12.3 Deleted

17.12.4 Persons working on or near tracks in a Defined Area, either by themselves or supervising a working party, must be suitably trained and qualified by the Employer or his delegates in the safety provisions of the Works Train Manual. Persons who are not qualified shall not attempt to gain access to the railway tracks unless accompanied by a qualified person.

17.12.5 When overhead lines are energised, EMUs may be running at high speed for testing. No work may be undertaken on either the Up or Down tracks when test trains are running. Procedures for gaining access to the energised track will be detailed in the Works Train Manual. The Contractor shall make requests for gaining access to the energised track at the weekly Works Train Meetings.

17.13 Not used

* End of Chapter *

CHAPTER 18

18. HEALTH AND SAFETY

18.1 Health and Safety Philosophy

18.1.1 The health, safety and welfare of all personnel working on the Project, the general public and the avoidance of damage to property are of paramount importance to the Employer. Prime consideration shall be paid to construction activities to ensure that all operations shall be conducted in such a manner as to eliminate the risks to persons and property. The Contractor shall treat safety measures as the first priority in all his activities with respect to executing the Works.

18.1.2 The Safety, Health and Environment shall in general be governed by SHE manual issued JMRC forming part of the bid. These documents set out the minimum standards to be achieved by the Contractor but do not relieve the Contractor of his liabilities and obligations under the Enactment. Where there is a discrepancy in the documents, the higher or stricter standards shall be applied.

18.2 Health and Safety Management

18.2.1 The Contractor shall be fully responsible for safety on the Site, for the Works, his personnel, sub-contractors' personnel, the public domain and all persons directly or indirectly associated with the Works, on or in the vicinity of the Site.

18.2.2 The Contractor shall submit reports, notices and information to Government bodies where there is a statutory requirement to do so.

18.2.3 The Contractor shall and will ensure that, his sub-contractors of any level, all persons employed by him on the Site and any person authorised by him to be on the Site shall comply in every respect with the provisions of relevant statutory requirements and the Employer's safety documents as listed in clause 18.1.2 above.

18.2.4 The provisions of the GS regarding health and safety shall apply to the Contractor and his sub-contractors of any level for any part of the Works.

18.2.5 The Contractor shall ensure that proper and adequate provisions to ensure compliance are included in all sub-contracts placed by him and into all sub-contract documentation.

18.2.6 The safety standards of the sub-contractors are to be properly assessed prior to the placing of contracts and the Contractor shall employ only sub-contractors with a track record of maintaining the highest safety standards.

18.2.7 The Employer's representative reserves the right to order the immediate removal and replacement of any item of Contractors equipment or temporary works, which in his opinion, is unsatisfactory for its purpose or is in an unsafe condition.

18.3 Legislation, Codes of Practice, Standards, etc.

18.3.1 The Contractor shall comply with all current and future Enactments, Codes of Practice and Safety Guides approved by the Commissioner for Labour relating to the Works.

18.3.2 Where identified specifically in the GS, Indian Standards are also to be complied with.

18.4 Breach of Health and Safety Obligations

- 18.4.1 Serious or repeated breaches of the Employer's safety documents as listed in clause 18.1.2 above, statutory regulations, or other disregard for the health and safety of any person, may be reasons for the Employer's Representative to exercise his authority to require the removal from the Site of any employee of the Contractor or a sub-contractor of any level.
- 18.4.2 Once removed from the Site at the request of the Employer's Representative, that person shall not be re-employed on the Contract, allowed on the Site or on any other JMRC related project.
- 18.4.3 The Employer's Representative shall have the right to order the suspension of any or all of the Contractor's activities where the Employer's Representative considers that to continue such activity or activities may pose a hazard to the safety of persons or property.
- 18.4.4 Where the Employer's Representative orders such suspension as described in clause 18.4.3 above, such suspension shall continue until the Contractor has satisfied the Employer's Representative that satisfactory corrective action has been taken to eliminate the hazard, the subject of the suspension

18.5 Contractor's Health and Safety Documentation

18.5.1 Sub-contractors documentation

- 18.5.1.1 Deleted
- 18.5.1.2 Deleted
- 18.5.1.3 Deleted
- 18.5.2 Not used

18.5.3 Site Safety Plan

- 18.5.3.1 Deleted
- 18.5.3.2 The Site Safety Plan shall fully comply with the Health and Safety requirements of the Project conditions and proposed work activities, the GS, the Employer's safety documents as listed in clause 18.1.2 above and all relevant Enactment, Regulations, Codes of Practice, Safety Guides and relevant Indian Standards. The plan shall be prepared and submitted to the Employer's Representative for review within 112 days of the date of Notice to Proceed.
- 18.5.3.3 The Site Safety Plan shall include a policy statement signed by the chief executive officer of the Contractor (or other senior officer) declaring that occupational health and safety shall be given the highest practicable priority in all aspects of the Contract and in the discharge of his contractual obligations. In the event that the Contractor is a consortium, partnership or joint venture, a policy statement signed by the chief executive officer (or other senior officer endorsed by the chief executive officer and agreed by the Employer's Representative), from each of the companies comprising the consortium, partnership or joint venture shall be submitted.

18.5.4 Not used

18.5.5 Method Statements

- 18.5.5.1 Deleted
- 18.5.5.2 Deleted
- 18.5.5.3 Deleted
- 18.5.5.4 Deleted

18.5.5.5 Deleted

18.5.5.6 Deleted

18.6 Contractor's Safety Arrangements

18.6.1 Co-ordination of work activities

18.6.1.1 Deleted

18.6.1.2 Deleted

18.6.2 Safety inspections

18.6.2.1 The Contractor shall conduct formal, documented Site safety inspections (at least once a month) which are to be attended by the Contractor's most senior Site staff and safety staff.

18.6.2.2 A report of each safety inspection shall be made and shall include the actions taken to resolve any problems or shortcoming discovered during the inspection. The report shall be made available for audit purposes and be discussed at the relevant meetings.

18.6.2.3 Deleted

18.6.2.4 Deleted

18.6.2.5 Deleted

18.6.2.6 Deleted

18.6.2.7 Deleted

18.6.2.8 Deleted

18.6.3 Safety audits

18.6.3.1 Deleted

18.6.3.2 Deleted

18.6.3.3 Deleted

18.6.3.4 Deleted

18.6.3.5 Deleted

18.6.3.6 The Contractor shall conduct regular (at least every 3 months) internal safety audits on both the safety management system and the physical Site conditions. The internal safety audits shall be performed to the same criteria and using the same grading and benchmarking as the Employer's audits.

18.6.3.7 The internal safety audits shall be conducted by person(s) reviewed without objection by the Employer's Representative, who are qualified and competent to carry out safety audits. The documentation generated by the audit process, shall be made available to the Employer's Representative for audit purposes.

18.6.3.8 The internal safety audits shall include the work of sub-contractors of all levels.

18.6.3.9 The Contractor shall advise the Employer's Representative of the date of the internal safety audit. The Employer's Representative may send a representative to assess the thoroughness of the internal safety audit.

18.6.4 Reporting of accidents, incidents and dangerous occurrence

18.6.4.1 The Contractor shall notify the Employer's Representative immediately of any dangerous occurrences or accidents, which result in death, serious bodily injury or incapacity for more than 3 days. Such initial notification may be verbal but shall in any event be followed by a preliminary written report, in a format reviewed without objection by the Employer's Representative, within 24 hours of the occurrence/accident and a detailed written report shall be submitted within 7 days.

Copies of all accident, incident and dangerous occurrence reports shall be kept on file and made available for audit purposes.

18.6.4.2 The Contractor's attention is drawn to the reporting requirements set out in the Factories and Industrial Undertakings Regulations, Occupational Safety and Health Ordinance and other local Regulations.

18.6.4.3 The Contractor shall deliver to the Employer's Representative, within 48 hours of the incident, a copy of any Form 2 or 2a or other statutory reports he submits to Government departments under these Regulations.

18.6.4.4 Deleted

18.6.5 **Monthly reports**

18.6.5.1 The Contractor shall, as part one of each Monthly Progress Report, submit a Site Safety Report duly signed by the Contractor's director responsible for the Contract.

18.6.5.2 The Site Safety Report shall comprehensively address all relevant aspects of occupational safety and health and shall contain certain standard forms and information, as directed by the Employer's Representative, for statistical analysis.

18.6.5.3 The Contractor shall submit reports or accident analysis, in a format reviewed without objection by the Employer's Representative, as and when required by the Employer's Representative.

18.6.6 **Safety staff**

18.6.6.1 The Contractor shall ensure that their safety staff have the necessary authority given to them to suspend any work where there is imminent danger of accident or injury. He shall also in consultation with the Employer's Representative deploy adequate number of Safety Supervisors.

18.6.7 **Deleted**

18.6.8 **Safety information**

18.6.8.1 The Contractor shall display in each of his Site offices, workshops and canteens a copy of the document on "A Guide to the Construction Sites (Safety) Regulations" published by the Government or a similar approved document. This document shall be translated into languages, which are understood by labour engaged by the Contractor or sub-contractors.

18.6.8.2 The Contractor shall ensure that safety, rescue and occupational health matters are given a high degree of publicity to all persons, regularly or occasionally on Site. Posters in English, Hindi and other languages understood by the workers, drawing attention to Site safety, rescue and occupational health, shall be made or obtained from appropriate sources and shall be displayed prominently in relevant areas of the Site.

18.6.8.3 Posters in both English and Hindi drawing attention to safety shall be obtained from the Labour Department and displayed prominently throughout the Site.

18.6.8.4 The Contractor shall keep on Site a complete and up-to-date set of all relevant occupational health and safety legislation, relevant Codes of Practice and any relevant guides and safety pamphlets published by the Labour Department and the Occupational Safety and Health Council or similar authorities or reference.

18.6.8.5 The Contractor shall keep a working stock of all relevant statutory forms to be used in compliance with the occupational health and safety legislation.

18.6.9 **Safety meetings**

18.6.9.1 The Employer's Representative shall establish a monthly Site Safety Management Committee to formally review the safety management of the Contractor and monitor the implementation of the Health and Safety Plan. The Employer's Representative

shall act as chairman of this committee with members of the Employer's Representative's staff attending as appropriate.

18.6.9.2 Attendance from the Contractor shall include, but not be limited to, the Senior Manager on Site and the Safety Manager/Officer/Supervisor.

18.6.9.3 The Contractor shall act without delay upon such decisions or recommendations as may be made by the committee on matters of health and safety.

18.6.9.4 The Employer's Representative as appropriate may invite representatives from third parties including statutory bodies.

18.6.9.5 The Contractor shall establish a tier of monthly safety meetings and shall ensure that all level of staff, all disciplines and all work areas are covered so that the dissemination of information is carried through to all levels of staff and workers.

18.6.9.6 The Contractor shall hold monthly meetings at which representatives from all sub-contractors shall attend.

18.6.9.7 Minutes of all tiers of Contractor safety meetings shall be issued to the Employer's Representative for information.

18.6.10 Safety training

18.6.10.1 The Contractor shall ensure that induction training courses shall be provided for construction site workers or equivalent.

18.6.10.2 The induction course shall be conducted by suitably qualified persons and repeated at six-month intervals.

18.6.10.3 All workers must receive induction training before they are allowed to commence work on the Site.

18.6.10.4 The Contractor is to issue all Site workers with a Site pass once they have attended the induction course. The pass is to include the worker's name, ID card no., photograph, types of courses attended and expiry date of the card (maximum 6 months). The pass is to be carried at all times when on the Site.

18.6.10.5 The Contractor shall keep records of such training for health and safety audit purposes. Upon completion of their training, the Contractor's Site staff shall sign a copy of their assigned safety responsibility statement, which shall be kept by the Contractor for audit purposes.

18.6.10.6 The Contractor is to report the number of training sessions and employees trained each month, at the Site Safety Management Committee meeting and in the Monthly Progress Report.

18.6.11 Alcohol and drugs

18.6.11.1 Deleted

18.6.11.2 Deleted

18.6.11.3 Deleted

18.7 Site Conditions

18.7.1 Emergency procedures and facilities

18.7.1.1 The Contractor shall establish and implement emergency procedures which detail the organisation of rescue and/or damage limitation teams to deal with emergency situations on the Site such as, but not limited to, fire, loss of power, typhoon, flooding, stranding or the evacuation of a seriously injured person(s) from a remote or difficult Site location, etc. The emergency procedures shall specify what equipment is needed, where it will be located and who is responsible for its maintenance.

18.7.1.2 The Contractor shall carry out regular (at least every 3 months) emergency evacuation exercises from their offices and Site area. This requirement includes evacuation of viaducts as a joint Fire Services Department exercise where applicable.

18.7.2 First aid facilities

18.7.2.1 The Contractor shall provide, or have access to, sufficient first aid provisions, including trained personnel and facilities appropriate to the Site conditions. Arrangements for transporting the injured (ambulance, stretcher, etc.) shall be provided.

18.7.2.2 A Nurse or trained First-Aider is required at all times at the Site of working.

18.7.2.3 The Contractor shall maintain a register of all persons attending the clinic or receiving first aid treatment. Records are to be in a comprehensive format as required by the appropriate authority and shall be kept for audit purposes.

18.7.2.4 First aid kits, up to the standards required by the appropriate authority shall be carried in supervisor's vehicles and made available where work is in remote areas

18.7.2.5 Minimum one telephone should be provided at every site/ site office for communication in emergency as per clause 15.5.1. The site should also display important telephone numbers of fire police, hospital, Project Management, JMRC etc for immediate use.

18.7.3 Lifting appliances and lifting gear

18.7.3.1 The Contractor shall prepare and maintain an up-to-date Site register of lifting equipment containing test certificates of all lifting and hoisting equipment used on the Works. The register shall be available on Site, from the commencement of construction, for inspection by the Employer's Representative and Relevant Authorities.

18.7.3.2 A system is to be devised and implemented, such as colour coding, to identify the expiry of the certification of lifting appliances and lifting gear. This system is to be displayed in the cabs of all lifting appliances.

18.7.3.3 A trained banksman shall be in attendance at each lifting appliance or hoisting operation.

18.7.3.4 The banksman shall be equipped with a radio link to the crane or hoist operator and shall be easily identifiable from other workers.

18.7.3.5 Competent operators with certificates issued by a recognised training body shall be provided to operate all mechanical plant particularly all lifting and hoisting equipment.

18.7.3.6 The operators of shaft hoisting gear shall be in communication with the top and bottom of the shaft and each intermediate landing.

18.7.3.7 All crane hooks and other lifting devices used on or around the Site shall be fitted with a safety catch or other device to stop the lifting gear being detached.

18.7.3.8 The safe working load shall be clearly and indelibly marked on all lifting equipment, either by stamping or by the addition of permanently secured tag labels. Stamping shall not be permitted on any stress bearing part.

18.7.3.9 Slings, shackles and such-like equipment used in lifting shall be colour coded for identifying lifting gear which require re-inspection or disposal.

18.7.4 Fire precautions

18.7.4.1 The Rajasthan State Fire Service Ordinance and any relevant regulations made there under and other requirements laid down in the Specification or as laid down from time to time by the Employer's Representative shall be observed at all times.

18.7.5 Dangerous goods, hazardous substances

18.7.5.1 Not used

- 18.7.5.2 The Contractor shall ensure that all explosives, compressed gases, petrol and other dangerous substances, shall be stored and handled in accordance with the relevant Ordinance.
- 18.7.5.3 Before being brought on to Site, any materials proposed by the Contractor shall be assessed by the Contractor for their occupational health and environmental compatibility. Any material that is toxic, explosive or inflammable or may otherwise create a hazard shall, whenever possible, be replaced by a less hazardous product.
- 18.7.5.4 All hazardous substances and dangerous goods brought onto the Site shall be entered into a Site register.
- 18.7.5.5 The Contractor shall ensure that material safety data sheets are available and issued to workers, for all hazardous substances brought onto the Site.
- 18.7.5.6 The Contractor shall make adequate provision for the storage and disposal of waste oils, de-greasing agents, etc.
- 18.7.5.7 Flash back arrestors shall be fitted to all oxygen and acetylene cylinders.
- 18.7.5.8 Oxygen and acetylene cylinders shall be stored and used in a vertical position and be transported upon a trolley or in cage.
- 18.7.6 **Not used**
- 18.7.7 **Excavations and floor openings**
- 18.7.7.1 Before the commencement of any excavation work, sufficient information shall be obtained from the utility companies to identify the locations of buried services. Buried services are to be located using a cable detector, digging hand dug trial pits and by reference to the relevant drawings, before mechanical digging takes place.
- 18.7.7.2 Excavations shall be carried out by trained and experienced workers who shall be fully instructed on the possible dangers and safety precaution to be taken, before work is commenced.
- 18.7.7.3 The Employer's Representative shall be notified immediately of any damage or interruption to a utility.
- 18.7.7.4 A Permit to Dig system shall be established and implemented prior to excavation starting.
- 18.7.7.5 The Contractor shall ensure that all temporary covers/decking to the trenches and barriers at the edges of excavations are safe and securely installed at all times, especially during adverse weather conditions.
- 18.7.7.6 Where there is a danger to the public, extra care must be taken to properly cover all temporary openings and adequately barrier and sign the excavation. Flashing warning lights, signs and adequate lighting is to be installed where required.
- 18.7.8 **Site transport**
- 18.7.8.1 The Contractor shall ensure that all Site vehicles are regularly maintained and kept in a safe condition with fully working brakes, lights, exhaust, windscreen, windows and doors, etc.
- 18.7.8.2 Each vehicle, piece of plant or machinery shall be uniquely and clearly identified and registered for maintenance purposes.
- 18.7.8.3 When instructed by the Employer or the Employer's Representative, the Contractor will remove any vehicle from the Site that is not up to the standards required.
- 18.7.8.4 The Contractor will remove from the Site immediately any vehicle that is beyond repair.
- 18.7.8.5 The Contractor is to ensure that only vehicles fitted with seats with backrests and seat belts are used as Site transport. If required by law the carrying of passengers in vehicles that have not been fitted with seat belts is strictly prohibited. No person shall

ride in the back of vehicles not legally authorised to carry passengers. Drivers of vehicles permitting this practice are to be warned for a first offence then removed from the Site for the second offence.

18.7.8.6 The speed limit on the Site is to be restricted and signs displayed advising drivers of the limits imposed.

18.7.8.7 Speed bumps are to be located at strategic points throughout the Site to enforce the speed limits.

18.7.9 **Driving/operator's licenses**

Drivers of vehicles and operators of the Contractor's Equipment shall hold the necessary license group for the vehicle or plant they are driving/operating. Where no such license group exists, drivers/operators shall have an equivalent group and undertake training in the vehicle/plant given by the Contractor's plant department. Records of the training given are to be retained.

18.7.10 **Personal protective equipment (PPE)**

18.7.10.1 The Contractor shall make available on Site at all times adequate provision of safety equipment including, but not limited to, safety helmets, goggles, ear protectors, safety belts, respiratory protection, safety equipment for working in sewers, drains and enclosed spaces, equipment for rescue from drowning, fire extinguishers, first aid equipment and other necessary safety equipment.

18.7.10.2 The Contractor shall ensure that safety footwear is worn at all times inside the tunnels and actively encourage the wearing of safety footwear on other areas of the Site. Where safety footwear is not worn, the Contractor is to ensure that strong shoes are worn.

18.7.10.3 High visibility vests shall be worn at all times when in the tunnels.

18.7.10.4 Deleted

18.7.10.5 Deleted

18.7.11 **NOT USED**

18.7.12 **Ladders, temporary access**

18.7.12.1 The Contractor shall provide, register, maintain and use only ladders, which are purchased as proprietary products, on the Site. Site made ladders are not to be used under any circumstances.

18.7.12.2 All ladders shall be free from patent defects, secured against movement and installed in accordance with the relevant construction regulations and Codes of Practice.

18.7.12.3 Wooden access steps with handrails are to be installed and maintained as access where the use of mobile access staircases are impractical.

18.7.13 **Temporary Works**

18.7.13.1 The Contractor shall appoint an engineer as a Temporary Works Co-ordinator. His duties shall include, but not limited to, checking and certifying all Temporary Works prior to erection and loading, ensuring that the erection work is carried out in accordance with the design, compiling a Temporary Works register, completing a suitably designed form or certificate which is to be displayed on the Temporary Works to say it has been inspected and is safe to load.

18.7.13.2 The Temporary Works Co-ordinator shall not be the same person who designed the Temporary Works.

18.7.13.3 Suspended, cantilever, bracket type scaffolding or working platforms are to be designed, certified and inspected by an independent engineer, who may be the Temporary Works Co-ordinator, prior to loading.

- 18.7.14 **Temporary buildings, sheds, workshops, etc.**
- 18.7.14.1 No temporary structure is to be erected without the consent of the Employer's Representative.
- 18.7.14.2 Except where consent is obtained from the Employer's Representative, no person shall reside on the Site.
- 18.7.15 Deleted**
- 18.7.16 Deleted
- 18.7.17 **Deleted**

* End of Chapter *

CHAPTER 19

19. DAMAGE AND INTERFERENCE

19.1 Damage and Interference

19.1.1 Work shall be carried out in such a manner that, as far as is practicable, there is no damage to or interference with the following, other than such damage as is necessitated to enable the execution of the Works:

- (1) watercourses or drainage systems;
- (2) utilities;
- (3) structures, roads including street furniture, or other property;
- (4) public or private vehicular or pedestrian accesses;
- (5) trees, graves or burial urns; and
- (6) existing railways and railway systems.

The Contractor shall obtain prior approval of the concerned authority or party, if so required, for any work near properties under their ownership or management.

The Contractor shall inform the Employer's Representative as soon as practicable of any item, utility or thing which is not stated in the Contract as requiring diversion, removal or relocation but which the Contractor considers as requiring diversion, removal or relocation to enable the Works to be executed. The Contractor shall not divert, remove or relocate any such item, utility or thing without such diversion, removal or relocation having been reviewed without objection by the Employer's Representative.

19.1.2 Items which are damaged or interfered with as a result of the Works being carried out and items which are diverted, removed or relocated to enable the Works to be carried out, shall be reinstated to the same condition as existed before the Works started or to such condition as may be reviewed without objection or instructed by the Employer's Representative.

19.1.3 The Contractor shall excavate by hand where damage may be caused by the operation of mechanical plant adjacent to any utilities.

19.1.4 Except with the prior approval of the Local Fire Services, no damage or interference with existing fire hydrants and valves shall be caused.

19.1.5 Prior to trench excavation, the Contractor shall carry out investigations to locate utilities by means of hand-dug inspection pits. The locations and number of inspection pits required in meeting the Contractor's obligations to establish the location of existing utilities and underground features shall be determined by the Contractor. The Contractor shall note that many existing

pipes/ducts/cables may not be shown in the records kept by the utility undertakings, and may only be exposed as the excavation proceeds. The trench excavation shall be carried out by hand where there are utilities adjacent to or within the excavation works and the Contractor shall have allowed in his programme the time required for the exposing, temporary support and diversion of these recorded or unrecorded utilities. Should any pipes/ducts/cables or cover tiles be exposed, the respective utility undertaking shall be contacted to determine if all the utilities have been located. Cover tiles and utilities shall only be removed by the utility undertakings concerned.

- 19.1.6 Where the Employer's Representative has conducted utility and ground investigation on behalf of the Employer, the Contractor may obtain the data obtained from the investigations from the Employer's Representative in accordance with clause 1.7.2 above and subject to the condition of clause 19.3 below.

19.2 Watercourses and Drainage Systems

- 19.2.1 Existing watercourses and drainage systems shall be temporarily diverted as required to enable the Works to be carried out. Particulars of the proposed diversions shall be submitted to the Employer's Representative for review at least 14 days before the relevant work starts. Diversions shall be constructed to the satisfaction of the Employer's Representative with such alignment and in such manner that the flow is discharged adequately and effectively without causing flooding or erosion to the adjacent area. The diversions shall be maintained while the work is being carried out and shall be reinstated, including the removal of any obstructions to flow, as soon as practicable after the work is complete.
- 19.2.2 Measures shall be taken to prevent excavated material, silt or debris from being deposited in existing drainage systems, watercourses or the river.
- 19.2.3 Under no circumstances shall foul sewage flow be diverted into existing storm-water drains and vice versa.
- 19.2.4 The Contractor shall adequately maintain the existing drainage and sewerage systems at all times including removal of solids in sand traps, manholes, gullies and streambeds.
- 19.2.5 The Contractor shall discharge water surface run-off from the Site into storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels or sandbag barriers shall be provided on Site to properly direct the storm water to such silt removal facilities. The Contractor shall remove all silt, which may have accumulated in the drainage or sewerage systems whether within the Site, or not. If at any time such provisions prove to be ineffective, the Contractor shall take such additional measures as the Employer's Representative deems necessary.
- 19.2.6 Water pumped out of the trenches under construction shall be discharged into storm drains after the removal of silt in silt removal facilities.
- 19.2.7 The Contractor shall maintain the silt removal facilities, channels and manholes and remove the deposited silt and grit regularly, at the onset and after each rainstorm to ensure that these facilities are functioning properly at all times.
- 19.2.8 No obstruction to flow is to be left in position longer than is necessary for carrying out the Works. The Contractor shall ensure that adequate provisions are made for dealing with increased flow of water during the wet season.
- 19.2.9 The Contractor shall keep interruption or disturbance to the public due to the diversion works to a minimum.
- 19.2.10 If any mechanical equipment is required for the foul sewage diversion work, the Contractor shall suggest and provide precautionary measures to mitigate against consequences of break down of the equipment.
- 19.2.11 The Contractor shall at all times ensure that all existing stream courses and drains within and adjacent to the Site are kept safe and free from any debris and any excavated materials arising from the Works. The Contractor shall ensure that chemicals and concrete agitator washings are not deposited in watercourses.
- 19.2.12 The Contractor shall be responsible for the Temporary Works involved in training, diverting, or conducting of open streams or drains intercepted by the Works and the

Site, for the maintenance of the Temporary Works and waterways as required by the Employer's Representative, and for reinstating these to their original courses on Employer's Taking Over of the Works, when and where in the opinion of the Employer's Representative such action is desirable.

19.2.13 The Contractor shall take all necessary precautions to prevent water entering upon or being discharged from the Site, from entering upon the works of adjacent contractors or adjacent properties.

19.2.14 The Contractor shall provide where necessary temporary water courses, floodwalls, flood gates, ditches, drains, pumping or other means of maintaining the Works and the Site free of water.

19.3 Utilities

19.3.1 The details of existing utilities are given by the employer for information only and the accuracy of the details is not guaranteed. The Contractor shall make his own enquiries and shall carefully excavate trial holes to locate accurately the utilities indicated to him by the utility undertakings.

19.3.2 Temporary supports and protection to utilities shall be provided by methods reviewed without objection by the Employer's Representative. Permanent supports and protection shall be provided if instructed by the Employer's Representative.

19.3.3 The Contractor shall inform the Employer's Representative and the utility undertakings without delay of the following:

- (1) damage to utilities;
- (2) leakage of utilities;
- (3) discovery of utilities not shown on any drawings; and
- (4) diversion, removal, repositioning or re-erection of utilities which is required to enable the execution of the Works.

19.3.4 The Contractor shall take all steps necessary to enable the utility undertakings to proceed in accordance with the programme agreed between the Contractor and the utility undertakings under clause 2.2.2 above. The Contractor shall maintain close liaison with the utility undertakings and shall inform the Employer's Representative of any delays in works by the utility undertakings.

19.3.5 The Contractor shall keep records of existing utilities encountered on the Site and a copy provided for the Employer's Representative. The records shall be submitted for review by the Employer's Representative and shall contain the following details:

- (1) location of utility;
- (2) date on which utility was encountered;
- (3) nature and size of utility;
- (4) condition of utility; and
- (5) temporary or permanent supports provided.

19.3.6 The Contractor shall co-ordinate the activities of the utility undertakings in connection with the diversion of utility services necessary for the execution of the Works.

19.3.7 The Contractor shall set up and manage a Utilities Liaison Group for the duration of the Contract. The Group shall meet at a frequency to be as instructed by the

Employer's Representative but at least once a month, and shall discuss and resolve matters associated with utility undertakings on programming, co-ordination and action. The Contractor shall ensure that all relevant utility undertakings and the Employer's Representative are represented at the meetings.

- 19.3.8 The Contractor shall inform the Employer's Representative of the date, time and place of every meeting with utility undertakings and he shall copy all correspondence and minutes of meetings to the Employer's Representative.
- 19.3.9 The programme for any section of work to be carried out by a utility undertaking shall be confirmed in writing by the Contractor to the utility undertaking no more than four weeks and no less than one week before the agreed scheduled start date for that section of Works, such confirmation to be notified to the Employer's Representative.
- 19.3.10 The Contractor shall monitor the progress of utility undertakings against the agreed programmes and shall notify the Employer's Representative of any slippage to these programmes. The agreed programmes shall mean those programmes agreed in writing by the Contractor and the various utility undertakings described in 19.3.9 above.
- 19.3.11 In the event of any such slippage, the Contractor shall prepare and execute a plan of action with the relevant utility undertaking to redress the slippage. Such a plan may, if necessary, include provision of Contractor's labour resources, materials and/or plant to the utility undertaking.
- 19.3.12 The Contractor shall ensure that the peak particle velocity and amplitude of ground movement due to temporary sheet pile driving for trench excavation or any other construction activities, as measured by a vibrograph at all water mains within or adjacent to the Site shall not exceed the values specified in Table 19-1 of this GS.

Type of structure or installation	Peak particle velocity (mm/s)	Vibration amplitude (mm)
Water retaining structures Water tunnels	13	0.1
Water mains Other structures and pipes	25	0.2

Table 19-1 – Peak Particle Velocity & Vibration Amplitude

- 19.3.13 Hand digging method shall always be employed where there are utilities adjacent to or within the trench excavation works. Portable mechanical tools may be used but shall be restricted to the breaking of the pavement surface. Due care shall be exercised to prevent damage to the underground cables, water pipes, gas pipes or other utility installations.
- 19.3.14 Exposed utility installations shall be adequately supported and protected from accidental damage.
- 19.3.15 Smoking and use of naked flames shall be prohibited if gas pipes are present, or pipes the use of which are not identified are present.

19.4 Structures, Roads and Other Property

- 19.4.1 The Contractor shall immediately inform the Employer's Representative of any damage to structures, roads or other property that is not required for the execution of the Works.
- 19.4.2 The Contractor shall use every reasonable means to prevent any of the highways or bridges connecting with, or on the routes to, the Site from being damaged by any traffic of the Contractor or any of his sub-contractors of any tier and the Contractor shall, in particular, select routes, choose and use vehicles and restrict and distribute loads so that the moving of Temporary Works, Permanent Works and Contractor's Equipment from and to the Site shall be organised as far as reasonably possible so that no unnecessary damage or injury may be occasioned to such highways and bridges. The Contractor shall in selecting such routes take advice from and follow the instructions of the Commissioner for Transport and other Relevant Authorities of GoR.
- 19.4.3 Should the Commissioner for Transport or any other Relevant Authority or the Contractor be of the opinion that it should be necessary to move one or more loads of Temporary Works, Permanent Works or Contractor's Equipment over a highway or bridge the moving of which is likely to damage any highway or bridge unless special protection or strengthening is carried out then the Contractor shall, before moving the load on to such highway or bridge, give notice to the Employer's Representative of the weight and other particulars of the load to be moved and request the protection or strengthening of the said highway or bridge. If within 14 (fourteen) days of receipt of such notice the Employer's Representative directs in writing that such protection or strengthening is unnecessary then the Contractor may move the said load or loads over the said highway or bridge but otherwise the Contractor shall not move the said load or loads until notified by the Employer's Representative of the route which he may use.
- 19.4.4 If during the execution of the Works or at any time thereafter the Contractor shall receive any claim arising out of the execution of the Works in respect of damage or injury to highways or bridges he shall immediately report the same to the Employer's Representative and thereafter the Employer shall negotiate the settlement of and pay all sums due in respect of each claim and shall indemnify the Contractor in respect thereof and in respect of all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in relation thereto. Provided always that if and so far any such claim or part thereof shall in the opinion of the Employer's Representative be due to any failure on the part of the Contractor to observe and perform his obligations under clauses 19.4.2 above and 19.4.3 above, the amount certified by the Employer's Representative to be due to such failure shall be paid by the Contractor to the Employer.
- 19.4.5 Where the nature of the Works is such as to require the use by the Contractor of water-borne transport, the foregoing provisions of this Clause shall be construed as though "highway" includes any river or other structure related to, on or beneath a waterway, and "vehicle" includes craft, vessels or platforms and shall be read and construed accordingly.
- 19.4.6 If in the course of or for the purposes of the execution of the Works or any part thereof any highway or road or way shall have been damaged, broken or broken into then notwithstanding anything herein contained:
- (a) If the permanent reinstatement of such highway or road or way is to be carried out by the appropriate Relevant Authority or by some person other than the Contractor or any sub-contractor of any tier to him, the Contractor shall:
 - (i) at his own cost and independently of any requirement of or notice from the Employer's Representative be responsible for the temporary reinstatement of such highway, road or way and the

making good of any subsidence or shrinkage or other defect, imperfection, settlement or fault in the temporary reinstatement of such highway, road or way and for the execution of any necessary repair or amendment thereof from whatever cause the necessity arises until the end of the Defects Liability Period in respect of the part of the Permanent Works beneath or over such highway, road or way or until the Relevant Authority or such other person as aforesaid shall have taken possession of the highway, road or way for the purpose of carrying out permanent reinstatement, whichever is the earlier; and

- (ii) indemnify and save harmless the Employer against and from any damage or injury to the Employer or claims by third parties arising out of or in consequence of any neglect or failure of the Contractor to comply with the foregoing obligations or any of them, and against and from all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto; and

- b) as from the end of such Defects Liability Period or the taking of possession of such highway, road or way referred to in clause 19.4.6(a)(i) above whichever shall first happen, the Employer shall indemnify and save harmless the Contractor against and from any damage or injury to the Contractor arising out of or in consequence of or in connection with the said permanent reinstatement or any defect, imperfection or failure of or in such permanent reinstatement and against and from all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

- 19.4.7 Where the Relevant Authority or other person referred to in clause 19.4.6 above shall take possession of the highway, road or way as aforesaid in sections or lengths, the responsibility of the Contractor under clause 19.4.6 above shall cease in regard to any such section or length at the time at which possession thereof is so taken. But shall during the continuance of the said Defects Liability Period continue to be responsible for any section or length of which possession has not been taken and the indemnities given by the Contractor and Employer respectively under clause 19.4.6 above shall be construed and have effect accordingly.

19.5 Access

Alternative access shall be provided if interference with existing public or private vehicular or pedestrian access is necessary to enable the execution of the Works. The arrangements for the alternative access shall be as reviewed without objection by the Employer's Representative. The permanent access shall be reinstated as soon as practicable after the work is complete and the alternative access shall be removed as soon as practicable after it is no longer required.

19.6 Trees and Other Similar Obstructions

- 19.6.1 Trees which are to be retained or which are not required to be removed in order to carry out the Works, shall be protected from damage at all times by methods reviewed without objection by the Employer's Representative. Materials, including excavated materials, shall not be banked around such trees and they shall not be trimmed or cut without having been reviewed without objection by the Employer's Representative.

- 19.6.2 If any trees or other obstructions are required to be removed during the execution of the Works which are not specifically required to be removed or otherwise catered for, the Contractor shall draw the attention of the Employer's Representative to them and

shall not remove them without having received a notice of no objection from the Employer's Representative.

19.7 Noise Control on Works Site

19.7.1 All Contractor's Equipment shall be effectively "sound-reduced" by means of silencers, mufflers, acoustics linings or shields or acoustic sheds or screens to levels prescribed in the relevant Noise Control Ordinance and measured outside the nearest occupied property or to the satisfaction of the Employer's Representative. The Contractor shall provide details of proposed noise control measures to the Employer's Representative for review prior to the use of any Contractor's Equipment on the Site.

19.7.2 Provided that the provisions of this Paragraph shall not be applicable in the case of emergency work necessary to save life or property or for the safety of the Works or in the case of blasting operations necessitated by urgency and reviewed by the Employer's Representative.

19.7.3 The Contractor shall provide a sound level meter (as specified in Appendix 7 of this Specification), reviewed without objection by the Employer's Representative, for the exclusive use of the Employer's Representative at all times during the continuance of the Contract.

19.8 Spoil Disposal

19.8.1 The Contractor shall make his own enquiries and arrangements regarding the location and the availability of spoil disposal areas and reclamation and shall pay all costs of complying with all regulations and requirements of Relevant Authorities in connection with the use of such areas. These areas are not within the control of the Employer and no claims will be entertained in respect of non-availability of a particular areas or changes in the costs of arrangements for the use thereof.

19.8.2 The Contractor shall be responsible for all necessary liaison to ensure compliance with the requirements of unproductive disposal of any surplus excavated rock or soft material which is suitable for filling

19.8.3 The Contractor shall conform to all pertinent Environmental Protection Ordinances and be liable for any breach of such Ordinances committed by himself and/or his sub-contractors during the disposal of surplus excavated material and water from the Site.

* End of Chapter *

CHAPTER 20

20. ENVIRONMENTAL PROTECTION REQUIREMENTS

20.1 GENERAL

- 20.1.1 The Contractor shall conform to the Indian Environmental Laws and codes as applicable. The current national standards established by the Ministry of Environment and Forest, Government of India and other government agencies for control of environmental pollutants such as air, water, noise and visual impacts/aesthetics shall be followed for compliance during project construction.
- 20.1.2 The Contractor shall comply with all enactment which shall include but are not limited to:
1. Environment Protection Act, 1986
 2. Air (Prevention and control of Pollution) Act, 1981
 3. Water (Prevention and Control of Pollution) Act, 1974
 4. Any other statutory requirement as required by GoR.
- 20.1.3 The provisions listed herein regarding Environmental Protection shall apply to and be binding upon the Contractor for any works on the site and the persons employed by sub-Contractors. The Contractor shall ensure that proper and adequate provisions to this end are included in all sub-contracts placed by him.
- 20.1.4 The provisions of this Chapter however, shall not be applicable in the case of emergency works necessary for saving of life and property or safety of the Works.
- 20.1.5 The Contractor has been issued with the Employer's Environmental Quality Management Manual. Within 20 weeks of notification of acceptance of the bid, the Contractor shall submit for review by the Employer's Representative, a draft of his own contract specific Site Environmental Plan based on the Employer's Environmental Quality Management Manual and his construction methodology. He shall submit a final version prior to the commencement of the works.
- 20.1.6 This contract specific Site Environmental Plan of the Contractor, as referred to in Chapter 3 above, shall be consistent with the provisions of the Environmental Management Plan outline, as given in the Employer's Environmental Quality Management Manual. The Contractor is however not required to undertake air monitoring.
- 20.1.7 The Contractor shall ensure that audits of all the activities detailed in his Site Environmental Plan are carried out at weekly intervals or at such intervals as the Employer's Representative may require to ensure the continuing effectiveness and compliance with the Site Environmental Plan. The Contractor shall make available on request any document, which relates to his recent internal audits.
- 20.1.8 The Employer's Representative may conduct quarterly Audits of the Contractor's Site Environmental Plan and its effective implementation on the works site. Not less than 2 weeks notice will be given by the Employer's Representative. During the audit by the Employer's Representative, the Contractor shall provide suitably qualified staff to accompany the auditor.
- 20.1.9 Payments will be achieved for successful quarterly audits for which the Employer's Representative has issued a "Notice of No Objection" or a "Notice of No Objection subject to...."
- 20.1.10 Requirements established in this Chapter shall apply to all sites and all activities of the Contractor, and shall supplement the Employer's Requirements – Construction.

20.2 AVOIDANCE OF NUISANCE

- 20.2.1 The Contractor shall take all precautions to avoid any nuisance arising from his operations. This shall be accomplished, wherever possible by suppression of nuisance at source rather than abatement of the nuisance once generated.
- 20.2.2 Following site clearing and before construction, the Contractor shall remove all trash, debris and other weeds.
- 20.2.3 The Contractor shall ensure that the work place is free of trash, garbage, debris and weeds. He shall provide and ensure proper uses of refuse containers to ensure that rodents, fleas and other pests are not harboured and attracted.
- 20.2.4 The Contractor shall provide at site, metal or heavy-duty plastic 'Refuse Containers' with tight fitting lids for disposal of all garbage or trash associated with food. The containers shall not have openings that allow access by rodents.
- 20.2.5 To keep the area free of litter and garbage, specific locations shall be designated for consuming food and snacks to prevent random disposal of waste. All waste shall be deposited in the refuse containers described in (3) above. Suitable notice shall be deployed prominently for strict compliance of these requirements.
- 20.2.6 The refuse containers shall be kept upright with their lids shut tight. These containers shall be emptied at least once daily by the Contractor to maintain site sanitation.

20.3 AIR QUALITY

- 20.3.1 The Contractor shall take all necessary precautions to minimise fugitive dust emissions from operations involving excavation, grading, clearing of land and disposal of waste. He shall not allow emissions of fugitive dust from any transport, handling, construction or storage activity to remain visible in atmosphere beyond the property line of emission source for any prolonged period of time without notification to the Employer's Representative.
- 20.3.2 The Contractor shall use equipment designed and equipped to minimise or control air pollution. He shall maintain evidence of such equipment and make these available for inspection by Employer's Representative.
- 20.3.3 If after commencement of activity, Employer's Representative believes that the Contractor's equipment or methods of working are causing unacceptable air pollution impacts then these shall be inspected and remedial proposals shall be drawn up by the Contractor, submitted for review to the Employer's Representative and implemented.
- 20.3.4 In developing these remedial measures, the Contractor shall inspect and review all dust sources that may be contributing to air pollution. Remedial measures include use of additional/ alternative equipment by the Contractor or maintenance/modification of existing equipment of the Contractor.
- 20.3.5 Dust generating materials shall be:
- (i) Transported in closed containers or covered trucks.
 - (ii) Loaded and unloaded in closed systems or wind protected areas.
 - (iii) Watered as appropriate to minimise dust production.
- 20.3.6 Contractor's transport vehicles and other equipment shall conform to emission standards fixed by Statutory Agencies of Government of India from time to time at

Jaipur. The Contractor shall carry out periodical checks and undertake remedial measures including replacement, if required, so as to operate within permissible norms.

- 20.3.7 In the event that approved remedial measures are not being implemented and serious impacts persist, the Employer's Representative may direct the Contractor to suspend work until the measures are implemented, as required under the Contract.
- 20.3.8 The Contractor shall cover loads of materials, debris and soil transported from construction sites. All trucks carrying loose material should be covered and loaded with sufficient free-board to avoid spills through the tail board or side boards.
- 20.3.9 The Contractor shall be responsible for ensuring that no earth, rock or debris is deposited on public or private right of way as a result of his operations, including any deposits arising from the movement of loaded/unloaded trucks and/or other construction vehicles.
- 20.3.10 The Contractor shall make his own arrangements for water for purposes stated in above clauses and wherever it may be required to control air pollution, dust and debris.
- 20.3.11 The Contractor shall establish and maintain records of routine maintenance program for internal combustion engine powered vehicles and equipment used on this project. He shall keep records available for inspection by Employer's Representative.
- 20.3.12 The Contractor shall promptly transport all excavation disposal materials of whatever kind so as not to delay work on the project. Stockpiling of materials will only be allowed at sites designated by the Employer's Representative.
- 20.3.13 The Contractor shall protect structures, utilities, pavements and other facilities from disfiguration and damage.
- 20.3.14 The Contractor shall place excavation materials in the dumping/disposal areas designated in the plans as given in the specifications.
- 20.3.15 The temporary dumping areas shall be maintained by the Contractor at all times until the excavate is re-utilised for backfilling or as directed by Employer's Representative.
- 20.3.16 The Contractor shall place material in a manner that will minimise dust production. Material shall be stabilised each day and wetted, to minimise dust production.
- 20.3.17 During dry weather, dust control methods must be used daily especially on windy, dry days to prevent any dust from blowing across the site perimeter.
- 20.3.18 The Contractor will make water sprinklers, water supply and water delivering equipment available at any time that it is required for dust control use.
- 20.3.19 Dust control activities shall continue even during any work stoppage.
- 20.3.20 The Contractor shall water down work sites as required to suppress dust, during handling of excavation soil or debris or during demolition.
- 20.3.21 At each work site, the Contractor shall provide storage facilities for dust generating materials and shall be:
- (i) Closed containers/bins or;
 - (ii) Wind protected shelters or;
 - (iii) Mat covering or;
 - (iv) Walled.

Or any combination of the above to the satisfaction of the Employer's Representative.

- 20.3.22 The Contractor shall implement his blasting techniques so as to minimise dust generation.

20.4 WATER QUALITY

- 20.4.1 The Contractor shall comply with the Indian Government legislation and other State regulations in existence in Jaipur in,sofar as they relate to water pollution control and monitoring.

- 20.4.2 The Contractor shall provide adequate precautions to ensure that no spoil or debris of any kind is pushed, washed, falls or deposited on land adjacent to the site perimeter.

- 20.4.3 In the event of any spoil or debris from construction works being deposited on adjacent land any silt washed down to any area, then all such spoil, debris or material and silt shall be immediately removed and the affected land and areas restored to their natural state by the Contractor to the satisfaction of the Employer's Representative.

- 20.4.4 Due to lowering of potable water supplies in Jaipur and subsequent contamination of ground water, the Contractor is not allowed to discharge water from the site without the approval of the Employer's Representative. The Contractor must comply with the requirements of the Central Ground Water Board for discharge of water arising from dewatering. Any water obtained from dewatering systems installed in the works must be either re-used for construction purposes and this water may subsequently be discharged to the drainage system or, if not re-used, recharged to the ground water at suitable aquifer levels. The Contractor must submit his proposals for approval of Employer's Representative, on his proposed locations of dewatering of excavation and collection of water for either construction re-use or recharge directly to aquifers. The Contractor's recharge proposals must be sufficient for recharging of the quantity of water remaining after deduction of water re-used for construction. The Contractor will not be permitted to directly discharge, to the drainage system, unused ground water obtaining from the excavation without obtaining approval of Employer's Representative or the Agency controlling the system.

- 20.4.5 The Contractor shall prevent soil particles and debris from entering the wells or water discharge points by use of filters and sedimentation basins as required.

- 20.4.6 The Contractor shall provide treatment facilities as necessary to prevent the discharge of contaminated ground water.

- 20.4.7 The Contractor shall at all times ensure that all existing stream courses and drains within, and adjacent to the site are kept safe and free from any debris and any excavated materials arising from the Works. The Contractor shall ensure that earth, bentonite, chemicals and concrete agitator washings etc. are not deposited in the watercourses but are suitably treated and effluents and residue disposed off in a manner approved by local authorities.

- 20.4.8 All water and waste products (surface runoff and wastewater) arising on the site shall be collected and removed from the site via a suitable and properly designed temporary drainage system and disposed off at a location and in a manner that will cause neither pollution nor nuisance.

- 20.4.9 Any mud slurry from drilling, tunnelling, diaphragm wall construction or grouting etc. shall not be discharged into the drainage system unless treatment is carried out that will remove silt, mud particles, bentonite etc.

- 20.4.10 The Contractor shall discharge wastewater arising out of site office, canteen or toilet facilities constructed by him into sewers after obtaining prior approval of agency

controlling the system. A wastewater drainage system shall be provided to drain wastewater into the sewerage system.

20.4.11 Oil removal / interceptors shall be provided to treat oil waste from workshop areas etc.

20.4.12 The Contractor shall take measures to prevent discharge of oil and grease during spillage from reaching drainage system or any water body through Spill Prevention and Control Plan.

20.5 NOISE

20.5.1 General

- (1) The Contractor shall consider noise as an environmental constraint in his planning and execution of the Works. The Contractor shall, at his own expense, take all appropriate measures to ensure that work carried out by the Contractor and by his sub-Contractors, whether on or off the Site, will not cause any unnecessary or excessive noise which may disturb the occupants of any nearby dwellings, schools, hospitals, or premises with similar sensitivity to noise.
- (2) Without prejudice to the generality of the foregoing, noise level reduction measures shall include the following:
 - (a) the Contractor shall ensure that all powered mechanical equipment used in the Works shall be effectively sound reduced using the most modern techniques available including but not limited to silencers and mufflers.
 - (b) the Contractor shall construct acoustic screens or enclosures around any parts of the Works from which excessive noise may be generated.
- (3) The Contractor shall ensure that noise generated by work carried out by the Contractor and his sub-Contractors during day time and night time shall not exceed the maximum permissible noise limits, as given in the Employer's Environmental Quality Management Manual. The same may be varied from time to time by and at the sole discretion of the Employer's Representative, In the event of a breach of this requirement, the Contractor shall immediately re-deploy or adjust the relevant equipment or take other appropriate measures to reduce the noise levels and thereafter maintain them at levels which do not exceed the said limits. Such measures may include without limitation the temporary or permanent cessation of use of certain items of equipment.
- (4) The noise monitoring requirements are given in the Employer's Environment Quality Management Manual. However, the monitoring locations shall be decided in consultation with the Employer's Representative.

20.5.2 Construction material should be handled and transported in such a manner as not to create unnecessary noise as outlined below.

20.5.3 Under the Contract, the Contractor shall:

- (1) Perform Work within the procedures outlined herein and comply with applicable codes, regulations, and standards established by the Central and State Government and their agencies.

- (2) Keep noise to the lowest reasonably practicable level. Appropriate measures will be taken to ensure that construction works will not cause any unnecessary or excessive noise, which may disturb the occupants of any nearby dwellings, schools, hospitals, or premises with similar sensitivity to noise. Use equipment with effective noise-suppression devices and employ other noise control measures as to protect the public.
- (3) Schedule and conduct operations in a manner that will minimize, to the greatest extent feasible, the disturbance to the public in areas adjacent to the construction activities and to occupants of buildings in the vicinity of the construction activities.
- (4) The Contractor shall submit to the Employer's Representative a Noise Monitoring and Control Plan (NMCP) under contract specific Site Environmental Plan. It shall include full and comprehensive details of all powered mechanical equipment, which he proposes to use during daytime and nighttime, and of his proposed working methods and noise level reduction measures. The NMCP shall include detailed noise calculations to demonstrate the anticipated noise generation by the Contractor.
- (5) The NMCP prepared by the Contractor shall guide the implementation of construction activity. The NMCP will be reviewed on a regular basis and updated as necessary to assure that current construction activities are addressed. It shall appear as a regular agenda item in project coordination meetings.

20.5.4 Vibration Level Limits

The vibration level limits at historical sites adjacent to the alignment shall conform to revised version of the German Standard (DIN 4150). The scheme for monitoring vibration level at these historical sites shall be submitted to Employer's Representative for his approval. The scheme shall include:

- (1) monitoring requirements for vibrations at regular intervals throughout the construction period.
- (2) pre-construction structural integrity inspections of historic and sensitive structures in project activity.
- (3) Information dissemination about the construction method, probable effects, quality control measures and precautions to be used.

20.6 WASTE

20.6.1 The Contractor shall handle waste in a manner that ensures they are held securely without loss or leakage thus minimising potential for pollution.

20.6.2 The Contractor shall remove waste in a timely manner. Scrap and waste material shall be removed and disposed off at landfill sites after obtaining approval of Conservancy and Sanitation Engineering Department of Municipal Corporation of Jaipur for its disposal.

20.6.3 Burning of wastes is prohibited. The Contractor shall not burn debris or vegetation or construction waste on the site but remove it in accordance with (2) above.

20.6.4 The Contractor shall maintain and clean waste storage areas regularly.

20.6.5 If encountered or generated as a result of Contractor's activity, then waste classified as hazardous under the "Hazardous Wastes (Management & Handling) Rules, 1989" and chemicals classified as hazardous chemicals under "Manufacture, Storage and

Import of Hazardous Chemical Rules, 1989 of Environment (Protection) Act, 1986 'shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.

20.7 PREVENTION OF MOSQUITO BREEDING

20.7.1 Measures shall be taken to prevent mosquito breeding at site. The measures to be taken shall include:

- (a) empty cans, oil drums, packing and other receptacles which may retain water shall be deposited at a central collection point and shall be removed from the Site regularly;
- (b) still waters shall be treated at least once every week with oil in order to prevent mosquito breeding;
- (c) Contractor's Equipment and other items on the Site which may retain water shall be stored, covered or treated in such a manner that water could not be retained.
- (d) Water storage tanks shall be suitably provided.

20.7.2 Posters in both Hindi and English which draw attention to the dangers of permitting mosquito breeding shall be displayed prominently on the Site.

* End of Chapter *

CHAPTER 21

21. PHOTOGRAPHS

21.1 Photographs

- 21.1.1 Colour progress photographs showing the progress of the Works and the quality of the materials and workmanship shall be taken by the Contractor. The photographs shall be taken by a professional photographer, nominated by the Contractor and reviewed without objection by the Employer's Representative. Processing shall be carried out by a competent processing firm, nominated by the Contractor and reviewed without objection by the Employer's Representative. The photographs shall be taken under the direction of the Employer or the Employer's Representative at locations selected by the Employer or the Employer's Representative. Photographs shall be taken once every month and at other times instructed by the Employer or the Employer's Representative.
- 21.1.2 One proof 3R print of each progress photograph shall be provided to the Employer's Representative not more than 2 days after the photographs are taken. The Employer's Representative shall select the sets of progress photographs to be provided. The selected sets shall be provided not more than 2 days after the Employer's Representative has selected the sets. The following shall be provided for the Employer's Representative:
- (1) one set of each selected progress photograph comprising the negatives and three 3R prints;
 - (2) albums for the photographs and negatives; and
 - (3) printed labels for each photograph.
- 21.1.3 The Contractor shall provide to the Employer's Representative the photographs selected in clause 0 above on Photo Compact Disks with a minimum resolution of 64 Base (4096 x 6144).
- 21.1.4 The Contractor may propose to the Employer's Representative the use of a digital photography system to meet the requirements of this Chapter. The Employer's Representative shall at his discretion, review the proposed system for practical and technical compliance.
- 21.1.5 Colour progress photographs shall provide a fair representation of the Works. A minimum of 24 photographs per month shall be submitted to the Employer's Representative.

* End of Chapter *

CHAPTER 22

22 TEMPORARY ELECTRICITY SUPPLY

22.1 Electricity Supply for the Contractor by the Project Civil Contractors

Please Refer Clause 56 of SCC

22.2 Applicability

22.2.3 Where the Contractor is required to provide temporary electrical supplies, or to use, extend or expand on temporary supplies installed by others, all such activity shall be executed in accordance with clauses 22.3 to 22.19 inclusive.

22.2.4 When the Contractor makes use of temporary electrical supplies provided by other, viz. Project (Civil) Contractors, he will observe and comply with the requirements of this Chapter.

22.3 Work on Site

22.3.3 The Contractor shall nominate a representative whose name and qualifications shall be submitted in writing to the Employer's Representative for review not later than 4 weeks before the appointment and who shall be solely responsible for ensuring the safety of all temporary electrical equipment on Site. The Contractor shall not install or operate any temporary Site electrical systems until this representative is appointed and has commenced duties.

22.3.4 The name and contact telephone number of the representative having been reviewed without objection by the Employer's Representative shall be displayed at the main distribution board for the temporary electrical supply so that he can be contacted in case of an emergency.

22.3.5 The Contractor shall submit schematic diagrams and the details of the equipment for all temporary electrical installations, and these diagrams together with the temporary electrical equipment shall be submitted to the Employer's Representative for review.

22.3.6 All electrical installation work on Site shall be carried out in accordance with the requirements laid down in BS 7375 and the Specification. All work shall be supervised or executed by qualified and suitably categorised electricians, who are registered as such under the Electricity Ordinance 1990/Electricity (Registration) Regulations 1990.

22.4 Electrical General

Temporary electrical Site installations and distribution systems shall be in accordance with:-

- (1) Indian Electrical Regulations;
- (2) The Power Companies' Supply Rules;
- (3) Electricity and its subsidiary Regulations;
- (4) IEE Wiring Regulations (16th Edition);
- (5) BS 7375 Distribution of Electricity on Construction and Building Sites;
- (6) BS 4363 Distribution Assemblies for Electricity Supplies for Construction and Building Sites; and
- (7) Any other applicable national standards

22.5 Materials, Appliances and Components

All materials, appliances and components used within the distribution system shall comply with BS 4363 and BS 7375 Appendix A.

22.6 Mains Voltage

22.6.3 The Site mains voltage shall be as the Electricity Companies' Utility supplies, 415V 3-phase 4 wire system.

22.6.4 Single-phase voltage shall be as the Electricity Companies' Utility supplies, 240V supply.

22.6.5 Reduced voltages shall conform to BS 7375.

22.7 Types of Distribution Supply

22.7.3 The following voltages shall be adhered to for typical applications throughout the distribution systems:

- (1) fixed plant - 415V 3 phase;
- (2) movable plant fed by trailing cable - 415V 3 phase;
- (3) installations in Site buildings - 240V 1 phase;
- (4) fixed flood lighting – 240V 1 phase;
- (5) portable and hand held tools - 115V 1 phase;
- (6) Site lighting (other than flood lighting) - 115V 1 phase; and
- (7) portable hand-lamps (general use) - 115V 1 phase.

22.7.4 When the low voltage supply is energised via the Employer's transformer, any power utilised from that source shall be either 415V 3 phase or / 240V single phase as appropriate. The Contractor shall carry out any conversion that may be necessary to enable him to use power from that source.

22.8 Protection of Circuits

22.8.3 Protection shall be provided for all main and sub-circuits against excess current, residual current and earth faults. The protective devices shall be capable of interrupting (without damage to any equipment or the mains or sub-circuits) any short circuit current that may occur.

22.8.4 Discrimination between circuit breakers, circuit breakers and fuses shall be in accordance with:-

- (1) BS 88;
- (2) BS EN 60898; and
- (3) BS 7375;
- (4) Any other appropriate Indian Standards.

22.9 Earthing

22.9.3 Earthing and bonding shall be provided for all electrical installations and equipment to prevent the possibility of dangerous voltage rises and to ensure that faults are rapidly cleared by installed circuit protection.

22.9.4 Earthing systems shall conform to the following standards:-

- (1) IEE Wiring Regulations (16th Edition);
- (2) BS 7430;
- (3) BS 7375; and
- (4) IEEE Standard 80 Guide for Safety in AC Substation Grounding.

22.10 Plugs, Socket Outlets and Couplers

Low voltage plugs, sockets and couplers shall be colour coded in accordance with BS 7375, and constructed to conform to BS EN 60309. High voltage couplers and 'T' connections shall be in accordance with BS 3905.

22.11 Cables

22.11.3 Cables shall be selected after full consideration of the conditions to which they will be exposed and the duties for which they are required. Supply cables up to 3.3KV shall be in accordance with BS 6346. The cable armouring shall be used as the earth return in conditions where the cable is continuously extended and not subject to continuous movement after installation.

22.11.4 For supplies to mobile or transportable equipment where operation of the equipment subjects the cable to flexing, the cable shall conform to one of the following standards appropriate to the duties imposed on it:

- (1) BS 6708 flexible cables for use at mines and quarries;
- (2) BS 6007 rubber insulated cables for electric power and lighting; and
- (3) BS 6500 insulated flexible cords and cables.

22.11.5 Where low voltage cables are to be used, reference shall be made to BS 7375. The following standards shall also be referred to particularly for underground cables:-

- (1) BS 6346 for armoured PVC insulated cables; and
- (2) BS 6708 Flexible cables for use at mines and quarries.

22.11.6 All cables which have a voltage to earth exceeding 65 V (except for supplies from welding transformers to welding electrodes) shall be of a type having a metal sheath and/or armour which shall be continuous and effectively earthed. In the case of flexible or trailing cables, such earthed metal sheath and/or armour shall be in addition to the earth core in the cable and shall not be used as the sole earth conductor.

22.11.7 Armoured cables having an over-sheath of polyvinyl chloride (PVC) or an oil resisting and flame retardant compound shall be used whenever there is a risk of mechanical damage occurring.

22.11.8 For resistance to the effects of sunlight, overall non-metallic covering of cables shall

be black in colour.

22.11.9 Cables which have applied to them a voltage to earth exceeding 12 V but not normally exceeding 65 V shall be either one of the type as described in clause 22.11.7 above or alternatively of a type insulated and sheathed with a general purpose or heat resisting elastomer.

22.11.10 All cables that are likely to be frequently moved in normal use shall be flexible cables.

22.11.11 Flexible cables shall be in accordance with BS 6500 and BS 7375.

22.12 Lighting Installation

22.12.3 Lighting circuits shall be run separate from other sub-circuits and shall be in accordance with BS 7375 and BS 4363.

22.12.4 Voltage shall not exceed 55 V to earth except when the supply is to a fixed point and where the lighting fixture is fixed in position.

22.12.5 Luminaries shall have a degree of protection not less than IP 54. In particularly bad environments where the luminaries are exposed to excesses of dust and water, a degree of protection to IP 65 shall be employed.

22.12.6 Where the Employer's Representative requires Site inspection of the Works, the Contractor shall upgrade the lighting level to a minimum of 200 lux by localised lighting in all areas.

22.12.7 Use of wire guards or other such devices shall provide mechanical protection of luminaries against damage by impact whenever risk of damage occurs.

22.13 Electrical Motors

22.13.3 Totally enclosed fan cooled motors to BS 4999:Part 105 shall be used.

22.13.4 Motor control and protection circuits shall be as stipulated in BS 6164. Emergency stops for machinery shall be provided.

22.14 Inspection and Testing

Electrical installations on Site shall be inspected and tested in accordance with the requirements of the IEE Wiring Regulations (16th Edition).

22.15 Identification

Identification labels of a type reviewed without objection by the Employer's Representative shall be affixed to all electrical switches, circuit breakers and motors to specify their purpose.

22.16 Maintenance

Strict maintenance and regular checks of control apparatus and wiring distribution systems shall be carried out by an electrician (duly qualified to carry out the said checks) to ensure safe and efficient operation of the systems. The Contractor shall submit for review by the Employer's Representative details of his maintenance schedule and maintenance works record.

22.17 Maintenance Record

All portable electrical appliances shall be permanently numbered (scarf tag labels or similar) and a record kept of the date of issue, date of the last inspection carried out and the recommended inspection period.

22.18 Metering

22.18.3 For the purposes of the clause 22.18 above, "construction works" shall mean the Works excluding both the Contractor's on and off Site, fabrication facilities, workshops, work-yards, offices and stores.

22.18.4 The Contractor shall install a separately metered and invoiced supply or supplies of electricity for:-

- (1) Site fabrication facilities;
- (2) Site workshops and work-yards; and
- (3) Site offices and stores.

22.19 Inability to Supply

Wherever, the Project Contractor (Civil) is not in a position to supply construction power and water supply to the System wide Contractor, he (the System wide Contractor) shall arrange for his own separate construction power and water supply.

* End of Chapter *

CHAPTER 23

23 NOT USED

APPENDIX 1

MONTHLY PROGRESS REPORT

1.Topics

1.1 The Monthly Progress Report required under clause 2.17 of the GS shall include as a minimum the following sections and topics:

- (1) Executive Summary, highlighting any matters of concern and explaining corrective action to be taken
- (2) Programme and overall progress
- (3) Physical progress report (see Paragraph 2.19 of the General Specification)
- (4) Achievement of Key Dates and Milestone Dates planned vs actual dates
- (5) Interface;and
Interface co-ordination progress
- (6) Approval of design and drawings, vendor finalisation
- (7) Issue of purchase orders for equipments, expected date of inspection, expected date of arrival at site.
- (8) Installation / erection on Site
- (9) Commissioning activity
- (10) System integration tests
- (11) Training
- (12) Maintenance issues
- (13) Payments / invoices
- (14) Employer's Representative's instructions and variation orders
- (15) Claims / potential claims
- (16) Contractor's resources (details of all staff and sub-contractors engaged on the Works)

2. PROGRESS REPORTS

The Monthly Progress Reports shall be accompanied by:

- a) the Works Programme, marked to show the status of progress to date;
- b) control schedules for document submissions and issues of a repetitive or multiple nature;
- c) where appropriate, exception reports to highlight any problem areas including any submissions and information which are overdue;
- d) the programme analysis report, in accordance with Paragraph 2.18 of the General Specification;
- e) the physical progress (earned value) report, in accordance with Paragraph 2.20 of the General Specification;

- f) "S" curve showing current status of the Contract;
- g) a full list of all submissions and their current status in comparison to the Submissions Programme. Special commentary shall be provided for each item that is late to this programme giving the reasons for the delay and the proposed corrective action that will ensure that the delay does not affect any overall or stage completion dates, particularly those that interface with other parties;
- h) identification and discussion of significant accomplishments, problem areas encountered, actions taken or planned to resolve actual or potential problems and conflicts, and other comments or proposals on matters (including the interfacing works) affecting or likely to affect the Works; and
- i) a critical items action list which identifies outstanding problems associated with the timely completion of the Works including anticipated actions for their resolution.

2.1 The programmes shall show current status to provide a comparison between the Works Programme and reported progress.

2.2 Actual progress shall be reported for each activity in the Works Programme in the following terms:

- (1) the percentage of the work which is complete;
- (2) the remaining duration of the work;
- (3) the actual start date; and
- (4) the actual completion date.

2.3 Actual progress shall reflect the physical scope of the work that has been completed and shall not be calculated based on elapsed time or hours worked. Any automatic statistical indications in the Contractor's software that is based on this principle shall be disabled.

2.4 Each Monthly Progress Report shall include a programme activity listing and an analysis report. All activities that have negative float shall be analysed by the Contractor to identify the impact on the achievement of target dates.

3.0 Copies

3.1 Monthly The Contractor shall submit 1 unbound original and 4 bound hard copies of all

Progress Reports and of the accompanying documents plus one copy in electronic format on PC compatible 3-1/2" diskettes compatible with Microsoft Office and Primavera P3 applications.

* End of Appendix 1 *

APPENDIX 2

3 NOT USED

APPENDIX 3

4 SUBMISSION FOR REVIEW REQUEST FORM

SUBMISSION FOR REVIEW REQUEST

Reference No. _____ (see Paragraph 4.3.2) Date _____

Programme reference and scheduled date: _____

Submission Stage _____ (see Paragraph 3.5.1.1)

Title _____

We hereby submit for review by the Employer's Representative the documents or articles listed below:

(Introduction and list of items submitted – see Paragraph 4.3.5.2 – continue on separate sheet if necessary)

I confirm that the material submitted is in full compliance with the Contract.

Signed _____ (Contractor's responsible engineer)

Employer's Representative's Response _____ Dated _____

The material submitted has been reviewed and the following decision is given:

"No Objection" / "No Objection Subject To" (see below) / "Rejected" (see below)

The following comments are made and a re-submission is to be made by the Contractor within 10 working days demonstrating fully how all of these are taken into account:

(Employer's Representative's comments)

Signed _____ (Employer's Representative)

* End of Appendix 3 *

APPENDIX 4

SCHEDULE OF ITEMS TO BE SUBMITTED BY CONTRACTOR

This Appendix lists the principal items to be submitted by the Contractor for review by the Employer's Representative. This list is not exhaustive and the Contractor is reminded to satisfy itself of the requirements for all submissions whether or not they are included within this Appendix.

Article	Reference Paragraph(s)	To be submitted
Works Programme	2.4.1.2	Within 60 days of the Commencement Date of the Works
Submissions Programme	2.5.1	Within 30 days of the Commencement Date of the Works
Procurement and Manufacturing Programme	2.6.1	Within 60 days of the Commencement Date of the Works
Material Control Schedule	2.6.5	As stated in the TS, or if none is given, within 60 days of the Commencement Date of the Works
Factory Testing Programme	2.6.8	Within 60 days of the Commencement Date of the Works
Installation Programme	2.7.1	Preliminary version within 60 days of the Commencement Date of the Works. Full version as stated in the TS or as directed by the Employer's Representative
Testing & Commissioning Programme	2.8.1	Preliminary version within 60 days of the Commencement Date of the Works. Full version as stated in the TS or as directed by the Employer's Representative
Monthly Progress Report and supporting documentation	2.17.1	The 5 th day of each month.
Contractor's Project Plan	3.1.2	As stated in the TS, or if none is given, within 60 days of the Commencement Date of the Works
Particulars of agent	3.3.1.6 (6)	30 days before the Commencement Date of the Works
Interface Management Plan	3.3.2 b)	Within 60 days of notification from the Employer's Representative of the identity of each Project Contractor
Detailed Interface Document	3.3.2 d)	Within 90 days of notification from the Employer's Representative of the identity of each Project Contractor
Contractor's Factory Testing Plan	3.5.1	As stated in the TS, or if none is given, within 60 days of the Commencement Date of the Works
Test Reports	3.5.1.7	Immediately after the completion of Factory Testing
Procurement, Manufacturing and Delivery Plan	3.5.2	As stated in the TS, or if none is given, within 60 days of the Commencement Date of the Works
Contractor's Health and Safety Documentation	3.6.2.2	Within 30 days of the Commencement Date of the Works
Commissioning Plan	3.7.2.1	First draft within 180 days of the Commencement Date of the Works

Article	Reference Paragraph(s)	To be submitted
Installation Test Schedule	3.7.2.2 b. (i)	As stated in the TS or if not given, not later than two months in advance of the Date scheduled for commencement of respective tests
Partial Acceptance Tests Plan	3.7.2.2 b. (ii)	As stated in the TS or if not given, not later than four months in advance of the Date scheduled for commencement of Partial Acceptance Tests
System Acceptance Tests Plan	3.7.2.2 b. (iii)	As stated in the TS or if not given, not later than four months in advance of the Date scheduled for commencement of System Acceptance Tests
Integration Tests & Commissioning Plan	3.7.2.2 b. (iv)	As stated in the TS or if not given, not later than four months in advance of the Date scheduled for commencement of Tests on Completion
Operation & Maintenance Manuals Plan	3.7.3.2	As stated in the TS or if not given, not later than nine months prior to the issue of the Taking Over Certificate for the Works
Training Plan	3.7.4.2	As stated in the TS or if not given, not later than six months prior to the issue of the Taking Over Certificate for the Works
Defects Liability Management Plans	3.7.6	Upon issuance of the Taking Over Certificate
Project Document Control Procedure	4.3.2	Within 28 days of the Commencement Date of the Works
Quality Manual	5.2.3	Within 30 days of the Commencement Date of the Works
Quality System Procedures	5.2.3	Within 30 days of the Commencement Date of the Works
Details of Quality Manager	5.2.6	Within 30 days of the Commencement Date of the Works
Proposed Corrective & Preventive Action Plan	5.2.7	Within 14 days of issue of CAR
Management Quality Plan	5.3	Within 30 days of the Commencement Date of the Works
Site Quality Plan	5.5	60 days prior to the commencement of the construction works
Reports of Quarterly Quality Audits	5.7.2	Every Three months
Quality Control Register	5.8	7 th working day of every month
Packaging Materials & Procedures	8.4.1	As stated in the TS, or if none is given, within 60 days of the Commencement Date of the Works
Latest drawings, test procedures, specifications and quality documentation for inspection of equipment	9.2.7.4	At least 15 days prior to each First Article Inspections (FAI)
Installation Tests Reports	9.4.3.3	Immediately after the completion of each test
Proposed Partial Acceptance Tests Records	9.4.4.7	As stated in the TS or if not given, not later than two months in advance of the Date scheduled for commencement of tests
Partial Acceptance Tests Records	9.4.4.9	Immediately following the successful Partial Acceptance Tests
System Acceptance Tests Records	9.4.5.8	Immediately following the successful System Acceptance Tests

Article	Reference Paragraph(s)	To be submitted
Integration Tests & Commissioning Records	9.4.6.8	Immediately following the successful Tests on Completion of the system
Service Trial Records	9.4.7.8	Immediately following the successful Service Trial of the system
Summaries of Inspection and/or Test	9.6.11	7 th day of the following month
Operation & Maintenance documentation (Draft Version)	11.4.1	As stated in the TS or if not given, not later than 6 months prior to the issue of the Taking Over Certificate for the Works
Operation & Maintenance documentation (Final Version)	11.4.3	As stated in the TS or if not given, not later than 1 month prior to the issue of the Taking Over Certificate for the Works
Operating & Maintenance instructions and illustrated parts list (Final Submission)	11.4.3	At a date set by the Employer's Representative
Spare Parts List	13.1.3	As stated in the TS
Construction & Installation Plan	14.1.1	As stated in the TS, or if none is given, within 60 days of the Commencement Date of the Works, and in any case not less than 12 weeks before starting the construction of the Works on Site
Proposals for the construction of the Employer's Representative's Site Offices	0	Within 14 days of the Commencement Date of the Works
Particular Uses of Site	17.2.1	Within 14 days of the Commencement Date of the Works
Detailed written report of accidents, incidents and dangerous occurrence	18.6.4.1	Within 7 days of occurrence/accident
Name and qualification of safety representative for temporary site electricity	22.3.3	Not later than 4 weeks before appointment

* End of Appendix 4 *

APPENDIX 5

TYPICAL TYPE TEST REQUIREMENTS

1 Electronic and Electrical Equipment

The initial visual inspection shall be carried out to ensure that the equipment is of sound construction and, so far as can be ascertained, meets the requirements of the Specification.

1.1 Initial Performance Test

- i. The initial performance tests shall consist of a comprehensive series of measurements of the characteristics of the equipment to demonstrate that its performance is in accordance with its functional requirements, including detailed requirements of the Specification.
- ii. This test shall normally be performed at an ambient temperature of 40°C +5°C while supplied at its normal voltage and frequency, if relevant.
- iii. This test shall extend to demonstrating compliance with any limitation on self-generated vibration or interference as stated in the Specification.

1.2 Modes of Testing

- i. Electrical tests will generally be applied to the 'external terminals' of the item of equipment to be tested which are normally used to interface the subject equipment to other equipment or external circuits, e.g. power supply terminals, signal input/output terminals, frame (safety) earth terminals, etc. Tests may be applied in Common Mode and/or Series Mode, as described below.
- ii. Common mode tests generally involve testing circuits with respect to the equipment's frame earth. All accessible metal parts (intended to be connected to earth) are to be connected to the frame earth.
- iii. All the terminals of the circuit to be tested shall be connected together, where practicable. All terminals of circuits not involved in the test shall preferably be connected to earth.
- iv. For example, a common mode test on the AC power supply circuit of an item of equipment would involve connecting all the supply circuit terminals together (e.g. phase (s) and neutral) and applying the test between those connected terminals and the equipment's frame earth

terminal. The terminals of all other circuits, e.g. signal input/output terminals, shall preferably be connected to earth.

- v. Series mode tests generally involve testing circuit connections with respect to each other.

- vi. Where an item of equipment to be tested has a large number of identical interfaces circuits series mode testing may be restricted to a representative sample of those interfaces, the proportion being to the agreement of the Employer's Representative.
- vii. The test is applied between terminals (other than the earth terminal) either associated with the same circuit (e.g. between power supply terminals) or associated with different circuits (e.g. between input signal terminals and output signal terminals). All terminals of circuits not involved in the test shall preferably be connected to earth.
- viii. For example, a series mode test on an RTU analogue input circuit would involve applying the test between the positive and negative analogue signal input terminals, preferably with all other terminals connected to earth.
- ix. For each item of equipment to be tested, there may be many combinations of terminals to which series mode testing could be applied. Not all combinations may be relevant or subject to the conditions against which a particular test is to be performed. However, the Contractor shall test all combinations unless specifically agreed otherwise by the Employer's Representative.

2 Mechanical Tests

2.1 Drop Test

- i. The drop test is intended to be carried out on units and sub-assemblies that are portable. It is not intended that it be carried out on complete racks of equipment.
- ii. Casings or dust covers, which have to be removed for servicing, shall be removed after subjecting equipment to this test to inspect for damage. The test is designed to reveal any weakness of assembly and to ensure that the component mountings are of adequate strength. It is not designed to check whether doors or windows made of glass will fracture and to this end meters, glass windows, etc., may be removed.
- iii. The equipment shall not be deemed to have failed the drop test if externally accessible components such as control knobs or connectors are damaged.

The Employer's Representative however reserves the right to ask for some form of guard, to prevent such damage, to be fitted at the Contractor's cost.

- iv. Test conditions shall be in accordance with IEC 68-2-31. Information required for paragraph 4.2 of that test:
 - a. Visual inspection and function test to specification.
 - b. Assembled ready for installation.
 - c. Connectorised cables removed, casings or covers in place.
 - d. Not applicable.
 - e. All.
 - f. 25mm, 6 times.

- g. 25mm, 6 times.
- v. Visual inspection and function test to specification.
- vi. Topple (or push over) test is not required.

2.2 Vibration Test

- i. The vibration test is designed to reveal any parts or components of the equipment that may be prone to any resonance severe enough to cause possible damage or malfunctioning.
- ii. The test shall be in accordance with IEC 68-2-6 1982. Information required for Chapter 12 of that standard:
 - a. Measuring Points: If four or less fixing points are used for the specimen, these shall also be used as checkpoints. If more than four fixing points are used then those nearest the corners shall be used as checkpoints. The checkpoints shall be located as close as possible to the fixing points.
 - b. Transverse Motion: Any transverse motion in excess of that specified in the above standard clause 4.1.2 shall be noted and recorded in the test results.
 - c. Distortion: As defined in clause 3 in excess of the limits in clause 4.1.3 of the above standard shall be noted as defined in clause 4.1.3 paragraph 4 of the same standard.
 - d. Derivation of Control Signal Single point.
 - e. Tolerances at check points shall be as clause 4.1.4.2 of the above standard. Where these cannot be achieved, the actual values shall be recorded.
 - f. Monitoring of Specimen(s): The equipment shall be rigidly mounted in a jig so designed as to transmit the input vibration with minimum modification.

2.3 Vibration Test 1

- i. Equipment intended for use with vibration isolators shall normally be tested with its isolator. When this is not possible, the equipment shall be rigidly secured to the vibrator and the input vibration levels modified to include transmissibility of the isolators.
- ii. Equipment under test is to be mounted in its normal operational attitude.
- iii. Frequency Range: See Chapter 6, Paragraph 5.5 (Equipment Requirements).
- iv. Vibration Amplitude: See Chapter 6, Paragraph 5.5 (Equipment Requirements).
- v. Special crossover frequency: See Chapter 6, Paragraph 5.5 (Equipment Requirements).
- vi. Type and duration of endurance:
 - a. Endurance by sweeping 6 hours, i.e. 2 hours per axis
 - b. Endurance at critical frequencies (as defined in the above standard clause 8.1): 1 minute at each frequency providing not more than four such frequencies exist per axis.

- vii. Pre-conditioning: None.
- viii. Initial measurements Functional test to the appropriate test procedure.
- ix. Axes of vibration: Three mutually perpendicular axes in turn.
- x. Force Limitation: Not required.
- xi. Test stages to be performed in the sequence below:
 - a. Vibration response investigation.
 - b. Endurance at fixed frequencies derived from vibration response investigation.
 - c. Endurance by sweeping.
- xii. The equipment functionality shall be verified throughout the sweep test to the appropriate test procedure.
- xiii. Action to be taken after vibration response investigation. If less than four critical frequencies are found in each axis, then endurance testing for the prescribed duration shall be performed at each frequency.
- xiv. Final response test not required.
- xv. Predetermined frequencies shall be derived from the vibration response investigation.
- xvi. Conditioning at the resonance frequencies of the specimen on its isolators (where fitted) shall be included.
- xvii. Final measurements Functional test to the appropriate test procedure.
- xviii. Any resonance liable to affect the performance or reliability of the equipment shall be reduced to an acceptable level by suitable modifications and the complete test repeated.

3. ENVIRONMENTAL TESTS

3.1 Dry Heat Test

- i. The dry heat test shall be carried out on each complete piece of equipment or assembly, with all doors and covers being in place and closed as in normal operation.
- ii. Test conditions shall be in accordance with IEC 68-2-2. Information required for paragraph 44 of that test:
 - a. Laboratory ambient.
 - b. Visual inspection.
 - c. Assembled and mounted in rack, enclosure or cabinet ready for operation or installation.
 - d. On.
 - e. Maximum class temperature (see Chapter 6, Chapter 5.2, Equipment Requirements) for 16 hours.
 - f. At maximum class temperature after 16 hours, switch on and function test to specification.
 - g. Recovery at laboratory ambient.

- h. Visual inspection and function test to specification.
- i. None.

3.2 Low Temperature Test (in case applicable for Jaipur ambient temperature range)

- i. The low temperature test shall be carried out on each complete piece of equipment or assembly, with all doors and covers being in place and closed as in normal operation.
- ii. Test conditions shall be in accordance with IEC 68-2-1. Information required for paragraph 33 of that test:
 - a. Laboratory ambient.
 - b. Visual inspection and function test to specification.
 - c. Assembled and mounted in rack, enclosure or cabinet ready for operation or installation.
 - d. Off.
 - e. Minimum class temperature (see Chapter 6, Paragraph 5.2, Equipment Requirements) for 16 hours.
 - f. At minimum class temperature after 16 hours, switch on and function test to specification.
 - g. Recovery at laboratory ambient.
 - h. Visual inspection and function test to specification.
 - i. None.

3.3 Change of Temperature Test

- i. If both Dry Heat and Low Temperature Tests are required (as decided by the Employer's Representative) they may be replaced by a single test in accordance with IEC 68-2-14.
- ii. Information required for paragraph 2.9 of that test:
 - i. Assembled and mounted in rack, enclosure or cabinet ready for operation or installation.
 - ii. Minimum class temperature.
 - iii. Maximum class temperature.
 - iv. Per Minute.
 - v. One.
 - vi. Visual inspection.
 - vii. On.
 - viii. Hours.
 - ix. None.
 - x. Recovery at laboratory ambient.
 - xi. Visual inspection and function test to specification.

3.4 Damp Heat Test

- i. The damp heat test shall be carried out on each complete piece of equipment or assembly, with all doors and covers being in place and closed as in normal operation.
- ii. Test conditions shall be in accordance with IEC 68-2-30. Information required for paragraph 10 of that test:
 - i. Maximum class temperature, two cycles.
 - ii. Visual inspection and function test to specification.
 - iii. Switched on, ready to use.
 - iv. None.
 - v. Variant 2.
 - vi. At maximum class temperature after 12 hours, function test to Specification. At 6 hours after the temperature starts to fall a further function test to specification. Tests to be repeated during second cycle.
 - vii. Laboratory ambient conditions.
 - viii. None.
 - ix. Visual inspection and function test to specification within 4 hours.

3.5 Driving Rain Test

- i. The test conditions shall be in accordance with IEC 68-2-18 Method Rb 2.2.
- ii. Information required for paragraph 5.3.8 of that document:
 - a. Minutes/m² for a minimum of 15 minutes.
 - b. No preconditioning of seals.
 - c. Visual inspection and function test to specification.
 - d. Table V1: a = 60°. B = 60°C. duration = 10 minutes.
 - e. Table V2: diameter = 0.40mm. water flow = 0.10 + 0.005 dm³/min. supply pressure = 80 kpa.
- iii. Equipment functioning throughout the test to be verified by testing.
- iv. Any ingress of water shall be reported to the Employer's Representative, the equipment shall be visually inspected and function tested to Specification.

04 Electrical Tests

4.1 Supply Variations

Measurements of equipment performance and maximum VA consumption shall be made, for supply voltage and frequency variations in all possible combinations of upper limit, normal and lower limit as detailed in the Specification. Throughout these tests, the equipment shall function in accordance with the Specification.

4.2 Supply Interruptions

- i. The supply input to the equipment under test shall be interrupted for periods of 10 ms.

- ii. The tests shall be performed ten times at random for ac supplies and three times at random for dc supplies.
- iii. The equipment shall be capable of withstanding these interruptions of supply input without damage, interruption or resetting by the operator and shall continue to function and operate correctly in accordance with the Specification.

4.3 High Frequency Disturbance Test

- i. The High Frequency Disturbance test is required to determine whether an item of equipment will continue to operate correctly when specified high frequency transients, representative of practical system conditions, are applied to the fully operating equipment.
- ii. The test to be applied is based on IEC 255-4, Appendix E.
- iii. This test shall be performed for all equipment required to operate in environments subject to Electrical Interference Class 2 or 3 (refer to Table 8-3) and shall be applied to the AC power supply terminals of that equipment.
- iv. Waveform: a damped oscillatory wave with the envelope decaying to 50% of peak value at the end of three to six cycles.
 - a. Frequency: 1 MHz tolerance + 10%.
 - b. Source impedance: 200 ohm tolerance + 10%.
 - c. Repetition rate: the test wave is applied to the equipment under test at a repetition rate of 400 per second.
 - d. Duration of test: 2 s tolerance + 10% 0% (see Sub-clause E5.2.7 of IEC 255-4, Appendix E).
 - e. Standard value of test voltage: Refer to Table 8-3.
 - f. Test voltage tolerance: +0 -10%.
- v. The test voltage levels are the voltages at the output of the test circuit before the equipment to be tested is connected to the test circuit terminals.
- vi. The test leads shall not be longer than 2 m.
- vii. The disturbance test shall be applied to the AC supply terminals of the equipment under test in series mode (refer to Sub clause 2.1.3).
- viii. The tests shall be carried out with the equipment operating under nominal supply conditions.
- ix. The equipment shall function in accordance with the Specification throughout the test.

4.4 Radio Frequency Interference

- i. Portable radio communication transmitters are a common source of radio frequency interference when they are operated in close proximity to equipment. A field strength of 10 V/m shall be assumed to be present in the VHF and UHF bands.

- ii. These field strengths are approximately those expected at a distance of 35 cm from a 5 watt hand portable radiotelephone. These fields can induce currents of the order of 100 mA into cables, screens and metalwork.
- iii. Other possible sources are low level radiation from adjacent equipment including fluorescent lamps and signals from powerful but more distant radio, television and radar transmitters.
- iv. The test to be applied is based on IEC 801-3 over a frequency range of 27 MHz to 500 MHz. The Severity Level (Chapter 5) to be applied shall be as follows:
- v. The Contractor shall state to what field strength the equipment is immune, and include as an option the cost of testing to 10 V/m. The equipment functionality and performance shall not be degraded during or after the RFI test.
- vi. With regard to RTUs and tele-protection equipment, the command outputs shall be immune to mal-operation with the cubicle doors open when the equipment is subjected to the radiated field strengths mentioned above.

4.5 Electrical Stress Impulse Voltage Withstand

- i. The Impulse Voltage Withstand test is designed to demonstrate that the equipment has been correctly designed to withstand, without damage, the electrical stresses to which it might be subjected in practice.
- ii. The test to be applied is based upon IEC 255-4, Appendix E.
- iii. This test shall be performed for all equipment required to operate in environments subject to Electrical Interference Class 2 or 3 (refer to Table 8-3) and shall be applied as follows:
 - a. To all AC power supply input and output terminals of all equipment.
 - b. To all signal input/output, communication interface and DC power supply terminals of RTU and tele-protection equipment.
 - c. For the withstand test, the impulse voltage is a periodic transient voltage without appreciable oscillations (see IEC Publication 60, High-voltage Test Techniques).
- iv. Impulse waveform: This shall be the standard 1.2/50 impulse specified in IEC Publication 60 and having the following tolerances:
 - a. Voltage rise time: + 30%.
 - b. Voltage falls time: + 20%.
 - c. Source impedance: 500 ohm tolerance + 10%.
 - d. Source energy: 0.5 J tolerance + 10%.
 - e. Standard value of test voltage: Refer to Table 3.
 - f. Test voltage tolerance: +0 -10%.
- v. The test voltage levels are the voltages at the output of the test circuit before the equipment to be tested is connected to the test circuit terminals.
- vi. The test leads shall not be longer than 2m.

- vii. Three positive and three negative impulses shall be applied at intervals of not less than 5s. Both common mode and series mode tests shall be performed (refer to Sub-clause 2.1.3).
- viii. After the above tests, the equipment shall be visually inspected and function tested to check compliance with the Specification.

4.6 Insulation Resistance (Across Isolating Barrier) Test

- i. Where a barrier is used to provide isolation from external circuits, its insulation resistance shall be measured.
- ii. If the barrier is required to withstand high voltage stresses, then it shall be stressed at the specified voltage to demonstrate its withstand capability and a further insulation resistance test shall be made to ascertain that it has not been significantly degraded as a result of the stress being applied.
- iii. The insulation of all circuits that include contacts of switches, relays or contractors for isolation functions shall be tested for insulation resistance, R1. R1 shall not be less than 20 mega ohm when measured at 500 V dc.
- iv. For switches, relays and contractors, 500 V is to be applied between:
 - a. The opposite ends of each circuit with contacts in open position.
 - b. Both ends of each circuit to earth with contacts in closed position.
- v. For circuits intended for connection to 100 V ac or dc and above, 2 kV RMS shall be applied for one minute and this shall be followed by a further test for insulation resistance, R2.
- vi. Stress to be applied between:
 - a. The individual circuits of this type.
 - b. Each circuit of this type and all other circuits including earth. These other circuits can be strapped together electrically for the purpose of this test.
- vii. Final insulation resistance shall be such that either:
 - a. $R2 > 20 \text{ megohm}$, or
 - b. $R2/R1 > 0.7$.
- viii. For circuits intended to provide isolation against large differences in earth potential, the barrier shall, after the initial resistance measurement, be stressed to the design voltage and this shall be followed by a further insulation resistance test.

* End of Appendix 5 *

APPENDIX 6

5 REQUEST FOR INSPECTION OF WORKS FORM

JAIPUR METRO RAIL CORPORATION

CONTRACTOR**REQUEST FOR INSPECTION OF WORKS**

To the _____ Date _____
 Employer's
 Representative
 * Location) Will be ready for your inspection
) on
 * Description of Works) at _____ prior to
)
 3.6 3.7
) on _____ at _____ hrs
 * Labour and plant to be used

Signed _____ for Contractor. Received by
 for Employer's
 Representative date 4.
 time
 5. 6. 7.

Filled in by Engineer Mr _____ Please arrange inspection
 Mr _____ Please check setting out
 Signed _____

Filled in by Inspector The above work was inspected and permission was given / not given to
 proceed with next operation.
 * The following remedial works were required
 * Contractor informed verbally (to MR
 by Mr _____ on _____ at _____ hrs)
 9. 10.

* Remedial works inspected and permission given to proceed with next
 10.1 operation on _____ at _____ hrs)
 11.
 as supervised

11.1 11 11.3 11.4
 by

11.5 11
 Signed
 Date _____ Time _____
 12.

Verbal or written permission by the Employer's Representative or his staff shall in no way relieve the Contractor of his responsibilities under the Contract.

* To be completed if applicable.

* End of Appendix 6 *

Appendix 7
ENGINEER'S ACCOMMODATION FOR OFF SITE WORK

Clause 15.6 of GS

(not Used)

APPENDIX 8

FIRST AID REQUIREMENTS

1. Provisions by others

- (1) First aid bases will be located at the Contractor's principal Works Areas. The bases will consist of a treatment room fitted with two treatment couches, a hand wash basin, sterilising equipment and lockable cupboards to contain sufficient medical supplies for the Contractor's workforce, the Employer's Representative's site supervisory staff, the Designated Contractors working in the area and any visitors to the Site. The first aid post will be air-conditioned, with cooling capability sufficient to maintain the temperature of the inside of the building at 20°C.
- (2) A qualified doctor, nurse and assistant nurse will be in attendance at the first aid base during all times when work is being undertaken on the Site, including work by the Designated Contractors and periods when only emergency activities are being undertaken, such as during periods of inclement weather.
- (3) A fully equipped ambulance and driver will be provided at the first aid base during all working hours. The ambulance will be equipped with emergency life support equipment suitable for application in construction site accidents.

2. Provisions by the Contractor

- 2.1 The Contractor shall supply portable first aid boxes maintained fully equipped at each local site offices and any work locations where 20 or more persons work at a time.
- 2.2 In each site office and work location at least one of the Contractor's employees shall be trained in first aid and should be available at all working hours for purpose of attending to emergencies.
- 2.3 The Contractor shall be responsible for making his employees aware of the location and access route to the nearest first aid base and if necessary shall provide facilities for evacuating a workman by stretcher from the worksite.
- 2.4 The Contractor shall keep the first aid base personnel informed of the number and identity of staff working within the area of responsibility of each first aid base.

* End of Appendix 8 *

APPENDIX 9

WORKS AREAS

1. Works Areas

- (a) Temporary occupation of land is governed by Part VI of land acquisition Act 1894 which limits occupation to 3 years.
- (b) Deleted.
- (c) Deleted.
- (d) Deleted.
- (e) Prior to the Works Area Handover Dates for returning any Works Area, the Contractor shall carry out the following works:
 - (i) construct all Permanent Works within the area, to the extent defined in this Appendix, in accordance with the requirements of the Contract,
 - (ii) reinstate the area to the condition as close as possible to its condition when it was taken over,
 - (iii) form the area to the approved lines and levels and carry out such other works as may be required by the Employer's Representative,
 - (iv) remove all rubbish, debris and other materials.

* End of Appendix 9 *



**Procurement of Plant
Design, Supply and Installation
JAIPUR METRO RAIL CORPORATION LIMITED
BIDDING DOCUMENT
for
Procurement
of**

NCB No.-JP/EW/1B/E2

**DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION,
TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV
AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA
SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID
TRANSPORT SYSTEM PROJECT PHASE-1B**

PART-II REQUIREMENTS

Section 6 - Employer's Requirements (ERQ)

Volume – II Technical Specifications

JAIPUR METRO RAIL CORPORATION LTD.

**Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**

Section 6 - Employer's Requirements

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1. Scope of Supply of Plant and Services

(As per volume 2 of Section -6)

2. Specifications

(As per volume 2 of Section -6)

3. Drawings

(As per volume 3 of Section -6)

4. Supplementary Information

5. Certificates

5.1 Form of Completion Certificate

Contract: [. . . .insert name of contract and contract identification details. . . .]

Date:

Certificate No.:

To: [. . . .insert name and address of contractor. . . .]

Dear Ladies and/or Gentlemen,

Pursuant to GCC Clause 24 (Completion of the Facilities) of the General Conditions of the Contract entered into between yourselves and the Employer dated [. . . .insert date. . . .], relating to the [. . . .brief description of the Facilities], we hereby notify you that the following part(s) of the Facilities was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Employer hereby takes over the said part(s) of the Facilities, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the Facilities or part thereof: [. . . .description]
2. Date of Completion: [. . . .date]

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

[. . . .Signature]

Project Manager

5.2 Form of Operational Acceptance Certificate

Contract: [. . . .insert name of contract and contract identification details. . . .]

Date:

Certificate No.:

To: [. . . .insert name and address of contractor. . . .]

Pursuant to GCC Subclause 25.3 (Operational Acceptance) of the General Conditions of the Contract entered into between yourselves and the Employer dated [. . .date. . .], relating to the [. . .brief description of the facilities. . .], we hereby notify you that the Functional Guarantees of the following part(s) of the Facilities were satisfactorily attained on the date specified below.

1. Description of the Facilities or part thereof: [. . . description . . .]
2. Date of Operational Acceptance: [. . . date . . .]

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

[. . . .Signature]

Project Manager

6. Change Orders

6.1 Change Order Procedure

- 6.1.1 General
- 6.1.2 Change Order Log
- 6.1.3 References for Changes

6.2. Change Order Forms

- 6.2.1 Request for Change Proposal
- 6.2.2 Estimate for Change Proposal
- 6.2.3 Acceptance of Estimate
- 6.2.4 Change Proposal
- 6.2.5 Change Order
- 6.2.6 Pending Agreement Change Order
- 6.2.7 Application for Change Proposal

6.1. Change Order Procedure

6.1.1 General

This section provides samples of procedures and forms for implementing changes in the Facilities during the performance of the Contract in accordance with GCC Clause 39 (Change in the Facilities) of the General Conditions.

6.1.2 Change Order Log

The Contractor shall keep an up-to-date Change Order Log to show the current status of Requests for Change and Changes authorized or pending. Entries of the Changes in the Change Order Log shall be made to ensure that the log is up-to-date. The Contractor shall attach a copy of the current Change Order Log in the monthly progress report to be submitted to the Employer.

6.1.3 References for Changes

- (1) Request for Change as referred to in GCC Clause 39 shall be serially numbered CR-X-nnn.
- (2) Estimate for Change Proposal as referred to in GCC Clause 39 shall be serially numbered CN-X-nnn.
- (3) Acceptance of Estimate as referred to in GCC Clause 39 shall be serially numbered CA-X-nnn.
- (4) Change Proposal as referred to in GCC Clause 39 shall be serially numbered CP-X-nnn.
- (5) Change Order as referred to in GCC Clause 39 shall be serially numbered CO-X-nnn.

Note:

- (a) Requests for Change issued from the Employer's Home Office and the Site representatives of the Employer shall have the following respective references:

Home Office	CR-H-nnn
Site	CR-S-nnn

- (b) The above number "nnn" is the same for Request for Change, Estimate for Change Proposal, Acceptance of Estimate, Change Proposal and Change Order.

6.2 Change Order Forms

6.2.1 Request for Change Proposal Form

[*Employer's letterhead*]

To: [*Contractor's name and address*]

Date:

Attention: [*Name and title*]

Contract Name: [*Contract name*]

Contract Number: [*Contract number*]

Dear Ladies and/or Gentlemen:

With reference to the captioned Contract, you are requested to prepare and submit a Change Proposal for the Change noted below in accordance with the following instructions within [*number*] days of the date of this letter [or on or before (*date*)].

1. Title of Change: [*Title*]
2. Change Request No./Rev.: [*Number*]
3. Originator of Change:
Employer: [Name]
Contractor (by Application for Change Proposal No. [Number Refer to Annex 6.2.7])
4. Brief Description of Change: [*Description*]
5. Facilities and/or Item No. of equipment related to the requested Change: [*Description*]
6. Reference drawings and/or technical documents for the request of Change:

<i>Drawing No./Document No.</i>	<i>Description</i>
---------------------------------	--------------------
7. Detailed conditions or special requirements on the requested Change: [*Description*]
8. General Terms and Conditions:
 - (a) Please submit your estimate showing what effect the requested Change will have on the Contract Price.
 - (b) Your estimate shall include your claim for the additional time, if any, for completing the requested Change.
 - (c) If you have any opinion that is critical to the adoption of the requested Change in connection with the conformability to the other provisions of the Contract or the safety of the Plant or Facilities, please inform us in your proposal of revised provisions.
 - (d) Any increase or decrease in the work of the Contractor relating to the services of its personnel shall be calculated.
 - (e) You shall not proceed with the execution of the work for the requested Change until we have accepted and confirmed the amount and nature in writing.

[*Employer's name*]

[*Signature*]

[*Name of signatory*]

[*Title of signatory*]

6.2.2 Estimate for Change Proposal Form

[Contractor's letterhead]

To: [Employer's name and address]

Date:

Attention: [Name and title]

Contract Name: [Contract name]

Contract Number: [Contract number]

Dear Ladies and/or Gentlemen:

With reference to your Request for Change Proposal, we are pleased to notify you of the approximate cost to prepare the below-referenced Change Proposal in accordance with GCC Sub clause 39.2.1 of the General Conditions. We acknowledge that your agreement to the cost of preparing the Change Proposal, in accordance with GCC Sub clause 39.2.2, is required before estimating the cost for change work.

1. Title of Change: [Title]
2. Change Request No./Rev.: [Number]
3. Brief Description of Change: [Description]
4. Scheduled Impact of Change: [Description]
5. Cost for Preparation of Change Proposal: [insert costs, which shall be in the currencies of the contract]

(a)	Engineering	(Amount)
(i)	Engineer _____ hours (hrs) x _____ rate/hr =	_____
(ii)	Draftsperson _____ hrs x _____ rate/hr =	_____
	Sub-total _____ hrs	_____
	Total Engineering Cost	_____
(b)	Other Cost	_____
	Total Cost (a) + (b)	_____

[Contractor's name]

[Signature]

[Name of signatory]

[Title of signatory]

6.2.3 Acceptance of Estimate Form

[*Employer's letterhead*]

To: [*Contractor's name and address*]

Date:

Attention: [*Name and title*]

Contract Name: [*Contract name*]

Contract Number: [*Contract number*]

Dear Ladies and/or Gentlemen:

We hereby accept your Estimate for Change Proposal and agree that you should proceed with the preparation of the Change Proposal.

1. Title of Change: [*Title*]
2. Change Request No./Rev.: [*Request number/revision*]
3. Estimate for Change Proposal No./Rev.: [*Proposal number/revision*]
4. Acceptance of Estimate No./Rev.: [*Estimate number/revision*]
5. Brief Description of Change: [*Description*]
6. Other Terms and Conditions: In the event that we decide not to order the Change accepted, you shall be entitled to compensation for the cost of preparing the Change Proposal described in your Estimate for Change Proposal mentioned in para. 3 above in accordance with GCC Clause 39 of the General Conditions.

[*Employer's name*]

[*Signature*]

[*Name of signatory*]

[*Title of signatory*]

6.2.4 Change Proposal Form

[Contractor's letterhead]

To: [Employer's name and address]

Date:

Attention: [Name and title]

Contract Name: [Contract name]

Contract Number: [Contract number]

Dear Ladies and/or Gentlemen:

In response to your Request for Change Proposal No. [Number], we hereby submit our proposal as follows:

1. Title of Change: [Name]
2. Change Proposal No./Rev.: [Proposal number / revision]
3. Originator of Change: Employer: [Name] / Contractor: [Name]
4. Brief Description of Change: [Description]
5. Reasons for Change: [Reason]
6. Facilities and/or Item No. of Equipment related to the requested Change: [Facilities]
7. Reference drawings and/or technical documents for the requested Change:
[Drawing/Document No./Description]
8. Estimate of increase/decrease to the Contract Price resulting from the Change Proposal:

Amount

[insert amounts in the currencies of the Contract]

(a)	Direct material		
(b)	Major construction equipment		
(c)	Direct field labour (Total	hrs)	
(d)	Subcontracts		
(e)	Indirect material and labour		
(f)	Site supervision		
(g)	Head office technical staff salaries		
	Process engineer	_____ hrs @ _____ rate/hr	_____
	Project engineer	_____ hrs @ _____ rate/hr	_____
	Equipment engineer	_____ hrs @ _____ rate/hr	_____
	Procurement	_____ hrs @ _____ rate/hr	_____
	Draftsperson	_____ hrs @ _____ rate/hr	_____
	Total	_____ hrs	_____

- (h) Extraordinary costs (computer, travel, etc.) _____
- (i) Fee for general administration, % of Items _____
- (j) Taxes and customs duties _____
- Total lump sum cost of Change Proposal [Sum of items (a) to (j)]
- Cost to prepare Estimate for Change Proposal [Amount payable if Change is not accepted]

9. Additional time for Completion required due to Change Proposal
10. Effect on the Functional Guarantees
11. Effect on the other terms and conditions of the Contract
12. Validity of this Proposal: within [Number] days after receipt of this Proposal by the Employer
13. Other terms and conditions of this Change Proposal:
- (a) You are requested to notify us of your acceptance, comments or rejection of this detailed Change Proposal within [Number] days from your receipt of this Proposal.
- (b) The amount of any increase and/or decrease shall be taken into account in the adjustment of the Contract Price.
- (c) Contractor's cost for preparation of this Change Proposal: [. . . insert amount. This cost shall be reimbursed by the employer in case of employer's withdrawal or rejection of this Change Proposal without default of the contractor in accordance with GCC Clause 39 of the General Conditions . . .]

[Contractor's name]

[Signature]

[Name of signatory]

[Title of signatory]

6.2.5 Change Order Form

[*Employer's letterhead*]

To: [*Contractor's name and address*]

Date:

Attention: [*Name and title*]

Contract Name: [*Contract name*]

Contract Number: [*Contract number*]

Dear Ladies and/or Gentlemen:

We approve the Change Order for the work specified in the Change Proposal (No. [*number*]), and agree to adjust the Contract Price, Time for Completion, and/or other conditions of the Contract in accordance with GCC Clause 39 of the General Conditions.

1. Title of Change: [*Name*]
2. Change Request No./Rev.: [*Request number / revision*]
3. Change Order No./Rev.: [*Order number / revision*]
4. Originator of Change: Employer: [*Name*] / Contractor: [*Name*]
5. Authorized Price:
 Ref. No.: [*Number*] Date: [*Date*]
 Foreign currency portion [*Amount*] plus Local currency portion [*Amount*]
6. Adjustment of Time for Completion
 None Increase [*Number*] days Decrease [*Number*] days
7. Other effects, if any

Authorized by: _____
 Employer

Date: _____

Accepted by: _____
 Contractor

Date: _____

6.2.6 Pending Agreement Change Order Form

[*Employer's letterhead*]

To: [*Contractor's name and address*]

Date:

Attention: [*Name and title*]

Contract Name: [*Contract name*]

Contract Number: [*Contract number*]

Dear Ladies and/or Gentlemen:

We instruct you to carry out the work in the Change Order detailed below in accordance with GCC Clause 39 of the General Conditions.

1. Title of Change: [*Name*]
2. Employer's Request for Change Proposal No./Rev.: [*number/revision*] dated: [*date*]
3. Contractor's Change Proposal No./Rev.: [*number / revision*] dated: [*date*]
4. Brief Description of Change: [*Description*]
5. Facilities and/or Item No. of equipment related to the requested Change: [*Facilities*]
6. Reference Drawings and/or technical documents for the requested Change:
[*Drawing / Document No. / Description*]
7. Adjustment of Time for Completion:
8. Other change in the Contract terms:
9. Other terms and conditions:

[*Employer's name*]

[*Signature*]

[*Name of signatory*]

[*Title of signatory*]

6.2.7 Application for Change Proposal Form

[Contractor's letterhead]

To: [Employer's name and address]

Date:

Attention: [Name and title]

Contract Name: [Contract name]

Contract Number: [Contract number]

Dear Ladies and/or Gentlemen:

We hereby propose that the work mentioned below be treated as a Change in the Facilities.

1. Title of Change: [Name]
2. Application for Change Proposal No./Rev.: [Number / revision] dated: [Date]
3. Brief Description of Change: [Description]
4. Reasons for Change:
5. Order of Magnitude Estimation (amount in the currencies of the Contract): [Amount]
6. Scheduled Impact of Change:
7. Effect on Functional Guarantees, if any:
8. Appendix:

[Contractor's name]

[Signature]

[Name of signatory]

[Title of signatory]

7. Personnel Requirements

Using Form PER-1 and PER-2 in Section 4 (Bidding Forms), the Bidder must demonstrate that it has personnel who meet the following requirements:

Sr. No	SECTOR	QUALIFICATION	EXPERIENCE LEVEL	NUMBERS
1.	Chief Project Manager (Team Leader)	Graduate in electrical/mechanical engineering.	minimum 3 years as in-charge of similar works and minimum total experience of 15 years	1
2.	Chief Coordinator (Dy. Chief Project Manager)	Graduate in electrical/mechanical engineering.	having 2 year metro experience and minimum total experience of 10 years	2 (1 EACH FOR ROCS/ASS WORKS)
3	Design Engineers			
a.	ROCS Design Engineers	Graduate in concerned disciplines	10 years experience out of which 3 years in the underground metro rocs system design	1
b.	ASS Design Engineers		10 year's experience out of which 3 years in the underground metro ass system design	1
c.	SCADA Design Engineers		10 years experience out of which 3 years in traction SCADA system design.	1
4	Quality Assurance Specialist	Graduate in electrical/mechanical engineering.	10 years experience out of which 3 years in construction related activity.	1
5	Installation Engineer (ROCS)	* 1 team comprising of all necessary engineering and technical staff and supportive staff		
6	Installation Engineer (ASS)	*1 team comprising of all necessary engineering and technical staff and supportive staff		
7	Installation Engineer (SCADA)	*1 team comprising of all necessary engineering and technical staff and supportive staff		
8	Safety Staff	As per SHE Manual		

In case JMRC judges that the continuation of any person of the bidder including its subcontractor (s) is not in the interest of the project, a written notice will be given to the bidder who will promptly remove the person within a week. JMRC can withdraw the approval of such persons if continuation of the person is judged by the JMRC.

NOTE – Please submit the CV of above Key Personals (up to resident engineers) in the format prescribed in PER-2.

STAMP & SIGNATURE OF AUTHORIZED SIGNATORY

8. Equipment Requirements

Using Form EQU in Section 4 (Bidding Forms), the Bidder must demonstrate that it has the key equipment listed below:

No.	Equipment Type and Characteristics	Minimum Number Required
1	Bidder to specify the available machineries, tools, plants and testing equipments that will be available by them during execution of the works.	
2		
3		
4		
5		

9. Schedule of Key Dates

All number refer to weeks from Commencement Dates of the works

(A) Key dates for– Rigid OHE (ROCS) Works

Key Dates	Description	Key Date in Weeks Chand pole to Badi Chaupar Corridors
KD-1	Preliminary Design Submission	12
KD-2	Definitive Design Submission	18
KD-3	Submission of Preliminary Simulation Study	16
KD-4	Submission of Final Simulation Study	22
KD-5	Submission of Earthing and Bonding scheme along with detailed drawings based upon Simulation study.	26
KD-6	Submission of Detail Engineering and Submittal of Technical proposals of major equipment/vendors to Engineer for Approval along with technical parameters.	18
KD-7	Delivery of major material at Site e.g. Contact wire, Aluminum Rail, insulator, bracket, Section insulator, Tunnel Earth Wire, GIS Interrupters/ Circuit Breakers, Return Conductor, Earth Wire, SCADA Equipment etc	38
KD-8	Installation of Rigid Catenaries System in tunnel sections, Neutral sections and completion of Earthing & bonding	42
KD-9	Installation of all equipment at SP (Sectioning Post) and Sub Sectioning Post as per the Cost Centers	43
KD-10	Testing and Commissioning of Rigid Catenaries System (ROCS) in tunnel Sections and SP (Sectioning Post) and Sub Sectioning Post as per the Cost Centers	48
KD-11	Charging of the Sectioning Post & Rigid OCS (ROCS) for Trail Runs, Signaling & rolling stock testing.	52
KD-12	Submission of Report by Independent Agency for Verification (Auditing) of design and installation of ROCS.	54
KD-13	System Acceptance Test including Integrating Testing of Rigid OCS of Section and checking/ measuring parameters e.g. step and touch Voltage and Parameters obtained by Simulation Study.	58
KD-14	Taking-over Certificate	80

(B) Key dates for Auxiliary Substations (ASS) Works

Key Dates	Description	Key Date in Weeks Chand pole to Badi Chaupar Corridors
KD-1	Detail Engineering and Submittal of Technical proposals of major equipment to Engineer for Approval	12
KD-2	Submission of Working Drawings/ Shop Drawings	18
KD-3	Delivery of Major Equipment (33 KV panels, TR's, HT & LT cables, SCADA equipment etc) to Site	40
KD-4	Installation of Majority of ASS Equipment and commence system testing, SCADA testing.	46
KD-5	Commissioning of Auxiliary Sub Stations	50
KD-6	Charging of the Auxiliary power supply network for E&M supply extension and for Trail Runs, Signaling & rolling stock testing.	52
KD-7	Completion of acceptance test after integrated testing with SCADA System	58
KD-8	Taking over of the system	80

Note:

- a) All the key dates are from the date of commencement.
- b) For the part week, full week will be considered for this purpose.
- c) The site shall be made available progressively and if some part is not made available then the extension of time shall be allowed only to the work/KD of that particular part.

10. Statements of Deviations

Chapter Number	Clause Number	Details of Deviations	Remarks explaining reasons for deviations and why it may be considered by the employer	Confirming that price of withdrawal of each deviation/s is given in Financial Package (Yes/No)

1. We hereby confirm that the pricing for unconditional withdrawal of the above deviations has been given in the financial bid.
2. We hereby confirm that all implicit and explicit deviations, comments and remarks mentioned elsewhere in our proposal shall be treated as NULL and VOID and stand withdrawn.
3. We hereby confirm that but for the deviations noted in this, our offer is fully and truly compliant.

STAMP & SIGNATURE OF AUTHORIZED SIGNATORY

Note:

Where there is no deviation, the statement should be returned duly signed with an endorsement indicating 'No Deviations'. In case, Performa of deviations is not submitted or submitted as blank, it will be construed that the bidder has not proposed any deviations from bid documents and will provide all equipment as per specifications.

Pricing of Unqualified Withdrawal of
Conditions, Qualifications, Deviations, etc

(To be submitted with financial bid only)

Item	Condition, Qualification, Deviation, etc	Key date affected by each condition, qualification, deviation, etc.	Increase or Decrease for unqualified withdrawal of each conditions, qualification, deviation etc	
			<u>Foreign Currency</u>	<u>Indian Rupees</u>
Total				

Note: In completing this appendix, the Bidder shall show every key date that will be affected by each condition, qualification, deviation, etc., included in his Financial Package for the unqualified withdrawal of that condition, qualification, deviation, etc.

1. We hereby confirm that the pricing for unconditional withdrawal of the above deviations has been given in the financial bid.
2. We hereby confirm that all implicit and explicit deviations, comments and remarks mentioned elsewhere in our proposal shall be treated as NULL and VOID and stand withdrawn.
3. We hereby confirm that but for the deviations noted in this Statement of Deviation our offer is fully and truly compliant.

STAMP & SIGNATURE OF AUTHORIZED SIGNATORY

11. Electrical Contractor License

(To be enclosed for Bidder or the Licensed Electrical Contractor)

12. Outline Quality Plan

1. Bidder shall submit an Outline Quality Plan illustrating the intended means of compliance with of the Employer's Requirements and setting out in summary form an adequate basis for the development of the more detailed document required as per SCC. The Outline Quality Plan shall contain sufficient information to demonstrate clearly the proposed method of achieving the Bidder's quality objectives with regard to the Employer's Requirements.
2. Bidder shall establish and maintain a Quality Assurance System in design and construction procedures and the interfaces between them. This Quality Assurance system shall be applied without prejudice to, or without in any way limiting, any Quality Assurance Systems that the Bidder already maintains.
3. The Bidder shall submit as part of his Bid an Outline Quality Plan which shall contain sufficient information to demonstrate clearly the Bidder's proposals for achieving effective and efficient Quality Assurance System. The Outline Quality Plan should include an outline of the procedures and regulations to be developed and the mechanism by which they will be implemented for ensuring Quality as required.
4. Bidder may be requested by the Employer to amplify, explain or develop its Outline Quality Plan prior to the date of acceptance of its Bid and to provide more detail with a view to reaching provisional acceptance of such a plan.

13. Outline Safety, Health and Environment (SHE) Plan

1. Bidder shall submit with its Bid an Outline Safety, Health and Environment Plan which shall contain sufficient information to demonstrate clearly the Bidder's proposals for achieving effective and efficient safety, health & environment procedures. The Outline Safety, Health and Environment Plan should include an outline of the safety procedures and regulations to be developed and the mechanism by which they will be implemented for ensuring safety as required by the Employer's Requirements.
2. The Outline Safety, Health and Environment Plan shall be headed with a formal statement of policy in relation to safety, health & environment and shall be sufficiently informative to define the Bidder's safety plans and set out in summary an adequate basis for the development of the Site Safety, Health and Environment Plan to be submitted in accordance with the Employer's Requirements.
3. Bidder may be requested by the Employer in writing to amplify, explain or develop its Outline Safety, Health and Environment Plan prior to the date of acceptance of the Bid and to provide more details with a view to reaching provisional acceptance of such a plan.

14. Detail of foreign currency

(Bidder should submit the details regarding the type of foreign currency used in the Bill of Quantities with the technical proposal)

S.No.	Name of Currency	Remarks
1		
2		
3		

15. PROPOSAL FOR EQUIPMENT / SYSTEMS

Sl. No.	Name of the equipment/system	Minimum Number required	Name of vendor	Address of the vendor	Contact Details
1	25 kV Rigid OCS with all its components, fittings and fixtures				
2.	25kV cable straight joints				
3.	25kV cable termination kits				
4	Transition element				
5.	Contact Wire				
6.	Rigid OHE fittings				
7	27.5 kV GIS				
8	Measuring & Protection equipment.				
9	Batteries				
10	Insulators				
11	Lightning Arresters				
12	Circuit breakers/ Interrupters (33kV/25kV)				
13	Measuring & Protection equipments.				
14	XLPE/ FRLS Cables (33kV/ 25kV/ LT Cables/ Control Cables) and XLPE LSOH Cables				
15	Motorized Isolators.				
16	Manual Isolators.				
17	Auxiliary Transformer (33 kV/0.415 kV)				
18	UPS				
19	SCADA equipment.				
20	SCADA system				

CHAPTER 1

Introduction & Project Overview

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1. INTRODUCTION

The Jaipur Metro Rail Corporation (JMRC) has successfully completed the following Metro Lines, under Phase I.

1.1 Phase I A

Line 1 : Mansarovar - Chand pole

This line consists of 1 underground station –chandpole and elevated stations. The OCC of the line is situated at depot- mansrovar.

2. PHASE-IB PROJECT

2.1 Corridors Covered

The Phase-1B Project comprises the following Corridors Chand pole to Badi chaupar

2.2 Revenue Operation Dates (ROD)

However, the alignment of above Corridors, number of stations and ROD may change during design and construction stage.

3. SCOPE AND PURPOSE

3.1 Purpose of this Document

This Specification defines the objectives, guidelines and requirements for Supply, Installation, testing and commissioning of Auxiliary Substations and SCADA interface for the Chand Pole to Badi chaupar underground Section of Jaipur Metro Rail Corporation (JMRC), collectively referred to as JP/EW/1B/E2

The works to be executed under the Contract include manufacture, verification of design, transfer of technology, delivery, installation, testing, including integrated testing and commissioning, technical support, supervision of maintenance, training of Employer's staff and documentation for a complete System necessary to deliver the requirements of this Specification.

3.2 Relevant Documents

This Specification should be read in conjunction with the General Conditions of Contract (GCC), the Special Conditions of Contract (SCC), the General Specification (GS), the Employer's Drawings and any other document forming part of the Contract.

In the event of a conflict between the GS and this Specification, this Specification shall prevail.

In the event of a conflict between this Specification and any other standards or specification quoted herein, the requirements of this Specification shall prevail.

The order of precedence, with item a) having the highest priority, is:

- a) Technical Specification
- b) General Specification
- c) Indian Railway Standards

- d) Indian Standards
- e) International Standards referenced herein.
- f) Other International Standards
- g) Other National Standards.

Notwithstanding the precedence specified, the Contractor shall always immediately seek advice from the Employer in the event of conflicts between Specifications.

3.3 Verification of Design

Although responsibility for the design service of the Works lies with the DMRC wherever applicable, the JP/EW/1B/E2 Contractor shall thoroughly satisfy himself that the tentative capacities, ratings and quantities of equipment as specified herein meet the operational requirements.

Taking into account the technical and other data contained in the Bid document, the Bidder shall verify the ratings, quantities of equipment etc as specified herein and if the Bidder considers any additional equipment, equipment of higher capacities and higher ratings for the systems and sub-systems or any other additions necessary for the complete, safe and reliable operable power supply system, he shall include such items in his bid, as additional items, providing all clarifications and justifications for the same.

4. OVERVIEW OF PROJECT

4.1 Phase I B Corridors

As stated in 2.1 above, the Phase 1B Project of JMRC comprises the following Corridors

4.2 Not used

4.3 Power Supply for Phase IB Corridors

4.3.1 Receiving Substations

Under Normal conditions, electric power to the above Corridors is supplied by the following Receiving Substations, hereinafter referred to as RSS.

s.no	RSS	
1	Mansarovar	
2	Shindi camp	

4.3.2 Traction & Auxiliary Supplies

At the JMRC Receiving Substations, the Incoming High Voltage Supply will be stepped down

- to 27.5 kV, single phase and will be fed to the traction overhead equipment, through a Traction Substation (TSS), located in the same premises as the RSS.

- to 33kV, three phase and will be fed to the 33 kV Auxiliary Network and the Auxiliary Substations, to meet the Auxiliary power demand at stations and en-route, through an Auxiliary Main Substation (AMS), located in the same premises as the RSS.

CHAPTER 2

Scope of Work

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1. GENERAL

A general description of the broad scope of work, relating to works covered in this Tender, is given below. It shall, however, be clearly understood that the description is for the purpose of general guidance only and is not exclusive. For complete appreciation of the Scope, the Specifications, Bills of Quantities along with their Explanatory notes, Drawings and other relevant paragraphs of the Tender documents shall be referred to.

1.1 Items of work

The following items of work are within the Scope of this Tender:

- a) Supply and Erection of 33 kV Insulated cables in Underground & adjoining stations of Underground in tunnel/ and at other places as detailed in subsequent paragraphs.
- b) Supply and Erection of 33 kV / 415 V Auxiliary Transformers and associated Switchgear and Equipment in all ASS's, in Underground Stations.
- c) Modification works, as required, at the relevant already erected installations.
- d) All Testing, integrated testing, and Commissioning of all erected equipment.
- e) Contractor will be required to provide SCADA system according to latest standards and specifications. The design of the SCADA should be prepared and submitted to Engineer in charge for approval. All the equipments, cables, connectors, links, connections, interface devices etc required for the successful operation of the underground SCADA system has to be provided by the ROCS contractor. The price of the SCADA system is included in the ASS works BOQ of this document.
- f) To enable implementation of SCADA system for the Rigid OCS and Switching Posts ROCS contractor has to make all necessary interface. The SCADA system proposed may be compatible/ integrated with the existing SCADA system of Jaipur 1A, all the details of existing system has to be arranged by the contractor (ROCS contractor to note that at present operating section of Jaipur phase-1A ABB SCADA system is provided). The entire local works and connectivity upto Operational control centre has to be maintained by ROCS contractor. Suitable OFC Communication cable/ link between all Rigid OCS, and TSS equipments shall be provided by JP/EW/1B/E2 contractor.

1.2 Corridors Covered by this Tender

This Tender covers the relevant works in the Underground Sections of the chand pole to Badi Chaupar.

2. SCOPE

2.1 General

In general, JP/EW/IB/E2 Contractor is responsible for all works relating to 33 kV Power Distribution Network and Auxiliary Substations & SCADA in the various Corridors, except for certain items of work which are specifically excluded from the JP/EW/1B/E2 Contractor's Scope and which would be carried out by other Contractors/Agencies.

2.2 JP/EW/IB/E2 Contractor's Scope

S.NO	NAME OF CORRIDOR	SCOPE
1	UNDERGROUND CHAND POLE TO BADI CHAUPAR	33 KV CABLE NETWORK AND ASS & SCADA INTEGERATION
	MODIFICATION WORKS	AS PER REQUIREMENTS

2.2.1 Auxiliary Main Substations (AMS)

JP/EW/1B/E2 Contractor's Scope of Work.

2.2.2 Auxiliary Substations (ASS)

2.2.2.1 *The following works shall form part of this Tender:*

Supply, erection, testing and commissioning of all equipments at all Underground ASS's, including, but not limited to,

- 33 kV / 415 V transformers
- 33 kV Switchgear
- 33 kV and Control Cables
- 33 kV Cables inside the ASS
- All control cables required for ASS
- All LT cables reuquired for interconnection of equipments etc in the ASS (excluding those required for connection from 415V side of Auxiliary Transformer)
- All measuring and protective devices
- Batteries and battery chargers
- Cable paths and earthing

- SCADA work of ASS as well as underground traction (ROCS) for the sections.
- Safety equipment and all other items required for successful and satisfactory working of the ASS, at all ASS's.

2.2.2.1.1 Tentatively, the following list shows the number of ASS's in the corridor

Sr. No.	Line Ref.	Name of Corridor	ASS's		Remarks
			Elevated	Underground	
1	Line-	Chand pole to Badi chaupar	--	2	

(Documents and Manuals :- The contractor shall have to supply, in English language, all the following drawings and documents according to the time table defined below which may be modified according to the contractual planning of the equipment supply.

2.3 Two months after the order

- One short bill of quantities for the supplies, with the precise limits of each interfaces.
- one overall planning of the stations execution
- for all high, medium and low voltage equipment:
 - final overall dimensions drawings
 - handling drawings
 - detailed installation drawings
- civil engineering and outfitting guide drawings
- detailed construction timetable, precisely defining the various equipment construction stages
- a list of general purpose apparatuses so as to reduce as much as possible, the different types required

Under no circumstance may the various detail modifications required for perfecting of the installations and requested within 1 month after supply of the drawings entitle the manufacturer to delay the delivery or to ask for a price increase of his supply.

2.4 Four months after the order

For all high, medium and low voltage equipment

- final schematic diagram

For the whole equipment of the OCC room, a detailed study defining:

- the layout of the part of the room under its responsibility
- the dimensions, colours and perspectives views of the console
- The appearance of the mimic panel with the monitoring devices
- The dimensions of the desk.

2.5 Six months after the order

- the wiring diagrams for the whole installations, including the schematic diagrams and the execution diagrams of the grounding circuits and of the interlocking
- the general assembly and operating manuals for the whole equipment
- a general guide for preventive maintenance of the various pieces of equipment
- a complete list of sub-contractors

The selection of these suppliers is at the manufacturer discretion and entirely under his responsibility. No approval that may have been given to him, in this respect, might release him from any of his responsibilities.

2.6 Nine months after the order

For the ASS in its final form

- the complete list of the auxiliary apparatuses
- the general maintenance guide
- the station descriptive manual
- the station manoeuvring manual

2.7 Three months before in-plant acceptance of the first equipment

- detailed set of the high, medium and low voltage equipment and of the power transformer drawings, in their final form:
- overall dimensions
- handling
- schematic and wiring diagrams

- detailed drawings of each auxiliary
- electrical and mechanical interlocking diagrams
- detailed part list

The manufacturer shall have to supply an absolutely complete list of the apparatus component parts with their referencing and their drawing number so as to enable setting-up the supplies and spare store general listing (in form of computerised list). The manufacturer shall supply the relevant catalogues and subscription to the updating for each part of these catalogues.

- detailed operating manuals of all accessories, auxiliaries and special tooling
- detailed manuals of preventive maintenance specific to each apparatus
- a recapitulative note specifying the transportation modes, the various handling methods and the storage precautions

If the manufacturer deems it necessary to carry out additional modifications after supply of the documents and data required above, he shall notify this as soon as possible and request approval.

This shall in no event be a justification for extension of the construction time he must comply with in all cases.

2.8 One month after in-plant acceptance tests of each piece of equipment

The manufacturer shall deliver the related detailed certificate and the detailed test report.

2.9 One month after putting into service

All documents whose updating will have been required so as to bring them in accordance with the actual works executed on the site and during testing and commissioning of the stations shall have to be supplied to the Employer for updating their documentary files

The manufacturer shall be responsible for the production of the documentary files. The structure of these files shall be defined at the beginning of the study; a systematically updated and re-issued table of contents shall be produced and included with each supply or additional documents.

The manufacturer shall have to supply entirely all the various files including folders, insets filing boxes, etc.

The manufacturer shall have to define, for each apparatus, the required maintenance operations: lubrications, checking or replacement of wear parts, etc. and shall indicate the following for each of these apparatus:

- the frequency
- the process: locking, drainage, pre-disassembly, etc.
- the special tooling required
- the personnel qualification and quantity requirements
- the approximate duration

2.10 As Built Drawings

The contractor shall prepare the as built and other drawings defined as:

- As built drawing depicting the completed works that have been certified as complete.
- Shop drawings containing information related to the permanent works.
- Working drawings containing information related to the temporary works depicting the construction of permanent works.

2.11 Electronic Drawing Format

All the drawings shall be prepared in AUTOCAD 2015 or the latest which shall be compatible with window 2007/2008.

3. SUMMARY

The work to be performed shall include but not be limited to:

- Providing the required 25 kV/ 33KV cable path from TSS to Feed FP's / ASS in Underground Sections, 25 kV cable bracket, ETS cable bracket, TEW brackets in the tunnel etc.
- Supply and installation of a duplicate 33 kV Auxiliary Power Network, in Underground portions and in specified elevated/ramp sections, continuous to Underground Secitons,
- Supply, installation, testing and commissioning of 33kV/415-Volt Auxiliary Substations, in Underground Stations,
- Provision of all the construction drawings, documents, and as-built drawings required to supply, install, test and commission the above installations.
- Supply of spare parts, tools and equipment for Power Supply;
- Deal and resolve in co-ordination with the employer/Employer's Engineer the Interface with other Contractors to ensure timely completion of the Works;
- Ensure Technology Transfer and Training to Employer's staff.

Note the entire installations shall :

- be realised to withstand the atmospheric pollution and ambient conditions furnished in General specifications relevant to the location where installed;
- meet the protective provisions relating to electrical safety;
- meet design requirements of fire safety in accordance with NFPA-130 Standard for Fixed Guide-Way Transit System, 1997 edition, except where amended by this TS.
- Meet the design requirements of Electromagnetic Compatibility in accordance the EN standard 50121-1 to 5 and EN 61000 series.
- Meet the Project Safety and Environment requirements as per "SHE manual".

CHAPTER 3

Interfaces

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1. INTRODUCTION

1.1 OBJECTIVE

The design and construction of the Jaipur Metro Railway, is a complex multidisciplinary project, **requiring close interaction and co-ordination between the various designers and builders**. The objective of the "Interfacing document" is to define as clearly as possible the Scope of Work of different Agencies, so that the problems which could arise during the Execution Stage are greatly minimized, if not eliminated. Notwithstanding the above, it is imperative that the JP/EW/1B/E2 Contractor shall maintain a close Interface with the other concerned Contractors and Design Consultants, so that the problems faced at site, if any, are **communicated through 'Interface requests' and discussed in periodical 'Interface meetings'**, to arrive at logical and expeditious solutions, to ensure smooth progress of physical works and realization of the scheduled dates of completion of works.

1.2 INTERFACING REQUIREMENTS

The following is an indicative list of the Contractors/Consultants/Agencies with whom the concern Contractor shall essentially interface. The List is not, however, exclusive and the JP/EW/1B/E2 Contractor shall ensure that any site problem, as and when it arises, is clearly and conclusively discussed with the appropriate Agency and solutions arrived at.

- Design and Build Contractors of Tunnel / Box-Section / Ra
- Station Building Contractors for Underground Stations (SBC),
- E & M Contractors for Underground Stations (E&M),
- Detailed Design Consultants (DDC)
- Track Contractor, Signalling Contractor and Telecom Contractor

2. INTERFACE WITH DESIGN & BUILD CONTRACTORS OF TUNNEL / BOX SECTION / RAMP (TBR), MIDSHAFT

2.1 GENERAL

The term TBR collectively refers to the Design & Build Contractors of Bored Tunnel Sections, Cut-and-cover sections and the Ramp Sections connecting the Underground Sections with the Elevated Sections.

The Line 1 which extends from Chand pole to Badi Chaupar has the following features on the alignment.

The following sections are Underground (in Tunnels/Box Section)

- **From Chand pole to Badi Chaupar about 2.525 km.**

2.2 ITEMS OF INTERFACE

The JE 01 Contractor is required to interface with the TBR Contractors, essentially for the following works:

- Auxiliary Substations in Mid-Shaft & U/G stations.

- Providing earthing connection
- Provision of opening in slabs etc for cable/equipment entry and cable/equipment exit
- Cable support/path for Power and Control cables in tunnels/Box Section/Ramp.

2.3 INTERFACE REQUIREMENTS

The Interface requirements are described in Table 2.3.

Table 2.3**Interfacing Requirements with Design & Build Contractors of Tunnel/Box Section/Ramp (TBR)**

Item No.	Item Description	JP/EW/1B/E2	TBR	Remarks
1.	Auxiliary Substations	<p>DDC will provide ASS layout drawings showing equipment layout etc.</p> <p>Civil JP/EW/1B/E2 will provide necessary foundations for transformers, panels other equipment etc. Alternatively, the Traction can provide suitably designed anchor-fasteners to fix transformers, 33kV panels, Battery chargers etc to the basic floor/pedestal.</p>	SBC/TBR will provide ASS room complete in all respects, including flooring, lighting, ventilation, power sockets, access doors, rolling shutters, windows, ventilators and interior finish, but excluding foundations for transformer and panels. SBC will provide the necessary cut-outs for cables entry and exit	
2.	Providing earthing connections	JP/EW/1B/E2 will provide necessary interconnections between earth terminals/riser terminals and earth conductors as shown in the Earthing connection drawings.	Will provide necessary earth terminals, earth mesh etc. and risers and respect the schematic earthing drawing, will ensure provision of minimum of 50mm dia pipe-5 Nos. on each platform under the floor for continuity of earthing of platform shelter/ canopy.	
3.	Provision of openings in slabs etc. for	DDC will provide drawings showing the locations and sizes of openings to be provided in slabs etc. to allow passage of cables.	Will provide openings as per drawing.	

Item No.	Item Description	JP/EW/1B/E2	TBR	Remarks
	cable/equipment entry and cable/equipment exit.	JP/EW/1B/E2 will supply and install cable supports inside the ASS Room.		
		JP/EW/1B/E2 will interface to ensure correct and adequate cable routings, openings etc.		
4	Cable support/path for power and control cables in tunnel/Box Section/Ramp	JP/EW/1B/E2 will interface with the TBR to ensure correct and adequate cable routing, openings etc	TBR will provide cable paths/supports along the cable route, outside the ASS room, in accordance with cable route drawing. The construction should take into consideration cable bending radius (specified in the drawing), cable fastening arrangements and suitable provision to cover the cables in public places.	

3. INTERFACE WITH STATION BUILDING CONTRACTORS FOR UNDERGROUND STATIONS (SBC)

The following list indicates the various Underground Stations in Line Chand Pole to Badi Chaupar

Sr. No.	Name of Station	Approx Centre Line of Station (Km)
1	Choti Chaupar	9.418
2	Badi Chaupar	10.271

3.1 ITEMS OF INTERFACE

Different Consultants / Contractors are assigned for design and construction of the various stations, collectively referred to as Station Building Contractor (SBC). The JP/EW/1B/E2 Contractor shall interface with the various Consultants / Contractors, mainly for the following works:

- Providing earthing connections
- Auxiliary Substations
- Provision of openings in slabs etc. for cable entry and cable exit.
- Provision of cable paths/supports for power and control cables in stations.

3.2 INTERFACE REQUIREMENTS

The Interface requirements are described in Table 4.3.

Table 4.3**Interfacing Requirement with Station Building Contractor (SBC)**

Item No.	Item Description	DDC/JP/EW/1B/E2 Contractor	Station Building contractor (SBC)	Remarks
1.	Providing earthing connections	JP/EW/1B/E2 will provide Earthing connection drawings for Auxiliary Substation, showing locations of earth terminals, etc required at the ASS.		
		JP/EW/1B/E2 will provide necessary interconnections between earth terminals/riser terminals and earth conductors as shown in the Earthing connection drawings.		
2.	Auxiliary Substations	DDC will provide ASS layout drawings showing equipment layout etc.	SBC will provide ASS room complete in all respects, including flooring, lighting, ventilation, power sockets, access doors, rolling shutters, windows, ventilators and interior finish, but excluding foundations for transformer and panels. SBC will provide the necessary cut-outs for cables entry and exit	
		JP/EW/1B/E2 will provide necessary foundations for transformers, panels other equipment etc. Alternatively, the JE 01 can provide suitably designed anchor-fasteners to fix transformers, 33kV panels, Battery chargers etc to the basic floor/pedestal.		
3.	Provision of openings in slabs etc. for cable entry	DDC will provide drawings showing the locations and sizes of openings to be provided in slabs etc. to allow passage of 33 kV power cables and control cables.	Will prepare cable route drawing. Will provide openings as per	

Item No.	Item Description	DDC/JP/EW/1B/E2 Contractor	Station Building contractor (SBC)	Remarks
	and cable exit.	JP/EW/1B/E2 will supply and install cable supports inside the ASS Room.	drawing.	
4	Cable supports/paths for power and control cables in Underground stations	JP/EW/1B/E2 will interface with Station Building Contractor to ensure correct and adequate cable routings, openings etc.	SBC will provide the necessary cable supports along the cable route, outside the ASS room, in accordance with cable route drawing. The construction should take into consideration cable bending radius (specified in the drawing), cable fastening arrangements and suitable provision to cover the cables in public places.	

3.3 ITEMS OF INTERFACE

The JP/EW/1B/E2 Contractor shall interface with the various Consultants / Contractors at these stations, mainly for the following works:

- Terminating the 33 kV Auxiliary Network Power cables in the ASS at Stations

3.4 INTERFACE REQUIREMENTS

The Interface requirements are described in Table 5.3.

Table 5.3**Interfacing Requirement with Station Building Contractor (SBC)**

Item No.	Item Description	DDC	Station Building contractor (SBC)	Remarks
1.	Provision of openings in slabs etc. for cable entry and cable exit, for the ASS.	DDC will provide drawings showing the locations and sizes of openings to be provided in slabs etc. to allow passage of 33 kV power cables and control cables.	Will prepare cable route drawing. Will provide openings as per drawing.	
2	Terminating the 33 kV Auxiliary Network Power Cables in the ASS	DDC will provide ASS Layout drawing showing Equipment Layout etc. JP/EW/1B/E2 will do the necessary jointing/termination of 33 kV cables on the appropriate Switchgear.	Will supply and install the 33 kV Switchgear in the ASS's.	

4. INTERFACING WITH E&M CONTRACTORS IN UNDERGROUND STATIONS (E&M) & ECS**4.1 GENERAL**

Different Consultants / Contractors are assigned for the design and construction of various E&M facilities, including lighting, pumps, escalators, elevators, D.G. sets etc in the stations. These Consultants / Contractors are collectively referred to as E&M/ECS. The JP/EW/1B/E2 Contractor is responsible for supply and erection of various equipments in the Auxiliary Substations at the stations to step down the 33 kV Auxiliary power to 415 V AC and supply to the Station Auxiliaries. JP/EW/1B/E2 shall interface with E&M for various items of work.

4.2 ITEMS OF INTERFACE

The mains items of Interface are

- Supply and erection of Low Voltage Switch Board (LVSB)
- Connection between Secondary of Auxiliary Transformer and the LVSB
- Low Voltage Protection
- Auxiliary Transformer Differential Protection

- Transformer door interlock
- Lighting and Ventilation in ASS
- Earthing in ASS
- Ventilation/cooling requirements if any.

4.3 INTERFACE REQUIREMENTS

The Interface requirements are described in Table 6.3.

Table 6.3

Interfacing with E & M Contractors in Stations (E&M)

Item No.	Item Description	JP/EW/1B/E2 Contractor	E & M / ECS Contractors (E&M)/ECS	Remarks
1	Supply and erection of Low Voltage Switch Board (LVSB)		LVSB will be supplied and erected by E&M	
2	Connection between Secondary of Auxiliary Transformer and the LVSB	JP/EW/1B/E2 shall ensure that facilities are available on the Transformer Secondary to receive cable or bus duct (Bus ducts will be used for transformers 1000 kVA and above)	Supply, erection and Connection by Bus duct or by cables will be done by E&M. Any interlinks, extension parts bus bars etc has to be provided by E&M on the secondary of transformer.	
3	Low Voltage Protection	JP/EW/1B/E2 shall ensure that the 415 V Breakers on the LVSB are provided with necessary protection relays to isolate faults on the LV side. JP/EW/1B/E2 shall also ensure that the tripping of 415 V Breakers shall also cause tripping of the corresponding HV breaker of the transformer, by inter-tripping.	E&M shall provide the necessary protection relays on the 415 V Breakers and provide inter-tripping facilities (The HV Breaker will be provided by the JP/EW/1B/E2)	
4	Auxiliary Transformer Differential Protection	JP/EW/1B/E2 will provide the necessary Differential protection relays, along with matching CT's for both HV. JP/EW/1B/E2 contractor will interface with the LT contractor and provide the requirements & specifications of the LT CT. JP/EW/1B/E2 will do the necessary control cable connections between HV and LV side.	E&M will supply & mount the relays and CT appropriately on the LV side. The connections of this LT CT are to be brought out at TB to be further taken for protection purposes.	

Item No.	Item Description	JP/EW/1B/E2 Contractor	E & M / ECS Contractors (E&M)/ECS	Remarks
5	Transformer door interlock	Wiring and interlock for transformer enclosure door will be provided by JP/EW/1B/E2		
6	Lighting and Ventilation in ASS	JP/EW/1B/E2 will advise to the E&M any special requirements or preferred location of lights, fans and exhaust fans.	E&M/ECS will provide Lighting and Ventilation arrangements.	
7	Earthing in ASS	JP/EW/1B/E2 will run an Earth Bus inside the ASS with suitable GI/copper flats. Various non-current-carrying metallic objects will be connected to the Earth Bus, by the JP/EW/1B/E2. Connection between Earth Bus and MET's will be done by JP/EW/1B/E2	E&M will provide an Earth Mesh for the Station and provide risers to the ASS. E&M will provide at least 4 Main Earth Terminals (MET's) in the ASS, in addition to a separate independent Met for SCADA equipment in the ASS. Interconnection between ASS Earth and the Station Earth will be provided by the E&M.	
8	Ventilation in ASS	JP/EW/1B/E2 will advise to ECS any special requirements or preferred, fans and exhaust fans, Cooling.	ECS will provide Ventilation arrangements.	
9	Cable support/path for power and control cables in tunnel/Box Section/Ramp	JP/EW/1B/E2 will interface with the TBR to ensure correct and adequate cable routing, openings etc	E&M will provide cable paths/supports along the cable route, outside the ASS room, in accordance with cable route drawing.	

CHAPTER 4

Testing and Commissioning

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1. TESTING

This Chapter describes the testing & commissioning relating to the Auxiliary Substations and 33 kV Auxiliary Network, in conformity with the requirements of international standards and Railway practices. Testing constitutes an essential obligation to satisfy the Railway System.

1.1 TESTING CONDITIONS AND EQUIPMENT ACCEPTANCE

The contractor will have to carry out all the tests and checks required guaranteeing the Employer of the good construction and the satisfactory operation of all power supply installation.

Also the contractor shall co-ordinate & arranges testing equipment etc required for testing facilities.

The various high, medium and low voltage equipment will be subjected to all the tests required under equipment test sheets, (lists are not exhaustive) as per the relevant IEC or other standards mentioned in the technical & performance specification of each equipment or otherwise.

It is reminded that the contractor is totally entrusted with full responsibility of assembly and installation of all pieces of equipment mentioned in this specification, with supplying the maintenance equipment and the special tooling which shall be delivered as soon as equipment installation will be completed and with the various duties he is bound to regarding witnessing of tests at commissioning and supervision after energising.

1.1.1 Documents related to the tests

The contractor shall draft and submit to the Employer approval of "the testing lists", which he will have to supply in their final form one month before in-plant acceptance of the equipment.

These lists shall be extremely detailed and include for each piece of equipment:

- The list of the in-plant tests,
- The operating mode (testing procedure) describing how to proceed to perform properly the test,
- The testing book indicating the expected result of the various tests and provision to indicate the obtained result during the test and to record all observations.

For the on-site tests, the contractor will have to draft a bilingual testing lists which will include, for each testing stage and for each piece of equipment the list of all the operations to be carried out and the precise mentions, for each of these, of the interventions to be executed, of the references required for proper identification of the equipment (testing procedure) and of the results which can be expected from these tests with provision to indicate the obtained result during the test and to record all observations (testing book).

The contractor will have to supply the various certificates and the relevant computation sheets, at the latest one month after the tests.

1.2 TESTING CONDITIONS

The Employer will appoint representative who will be in charge of supervising the design, the manufacturing and the assembling of the equipment in the contractor's workshops.

They will be empowered to halt the proceeding of any assembly work, which would not be in accordance with the stipulations, and to have replaced every part damaged during assembly or transportation.

They will witness the in-plant tests.

All delays which could arise from additional tests from modifications required due to defects will not be able to be used by the contractor to justify price increase or time extensions.

Each piece of equipment will be subjected to two successive tests: in the plant and on the site after assembly.

These tests will be carried out by the contractor, under his responsibility and in the presence of the Employer and of the consulting engineer.

Each of these tests will be subjected to a certificate. Provisional acceptance will be granted only after execution of the both sets of tests.

NOTE: For type tests, the contractor can provide test reports performed according to the corresponding IEC standard, on similar equipment of same capacity and design.

1.2.1 In-plant testing

In plant testing concern type and routine tests

- Type tests are tests performed on one or two of a equipment series
- Routine test are tests performed on each equipment

These tests will enable checking the quality of the equipment and its compliance with the specifications.

Once the Equipment have passed the in-plant acceptance tests, it shall be delivered and installed under the contractor responsibility.

Concerning some type tests, test certificates issued by recognized agencies will be able to be supplied if the contractor cannot carry out these tests himself and if the test certificates are related to a similar equipment of same capacity and design.

However, the tests of checking the operation of isolators and earth isolators will have to be performed as routine test.

The final factory tests will be carried out on the fully assembled equipment as specified. Thereafter, if required and permitted by the technical features of the equipment, the equipment may be dis-assembled for transportation purposes. The dis-assembly should not, however, cause any deterioration of the technical performance of the equipment. In respect of certain routine tests, it may be necessary to repeat the tests at more than one stage, and the Contractor should ensure that this is done, as required by the Employer's representative. The fact that certain tests had to be carried out on the equipment and/or any part, at more than

one stage, cannot be claimed by the Contractor, as reason for any failure/sub-standard technical performances of the equipment.

1.2.2 After shipment and Preliminary tests

1.2.2.1 After shipment

It should be performed at this stage the tests verifying that any damage have taken place during transportation.

They should include, at least, the tests listed in the column "after shipment" of each concerned equipment test sheet

1.2.2.2 Preliminary tests

It should be performed at this stage the tests verifying that equipment have been installed and assembled correctly.

They should include, at least, the following:

- All test listed in the column "on site" of each equipment test sheet
- Conformity of the assembly and wiring with the contractor's drawings and instructions
- Sealing of all pipe junctions, and the tightness of bolts and connections;
- Proper function of each part of equipment, of each equipment and of sections
- Cleanliness of installations

2. COMMISSIONING

2.1 GENERAL

The Commissioning description, based on the following frame, will have to be defined by the contractor and submitted to the Employer.

Once the contractor will have completed the after shipment tests, and the various pieces of equipment installation, the assignment should include:

Station tests

Putting into service tests

After energising

The Employer and the consulting engineer will be empowered to ask for any additional testing they may deem necessary.

The contractor will have to supply the testing installations and measuring apparatuses required to this effect.

In accordance with the stipulations, provisional acceptance will then take place, followed by final acceptance at the end of the guarantee time.

2.2 STATION TESTS

The testing period shall mandatorily be included in the period of the works stated in the contract project

All putting into tests will be carried out in co-operation with the Employer or its representative.

It should be performed at this stage the tests verifying that the different sections are electrically and mechanically compatible.

They should include, at least, the following:

- Tests requiring several sections to operate at once,
- Internal and between sections operational and safety Interlocking tests,

2.3 PUTTING INTO SERVICE TESTS

It should be performed at this stage the tests verifying that the different equipment are acting correctly when energised.

2.4 INTEGRATED TESTING AND COMMISSIONING

The general testing having shown proper operation, an overall integrated test of the installations, should be performed, after the first 15 days of operation, during which the various actuation and operation situation (putting into service, normal actuation, failure tripping) will be simulated.

2.5 SPECIFIC TESTS

Once the installation of the various pieces of equipment will have been completed, and the common test performed, some equipment will require specific tests.

The list of this tests shall be included in the "On site testing" document, which the contractor will have to supply.

CHAPTER 5

Installation and Construction

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1. REQUIREMENTS

1.1 General Requirements

The Contractor shall comply with all Enactments in executing the Works, including but not limited to all statutory provisions on occupational health and safety.

The Contractor shall co-ordinate with Other Contractors in the execution of the Works.

The Contractor shall also co-operate with all Relevant Authorities in the execution of the Works.

The installation of all equipment shall be undertaken at all times by suitably trained and competent employees of the Contractor, to the satisfaction of the Employer's Representative.

Only appropriate tools, plant, equipment and vehicles shall be used.

Installation of all equipment shall be in accordance with the Construction and Installation Plan described in the GS.

Installation of all equipment shall conform to the best industry practices.

Precautions shall be undertaken to ensure the safety of personnel and equipment for all installation works.

The Contractor shall, prior to starting any installation and construction work, identify any possible hazards, and implement measures of eliminating and/or controlling such potential hazards, in line with safe working practices.

Further details on Site safety management are described in Conditions of Contract on Safety, Health and Environment.

The Contractor shall ensure that all areas of work are sufficiently illuminated for the works to be undertaken and that a safe system of work is employed for all activities.

The Contractor shall operate a robust system for the control of persons entering or working upon the site.

The system shall include as a minimum:

- register of all employees;
- personal identification, with photograph;
- levels of competency;
- date of expiry;
- date of issue;
- signature; and
- register of all visitors.

The Contractor shall co-operate, at all times, with the Employer's Representative and Other Contractors to ensure that the Site is protected from unauthorised admission, either wilfully or otherwise.

The Contractor shall make due provision for the safe access and egress to the Site of Works for its staff and subcontractors.

This access shall be maintained such that it is free of all hazards and is in a safe condition throughout the duration of the Works.

1.2 Specific Requirements

The installation and construction work pertaining to this Contract shall include, but not be limited to the following: -

- Finalisation of the Construction and Installation Programme;
- Survey on Site and review the technical requirements shown in this Specification and the Employer's Drawings;
- Production of the calculation sheets and installation drawings for Site installation;
- Production of specific site designs and drawings based on typical designs and drawings supplied;
- Installation in accordance with the finalised installation drawings;
- Co-ordination with Other Contractors;
- Submission of the installation reports and records;
- Testing and commissioning, as per finalised protocol and programme.
- Production of as built drawings, documents, calculation sheets, and records.

1.3 Construction and Installation Plan

The Contractor shall undertake installation work in stages as shown in the detailed installation programme. Installation, testing and commissioning of later stages shall not impact revenue operation of earlier stages.

As a minimum, the detailed Construction and Installation Plan shall include but not be limited to all the activities described in clause 1.1 of this TS and the relevant clause of the GS, installation details and methods of all activities, equipment and tools to be used for installation, safety issues, supervision, temporary land occupation needed and the vehicles to be used for installation.

1.3.1 Manual Handling

To facilitate handling of equipment during installation and maintenance thereafter, the Contractor shall closely co-ordinate and interface with station contractor, Via-ducts contractor, track contractor, depot Contract and Signalling & Telecommunications Contractor for installation of the material handling equipment as below:

- Travelling hoists and unloading jib cranes for traction substations.

- Any other handling arrangement in order to ensure smooth handling of ASS equipment, from point of receipt at site to the final point of installation

The work of installation of the hoists and jib cranes shall be closely co-ordinated with Viaduct and Station Building and track contractors who will have to design the structures, install the beams at appropriate locations and provide the hoists and jib cranes.

The entire material handling plan for movement of bulky item such as OHE Conductors, Steel and Concrete masts, 33 kV cables, 33 kV & 25 kV Switchgear and Transformer at Auxiliary Substations etc, shall be carefully planned.

1.4 Works Area

The Contractor will be given temporary work sites as stipulated in this Specification.

The Contractor shall comply with the requirements specified in the relevant Chapter of the GS in relation to the use of works sites allocated to the Contractor.

1.5 Temporary Works

The design of the Temporary Works shall be submitted to the Employer's Representative for review.

All Temporary Works shall be removed on completion of the Section, or as directed by the Employer's Representative.

All Temporary Works shall be clearly distinguishable from the Permanent Works.

1.6 Works Train

The Contractor shall provide for himself the required number of Work Trains for Construction. .

For the use of any Works Train, the Contractor shall ensure its safe loading, restraint against shifting while in motion and that the dimensions of materials and/or equipment carried shall not exceed the space constraints (Schedule of moving dimensions) and that no other track related installation will be damaged during its use.

The Contractor is advised to carefully consider the works train design so that the working platform have the flexibility to enable this train to pass the height restriction and yet be of sufficient height for safe and efficient installation of OHE when on site.

1.7 Site Supervision and Safety Issues

The Contractor shall set up a Site supervision system, which shall be part of the overall safety, system assurance and quality management system.

Details of Health and Safety requirements at Site are described in the relevant Chapter of the GS.

The Contractor shall adopt an appropriate quality management system throughout the entire Site installation period to ensure that the System performance requirements as specified in this TS are achieved.

The Contractor shall provide sufficient number of suitably experienced supervisors and skilled workers to ensure that the progress and quality of the work, both on Site and in the Contractor's workshops, are maintained to the satisfaction of the Employer's Representative.

Supervisors shall have a minimum of five years' previous experience in a supervisory capacity on similar projects and all the skilled workers including linesmen electricians fitters and craftsmen, shall have a minimum of two years' previous experience in installation of similar systems.

The Contractor's supervision system shall be responsible not only for the supervision of the concerned system installation but also for the supervision of the installation of the primary fixing system (mast foundation), the earth mats and systems, etc. The supervisors shall work on a full-time basis during the entire installation process.

The Contractor shall maintain a set of drawings at each project site which accurately reflect the current status of field changes. The Contractor shall obtain letter of no objection from the Employer's Representative for any such changes. The Contractor shall prepare final drawings showing the as built configuration. These drawings shall be developed in a logical format to facilitate routine system maintenance and troubleshooting. All drawings and details shall be endorsed by the Contractor.

The Employer's Representative reserves the right to undertake, at any time, checks on the proficiency of the Contractors staff, licensing and all associated documentation. Should any of the Contractors staff be found incompetent or unlicensed he shall be removed from the site until their Competency has been established.

1.8 Installation of Cables

The Contractor shall co-ordinate with the Civil Contractors wherever necessary, for the installation of cables in cable galleries, trenches, ducts, troughs, risers and other locations.

The cable system shall, during installation, be fully protected from mechanical damage and be generally accessible at all points for inspection along its entire route. Suitable cable markers shall be provided for covered cables upon completion of installation.

Should it prove necessary to cut any cable during installation, all cut ends shall be properly sealed.

The maximum pulling force of any cable during installation shall not exceed the design force of cables.

All cables shall be installed in the formed cable trenches, shafts, hangers, trays and brackets. The minimum recommended bending radius of the cables shall be adhered to during installation.

All materials used for termination, jointing and installation of cables in confined spaces shall have flame retardant, low smoke, halogen free characteristics.

1.9 Workmanship

All the installation shall be carried out according to the instructions shown in this Specification and Employer's Drawings.

All assemblies of equipment and their components and parts shall be completely interchangeable if they are of similar type

The style and procedure of the workmanship shall be consistent throughout the Works.

Unless otherwise specified, the Employer's Representative shall decide the final colours for all paint work and other finishes to be applied to any part of the Works.

All parts, which are subject to, wear or damage by dust shall be completely enclosed in dust proof housings.

2. PROGRAMME REQUIREMENT

2.1 GENERAL

The expected date of commencement of commercial services, hereinafter referred to as Revenue Operation Date (ROD), for the various Sections/Corridors have been given in clause A1 of ITT.

Accordingly, the Power Supply works in the Section, shall be ready for commissioning at least 6 months before the specified ROD.

In addition to the requirements specified in the General Specification, the Contractor shall programme the Works in accordance with a pre-determined sequence to meet various Key Dates and Access Dates so as to meet the Target Dates of commercial opening.

2.2 CHANGE IN KEY DATES (KD) AND ACCESS DATES (AD)

The bidders attention is invited to the various Key Dates and Access Dates, described in the subsequent paragraphs. It is essential that the Contractor shall achieve the identified work by the specified Key Date mentioned against it, failing which Liquidated Damages shall become leviable as set out in the Contract.

The Employer will, on his part, make all efforts to provide to the Contractor access to information as well as to various locations at stations/track/viaduct, in stages, in order to plan/execute his activities for time-bound completion of his obligations under the Contract, as per the Access Dates mentioned in the subsequent paragraphs. If, however, due to any reasons, the Employer is not in a position to provide access or shared access, as per the stated Access Dates, the Employer, in these circumstances, will inform the Contractor, in writing, about the proposed revised Access Date, at least 8 weeks before the scheduled Access Date. The Contractor shall suitably make necessary changes in his Work Program and shall ensure that, irrespective of the revised Access Dates, the concerned Key Dates are adhered to.

- 2.2.1** a) Work will be done under power block during day or night as required due to operational requirement or train trials or as per circumstances.
- b) Various sections of main line are generally planned to be commissioned in different stages as defined under respective key dates. These sections on main lines / depots may further be split up into additional stages. Contractor shall take into account such situations & schedule his work activities accordingly Contractor shall not have any extra claim on such accounts.

2.3 KEY DATES

The work includes a number of stages. These stages, which are inter-related with, and essential to the completion of the supply, Installation testing and commissioning of power supply, power distribution and Auxiliary Substations in the Section/Corridor, are to be achieved by the Key Dates.

The Key Dates indicated in the Schedule of Key Dates are mentioned in terms of the time period reckoned from the commencement of the works, and the deliverables for each Key Date shall be achieved by the midnight of the last day of the week mentioned.

If the identified work is not achieved by the stated Key Dates, liquidated damages may become applicable as set out in the Contract.

Description of each Key Date is as detailed below:

2.3.1 STAGE 1 – Key Date 1 to Key Date 6 (KD-1 to KD-6) : Commissioning & charging of ASS's

Achievement : Commissioning of Auxiliary Sub stations, after completing erection of all equipments at various ASSs, as per specifications in the GS and TS of this Tender, for achieving these Key Dates.

2.3.2 STAGE 2– Key Date 7 (KD 7): Completion of the acceptance test after integrating testing of SCADA.

Achievement: Completion of Integrated Testing, completion of all finishing works and carrying out service trials for satisfactory operation of the System.

2.3.3 STAGE 3– Key Date 8 (KD 8): Taking over of the system

Achievement: After completion of all works and satisfactory trial running of system. Supply of “As built” drawings and training and supply of manuals / documents as laid down in the Specifications, will also required to be completed in time including approval of the Commissioner of Metro Railway Safety.

2.4 ACCESS DATES

The JP/EW/1B/E2 Contractor will require access to information as well as to various locations at station/track/viaduct, etc., in stages, in order to plan his activities for time-bound completion of his obligations under the Contract.

The dates on which such access becomes available will be provided after award of the work and contractor shall update the work program to achieve the key dates.

Please refer [Section 9 - Contract Forms \(COF\)](#) for details of Key dates

CHAPTER 6

Maintenance & Training

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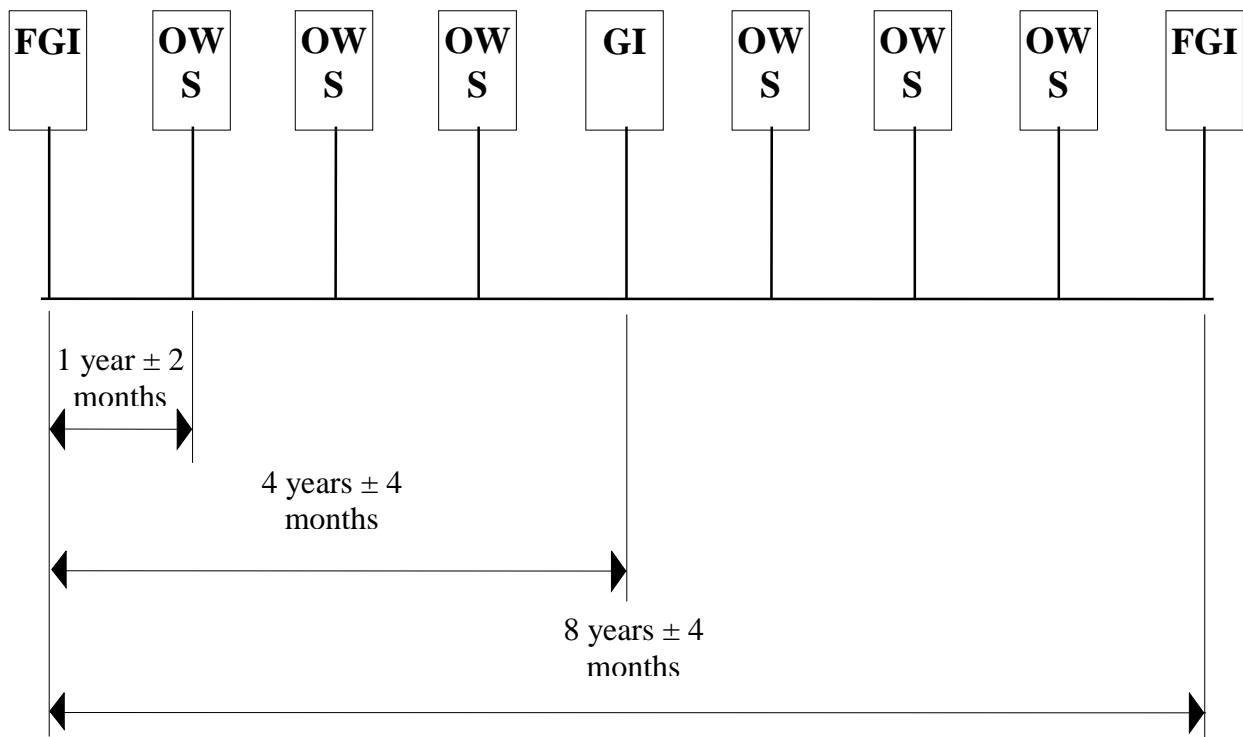
1. INTRODUCTION

This Chapter describes training of maintenance staff for power supply, control & monitoring installations taking into account international standards and Railway practices.

The Contractor shall provide comprehensive training and documentation to the employer's staff in accordance with the requirement of this chapter and the chapter of General Specifications.

This training shall enable all the installations, to be operated and maintained in the most efficient and safe manner, so as to achieve the maximum reliability and economy required by such Mass Rapid Transit System.

1.1 Preventive maintenance periodic inspections cycle



2. OPERATION AND MAINTENANCE DOCUMENTATION

2.1 General

The Contractor shall provide Operation and Maintenance manuals, for use by supervisory, operating and technical staff of Employer.

Requirements of submission have been furnished in the relevant Chapter of GS.

Each and every manual shall be divided into indexed sections explaining the subject matter in logical steps.

Most manuals shall consist of A4-size printed sheets bound in stiff-cover wear-resistant binders clearly and uniformly marked with the subject matter and reference number.

Where alternative sizes are proposed, (e.g. A5/A6 pocket books of schematic wiring diagrams) these shall be submitted for review of Employer' Representative.

The binding shall allow for all subsequent changes and additions to be readily effected.

Information shall be provided in pictorial form wherever possible and shall include step-by-step instructions and views of the particular equipment including exploded views.

Programmable equipment shall be supplied with sufficient flow charts and fully documented programmes to enable faults to be quickly identified and system modification to be undertaken at any time.

The Contractor shall provide clarifications and amendments to the Operation and Maintenance manuals as necessary during the Defects Liability Period. Updates shall be provided for the originals and all copies.

2.2 Operation Manuals

The Contractor shall provide operation manuals explaining the purpose and operation of the complete system together with its component subsidiary systems and individual item of equipment. The characteristics, ratings and any necessary operating limits of the Equipment and Sub-systems shall be provided. **The Operation Manuals shall focus on operation aspects under normal and emergency conditions.**

2.3 Maintenance Manuals

The Contractor particulars of operating parameters, tools for dismantling and testing, methods of assembly and disassembly, tolerances, repair techniques and all other information necessary to set up a repair and servicing programme.

The Contractor shall provide documentation for all hardware and software for computer systems and other associated electronic equipment to meet the following requirements.

Such documents shall include but not be limited to:

manufacturers' documentation supplied as standard with the equipment;

- hardware configuration with details of expansion capabilities and options;
- programme loading instructions, including runtime environment configuration;
- programme listing including comprehensive 'comment statements' in hard copy and soft format for source code, compilers and development tools necessary to modify and recompile software;
- flow charts, data flow diagrams and state diagrams as appropriate;
- description of software modules including purpose, linkage with other modules, error routines and any special considerations;
- memory maps for both internal and peripheral memory showing description of all programmes, data files, overlay areas, memory available for expansion and the like;

- loading and operating instructions for diagnostic programmes and specifically developed debugging tools; and
- programming manuals relevant to operating systems, languages, development tools, etc.

The manual shall also include inspection/overhaul procedure and periodicity of various inspection/overhaul schedules in detail including the tools, special tools/plants, and facilities required.

The manual shall be subject to review by the Employer's Representative.

The maintenance manual shall also include an illustrated parts catalogue of all plant supplied and shall contain sufficient information to identify and requisition the appropriate part by maintenance staff.

The catalogue shall comprise 3 sub-sections.

The first shall be an alphanumeric parts list, which shall include the following information:

Part number

- Description
- Name of manufacturer
- Quantity and Unit
- Part number of next higher assembly (usually a line replaceable unit).
- Cross-reference to figure number.
- Category : e.g. consumable, line replaceable unit, repairable.
- Life-expected life, Mean time between failure or mean distance between failure where available.
- General or specific purpose

The second is a series of illustrations to indicate the location of each replaceable item which shall be clear and progressive with exploded views to enable parts to be identified easily by cross-reference with the alpha-numeric list.

And the third an indicative price list which shall list in alpha-numeric sequence the part number with the price, lead time and vendor.

2.4 Quantity of Manuals

The Contractor shall supply Original plus five hard copies of Operating Manuals; Maintenance Manuals and Subsystems / Systems spare parts catalogue.

These Manuals and Catalogue shall also be submitted in electronic format (CD).

The format of the electronic copies shall be proven in at least two other applications and shall allow for links between parts catalogue and maintenance instructions.

The Documents Management System and Language used shall be subject to Employer's Representative's review.

3. TRAINING

3.1 General Requirements

The Contractor keeping the above aspect in view shall provide comprehensive training to the Employer's staff in accordance with the requirements contained in this TS and in the GS. A central training school has been planned for this purpose.

The training shall be carried out at such locations where the greatest benefit for trainees may be gained. This may be in India, abroad, at place of manufacture, assembly or testing, or at such other locations as may be necessary. All places of training shall be subject to review by Employer's Representative.

The training courses and/or sessions shall include system performance requirements and all major equipment and works designed, by the Contractor.

The specific objectives of each course, training facilities to be used, the qualification and experience of the training instructors and the assessment criteria shall be developed by the Contractor and submitted to the Employer's Representative for review at least three months before any course is conducted.

Manuals to be used for training, including the manuals to the instructors and trainees, shall be delivered to the Employer's Representative **at least six months before the issue of the Substantial Completion Certificate for the Works**, as required under the relevant Chapter of the GS. **The training manuals shall be submitted in original plus five hard copies and in electronic format (DVD).**

The Contractor shall provide full-time on-Site management and co-ordination of the entire training programme to ensure the continuity of classes, and proper distribution of training materials, and be responsible for interfacing with the instructors.

The training courses shall be delivered to all relevant Employer's staff, including instructors, operation and maintenance engineering staff.

The proposed training requirements are given at the end of this Chapter.

3.2 Mock-Up for Training

The Contractor shall install mock-up equipment for system and any such facility(s) considered necessary for the training of Employer's staff in the training school.

The training mock-up shall include but not limited to the following: -

Clear Cut Section drawings / photographs of various power supply equipments such as Circuit Breakers, Interrupters, Current Transformers, Potential Transformers, Lightning Arresters and Isolators.

- Cut Section drawings / photographs of HV & MV cables
- Cut Section drawings / photographs of Gas Insulated Switchgear
- Clear photographs of transformers, their windings, bushings etc.
- Samples of various clamps and fittings used

- Samples of various conductors used
- Clear drawings and photographs of Control panel, protection schemes, earthing and bonding arrangement;

The Contractor shall submit full details of the training span and other mock up equipment, photographs etc. including proposed training activities and objectives, for the Employer's review in accordance with clause 3.1 of this Specification.

3.3 Training Plan

The Contractor shall submit a Training Plan in accordance with the requirements of the General Specification. In addition, the Training Plan shall include the following:

- Details of the Contractor's ability to carry out the necessary training.
- Details of the proposed approach to structuring and providing the courses required.
- Course details including duration, maximum number of trainees, ratio of trainees to trainers, facilities required or available and prerequisites for attending the course.
- Recommendations for additional training or alternative means by which the Employer's training objectives may be met.

The Training Plan shall be submitted for review by the Employer's Representative and will be Implemented in a timeframe such that complete and comprehensive training has been received by the designated Employer's staff prior to the System Acceptance test.

3.3.1 Training of Employer's Training Instructors (ETI)

The objective of the training is to enable the Employer's Training Instructors to be competent to deliver future training courses for other employees of the Employer.

The Contractor shall provide training to the Employer's Training Instructors on the various Systems. Aspects covered shall include, but not be limited to, the following:

- Configuration of the entire System, including interface with the supply system at the feeding points;
- Feature and functional principles of the entire System;
- System design aspects including but not limited to design standards, design criteria and parameters, short-circuit and other calculations, insulation and protection co-ordination;
- Details of major equipment and material including but not limited to 25kV circuit breakers, interrupters, isolators, voltage and current transformers, Conductors, fittings, assemblies and protection relays, and cables of different types and their joints used in the System;
- Details of 33 kV Switchgear and protection;
- System operation and maintenance management and procedures;
- Earthing and bonding arrangement, covering safety aspects of touch and step potential, safety to personnel, passengers and outsiders.
- SCADA Integration.

3.3.2 Operations Staff Training

The objective of the training is to enable the Employer's operations staff to be familiar with the Systems, with focus on the operational aspects under normal and emergency conditions.

The training shall also enable the trainee to acquire full capability for identification, trouble shooting and rectification of faults in the specified duration. After classroom training which includes mock ups of equipment, the staff shall be trained in actual operation.

3.3.3 Maintenance Staff Training

The objective of the training is to enable the Employer's maintenance staff and Engineering staff to be familiar with the Systems focus on the maintenance aspects of the System including but not limited to the following:-

- Full understanding of all the equipment, sub-systems and system, their function, maintenance and overall requirements.
- Procedures to be followed for unscheduled maintenance and repair.
- Identification of failed components and sub-systems in electronic equipment by use of special test kit as necessary.
- Modification in the software to extend or modify the control, monitoring and protection functions.

3.4 Computer Based Training (CBT)

The Contractor shall submit, for the Employer's Representative's review, the following CBT information documents:

- Operation of the Auxiliary power Systems;
- Maintenance of Auxiliary power Systems;
- Operation Bay Controllers;
- Operation of Substation Automation System;

The CBT Information Document on Operation of individual System shall contain, but not be limited to, the following:

- General introduction of the System, its functionality and objectives (including the RAMS requirement);
- Single line diagrams;
- Description of the System operation principles, for both normal and emergency operation conditions;
- An overview on the System configuration, including interface with other agencies;
- General description of the functions of each key equipment and components of the System with photographs showing the appearance of each of them;
- Where they are located throughout the System;

- List of potential hazards that may arise in operating the System; and
- Any specific points to note in operating the System to ensure safety to personnel (the Employer's staff and members of the public) and equipment.
- Electric shock treatment.

The CBT Information Document on Maintenance of individual System shall contain, but not be limited to, the following:

- General description of the functions of key components of the System, with photographs showing the appearance of each of them;
- A general description of the proposed maintenance strategy of the System and major components;
- The maintenance plan and procedures proposed for the System and major components in accordance with the MMS;
- A general description of the 1st, 2nd 3rd and 4th maintenance activities (as described above) required for the System and major components;
- An introduction to the special tools and equipment required for maintaining the System and major components;
- A description of the symptoms of the common faults found on the System;
- Simulation of faults on the entire System, and how to promptly restore the system; and
- Other points to be noted in effectively maintaining the System.

3.5 Training Requirements

Man week of contractors training instructors for training employers Maintenance personal in INDIA

GIS and other switchgear	2
Cables & Transformers	2
Electrical safety & Earthing	2
SCADA Integration	1

Man week of contractors training instructors for training employers operating personal in INDIA

GIS and other switchgear	2
SCADA Integration	1

Man weeks of employers personnel's for Off-Shore training at Contractors works

GIS and other switchgear	Maintenance/Operation	2
	ETI	1
Transformer	Maintenance/Operation	2
	ETI	1

<p>CHAPTER 7</p> <p>Definition and Lists</p>
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1. DRAWINGS LIST**1.1 LINE-1 EXTENSION (CHAND POLE TO BADI CHAUPAR))**

Sr. No.	DRAWING No.	DESCRIPTION
	AUXILIARY NETWORK DRAWINGS	

2. MAIN APPLICABLE INTERNATIONAL STANDARDS

All equipment of the JP/EW/1B/E2 Contract shall comply with the EMC standards EN 50-121-1 to 5. Concerning the tests, when not defined into the EN 50121, the equipment shall comply with the relevant EMC standard of the series IEC 61000.

Standard Number	Title
IEC 38	IEC standard voltage
IEC 44-6	Instructions related to protection current transformer for transient state response
IEC 62271-100	High voltage circuit breaker for alternating current
IEC 59	IEC standard current
IEC 99-4	Metal oxide surge arrester without gaps for a.c. systems
IEC 62271-102	Alternating current disconnectors and earthing switches
IEC 383-1 & 2	Insulators and fittings for overhead lines. Insulators of ceramic material or glass for overhead line with nominal voltage higher than 1000 V. Requirements
IEC 60502	Power cables with extruded insulation and their accessories for rated voltage from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV). Part 2: rated voltages from 6 kV (Um = 7,2 kV) up to 30 kV (Um = 36 kV)
IEC 529	Degrees of protection provided by enclosures (IP code)
IEC 617-2	Graphical symbols for diagrams. Part 2: symbol elements, qualifying symbols and other symbols having general application.

Standard Number	Title
IEC 694	Common specifications for high-voltage switchgear and controlgear standards
IEC 721-3-4	Classification of environmental conditions- Classification of groups of environmental parameters and their severities- Stationary use at non weather 'protected locations.
IEE 802-3	
UIC 812-3	
IEC 840	Power cables with extruded insulation and their accessories for rated voltage above 30kV (Um = 36 kV) up to 100 kV. Test methods and requirements.
IEC 865	Earth mesh and earth procedure code
IEC 889	Hard-drawn aluminium wire for overhead line conductor
IEC 60071	Insulation co-ordination
IEC 60076	Power transformer
IEC 61000	Electromagnetic compatibility
IEC 61508-3	Functional safety of electrical/electronic/programmable safety-related systems. Part 3: software requirements

Standard Number	Title
EN 10025	Hot Rolled Products of Non-Alloy Structural Steels: Delivery Conditions
EN 10034	Structural Steel I and H Sections – Tolerances on Shape and Dimensions
EN 10055	Hot Rolled Steel Equal Flange Tees with Raduised Root and Toes – Dimensions and Tolerances on Shape and Dimensions
EN 10056	Structural Steel Equal and Unequal Leg Angles
EN 10083	Quenched and Tempered Steels
EN 10088	Stainless Steels
EN 1301	Aluminium and Aluminium Alloys
EN 50163	Supply Voltage of Traction System
EN 60811	Insulating and Sheathing Materials of Electric Cables
ENV 50121-5	Railway Application Electromagnetic Compatibility Part 5: Fixed Power Supply Installations
EURONORM 19	IPE Beams; I-Beams with Parallel Flange Facings and Steel Products – IPN Beams – Dimensions
IEC 60398	General Test for Electro-heating Equipment
IEC 1131	Programmable controllers
IEC 265.1	High Voltage Switch
IEC 502	Insulated and protected cables for power supply network
IEC 60 44-1	Current Transformers
IEC 60 44-2	Voltage Transformer
IEC 60137	Insulated Bushing for rated Voltage above 1 kV
IEC 60157	Low Voltage Switchgear Circuit Breakers

Standard Number	Title
IEC 60168	Tests on Indoor and Outdoor Post Insulators of Ceramic Material or Glass for Systems with Nominal Voltages greater than 1000 V
IEC 60228	Conductor of Insulated Cables
IEC 60273	Dimensions of Indoor and Outdoor Post Insulators and Post Insulator Units for Systems with Nominal Voltages greater than 1000 V
IEC 60296	Insulating oils for transformers
IEC 60297	Dimensions of mechanical structures of the 482.6 mm (19 in)
IEC 60372	Locking Devices for Ball and Socket Couplings of String Insulator Units – Dimensions and Tests
IEC 60376	Sulphur Hexafluoride
IEC 60383	Insulators for Overhead Lines with a nominal Voltage above 1000 V
IEC 60502	Power Cables from 1 kV to 30 kV
IEC 60591	Test for OHCS Ceramic or Glass Insulators above 1 kV
IEC 60591	Sampling Rules and Acceptance Criteria when applying Statistical Control Methods for Mechanical and Electromechanical Tests on Insulators of Ceramic Material or Glass for Overhead Lines with a Nominal Voltage greater than 1000 V
IEC 60721	Environmental conditions :Specifications for painting
IEC 622	Sealed Nickel-Cadmium prismatic rechargeable single cell.
IEC 801	Electromagnetic Compatibility for Industrial-process Measurement and Control IEC 870
ISO 1035	Hot Rolled Steel Bars
ISO 1190	Copper and Copper Alloys
ISO 1234	Split Pins

Standard Number	Title
ISO 1337	Wrought Coppers (having Minimum Copper Contents of 99,85%) – Chemical Composition and Forms of Wrought Products
ISO 1460	Metallic Coatings – Hot Dip Galvanised Coatings on Ferrous Materials – Gravimetric Determination of the Mass per Unit Area
ISO 1461	Metallic Coatings – Hot Dip Galvanised Coatings on Fabricated Ferrous Products – Requirements
ISO 2092	Light Metals and their Alloys – Code of Designation based on Chemical Symbols
ISO 2340	Clevis Pins without Head
ISO 2341	Clevis Pins with Head
ISO 261	ISO General Purpose Metric Screw Threads – General Plan
ISO 262	ISO General Purpose Metric Screw Threads – Selected Sizes for Screws, Bolts and Nuts
ISO 2859/1	Sampling Procedures for Inspection by Attributes – Sampling Plans Indexed by Acceptable Quality Level (AQL) for Lot-by-lot Inspection
ISO 3768	Metallic Coatings – Neutral Salt Spray Test (NSS Test)
ISO 4014	Hexagon Head Bolts – Product Grades A and B
ISO 4017	Hexagon Head Screw Bolts – Product Grades A and B
ISO 4032	Hexagon Nuts, Style 1 – Product Grades A and B
ISO 404	Steel and Steel Products – General Technical Delivery Requirements
ISO 657	Hot Rolled Steel Sections
ISO 68	ISO General Purpose Screw Threads – Basic Profile
ISO 8402	Quality Management and Quality Assurance – Vocabulary

Standard Number	Title
ISO 898	Mechanical Properties of Fasteners
ISO 9000	Quality Management and Quality Assurance Standards
ISO 9001	Quality Systems – Model for Quality Assurance in Design / Development, Production, Installation and Servicing
ISO 9002	Quality Systems – Model for Quality Assurance in Production and Installation
ISO 9003	Quality Systems – Model for Quality Assurance in Final Inspection and Test
ISO 9004	Quality Management and Quality System Elements
ISO 965	ISO General Purpose Metric Screw Threads
UIC 505-1	Railway Transport Stock – Rolling Stock Construction Gauge
UIC 505-4	Effects on the Application of the Kinematic Gauges defined in the 505 Series of Leaflets on the Positioning of Structures in relation to the Tracks and of the Tracks in relation to each other
UIC 606-1 OR	Consequences of the Application of the Kinematic Gauges defined by UIC Leaflets in the 505 Series on the Design of the Contact Lines
UIC 606-2 OR	Installation of 25 kV and 50 or 60 Hz Overhead Contact Lines
UIC 608 OR	Conditions to be complied with for the Pantographs of Tractive Units used on International Services
UIC 791 R	Quality Assurance of Overhead Line Equipment
UIC 811-1	Technical Specifications for the Supply of Axles and Trailing Stock
UIC 812-2	Solid Wheels for Tractive and Trailing Stock – Tolerances
UIC 870 O	Technical Specification for Grooved Contact Wires

Standard Number	Title
IEC 28	International specification of soft annealing type copper
IEC 99-2	Expulsion type lighting arresters
IEC 99-1	Non-linear resistor type gapped surge arresters for A.C. system
IEC 62271-200	Alternating current disconnectors and earthing switches
IEC 62271-100,102	GIS Switchgears
IEC 146-1-3	Semiconductor converters, general requirements and line commutated converters. Transformers and reactors
IEC 146-1-2	Semiconductor converters, general requirements and line commutated converters. Application guide
IEC 146-1-1	Semiconductor converters, general requirements and line commutated converters. Specifications of basic requirements.
IEC 196	IEC standard frequencies
IEC 228	Conductors of insulated cable
IEC 265-1	High voltage switches for rated voltage above 1 kV and less than 52 kV
IEC 296	New insulating mineral oil specification for transformers
IEC 298	A.C. metal enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 72,5 kV
IEC 502-2	Extruded solid dielectric insulated power cables and their accessories for rated voltage from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)
IEC 551	Determination of transformer and reactor sound level
IEC 622	Alkaline secondary cells and batteries- Sealed nickel-cadmium parallelepiped rechargeable single cells

Standard Number	Title
IEC 721-3-3	Classification of environmental conditions- Classification of groups of environmental parameters and their severity- Stationary use at weather protected locations.
IEC 726	Dry type power transformer

Standard Number	Title
IEC 1131	Programming languages – Programmable controllers– Part 3
IEC 1131	Programmable Logic Controllers
IEC 297-3	Dimensions of mechanical structures of the 482.6 mm (19 in) series
IEC 571	Electronic equipment specification
IEC 60870	Transmission Protocol
IEC 801-1	Electromagnetic compatibility for industrial-process measurement and control equipment – General introduction
IEC 801-2	Electromagnetic compatibility for industrial-process measurement and control equipment – Electrostatic discharge requirements
IEC 801-3	Electromagnetic compatibility for industrial-process measurement and control equipment – Radiated electromagnetic field requirements
IEC 801-4	Electromagnetic compatibility for industrial-process measurement and control equipment - Electrical for transient/burst requirements
IEC 801-5	Electromagnetic compatibility for industrial-process measurement and control equipment – Shock wave requirements
IEC 801-6	Electromagnetic compatibility for industrial-process measurement and control equipment – Immunities to disturbances conducted and induced by radio fields
IEC 848	Preparation of block diagrams for control systems

Standard Number	Title
IEC 870-1-1	Control equipment and systems – General principles
IEC 870-2-1	Control equipment and systems – Power supply and environment conditions
IEC 870-3	Control equipment and systems – Interfaces (electrical characteristics)
IEC 870-4	Control equipment and systems – Performance requirements
IEC 870-5	Control equipment and systems – Transmission protocol

3. DEFINITION OF ABBREVIATIONS

Abbreviations	Meaning
AC	Alternating Current
ACOCB	Alternating current outgoing circuit breaker
ACRC	Alternating current rectifier contactor
ACRCB	Alternating current rectifier circuit breaker
AMS	Auxiliary main sub Station
ASS	Auxiliary Sub Station
AT	Auxiliary transformer
ATCB	Auxiliary Transformer Circuit Breaker
ATIS	Auxiliary Transformer Isolator
B	Traction bus bar
BA	Batteries
BAIT	Batteries interrupter

Abbreviations	Meaning
C&C	Control & Communication
CAMS	Computer Aided Maintenance System
CB	Circuit Breaker
CCB	Coupling circuit breaker
CIS	Coupling Isolator
CTATP	Current Transformer for protection of Auxiliary Transformer
CTC	Current transformer for coupling
CTIM	Incoming Current Transformer for Measures
CT	Current transformer for traction transformer
CTTTP	Current Transformer for Protection of Traction Transformer
DC	Direct Current
DCAC	Direct current auxiliary contactor
DCACC	Direct current auxiliary coupling contactor
DCOCB	Direct current outgoing circuit breaker
DCRC	Direct current rectifier contactor
DTN	Data Transmission Network
TRANSCO	State Transmission Company
ECC	Energy Control Centre
EIS	Earthing Isolator
EMIS	Energy Management and Information System
GRC	General Remote Control
IED	Intelligent Electronic Device

Abbreviations	Meaning
IS	Isolator
IR	Indian Railways
IT	Interrupter
OCC	Operations Control Centre
ITC	Coupling interrupter
L	Hand operated traction isolator
LAAT	Surge arrester for Auxiliary Transformer
LAN	Local Area Network
LATT	Surge arrester for Traction Transformer
LBCB	Lighting bridge circuit breaker
LBCCB	Lighting bridge coupling circuit breaker
LBCCT	Lighting bridge coupling current transformer
LBCT	Lighting bridge current transformer
LBCVT	Lighting bridge coupling voltage transformer
LBEIS	Lighting bridge earthing isolator
LBVT	Lighting bridge voltage transformer
LEIS	Line Earthing Isolator
LFCB	Lighting feeder circuit breaker (spare)
LFEIS	Lighting feeder earthing isolator
LIS	Line Isolator
LV	Low Voltage
LVACB	Low voltage auxiliary circuit breaker

Abbreviations	Meaning
LVACCB	Low voltage auxiliary coupling circuit breaker
LVAT	Low voltage auxiliary transformer
LVATCB	Low voltage auxiliary transformer circuit breaker
LVATEIS	Low voltage auxiliary transformer earthing isolator
LVCB	Low voltage circuit breaker
LVCCB	Low voltage coupling circuit breaker
MC	Metro Corridor (Underground Alignment operational)
MCCB	Metro corridor circuit breaker
MCEIS	Metro corridor earthing isolator
MCIS	Main coupling isolator
MMI	Man Machine Interface
HMI	Human Machine Interface
MVCB	Medium Voltage Circuit Breaker
NMS	Network Management System
NGR	Neutral Ground Resistor
OCC	Operation Control Centre
OHE	Over-Head Equipment
PCW	Power Control Workstation
PICOP	Person In Charge Of Protection
PLC	Programmable Logic Controller
PNCT	Primary neutral current transformer
PNEIS	Primary neutral earthing isolator

Abbreviations	Meaning
PNLA	Primary neutral surge arrester
RC	Rail Corridor
RCCB	Rail corridor circuit breaker
RCEIS	Rail corridor earthing isolator
RSS	Receiving Sub Station
SCADA	Supervisory Control And Data Acquisition System
SNCT	Secondary neutral current transformer
SNEIS	Secondary neutral earthing isolator
SNLA	Secondary neutral surge arrester
SP	Sectioning and Paralleling Post
SSP	Sub-Sectioning and paralleling Post
T	Transformer
TCB	Traction Circuit breaker
TEIS	Transformer Earthing Isolator
TSS	Traction Sub Station
TT	Traction transformer
TTCB	Traction Transformer Circuit Breaker
TTIS	Traction Transformer Isolator
UPS	Uninterruptible Power supply
VDU	Video Display Unit
VT	Voltage Transformer
VTB	Voltage Transformer for traction bus bar

Abbreviations	Meaning
VTBB	Bus Bar Voltage Transformer
VTC	Voltage transformer for coupling

4. SPARE PART LIST

4.1 GENERAL

The following list indicates the description and quantities of requirement of spare parts, to be supplied by the Contractor. The Contractor shall deliver these spare parts, at the same time as of handing over the first lot of erected equipment, if not earlier in a phased manner. The spare parts shall be adequate to meet the maintenance requirement for two years after DLP. The employer at his discretion may order any number of quantities of the spares, the price shall be valid till the two years after DLP. If, however, the Tenderer feels that some more items mentioned herein are required for the proper operation and maintenance of the installations supplied and erected by him, for a period of at least 2 years commencing from the expiry of the Defects Liability Period, the Tenderer shall, in that case, add such items to this list and shall include the amended list in his bid. The Tenderer, shall quote the price against each item even if the quantities are mentioned as 'NIL'. The prices shall not be unbalanced.

PSI Spares for ASS of Line-8 *					
S. No	Description	Unit	Qty	Unit Price	Total Price
1	33 KV IT	No	Nil		
2	33 KV CB	No	1		
3	Transformer 630 KVA	No	Nil		
4	Transformer 3150 KVA	No	1		
5	Battery Bank	No	1		
6	Battery Charger (1 Main+ 1 Standby)	Set	1		
7	ACDB	No	1		
8	DCDB	No	1		
9	O/C relay	No	1		
10	E/F relay	No	1		
11	MTR relay	No	1		
12	PILOT wire protection relay for one panel	No	1		
13	Differential relay	No	1		
14	Distance relay	No	Nil		
15	33 Breaker poles (VCB)	No	1		
16	SF6 leak detector	Set	1		

17	SF 6 filling kit with cylinder	Set	1		
18	33 KV breaker gasket set	Set	Nil		
19	33 KV breaker tulip contact set	Set	Nil		
20	33 KV breaker auxiliary contact set	Set	Nil		
21	33 KV breaker sliding rail set	Set	Nil		
22	All type of panel locks, indicators, selector switches, auxiliary contactors, limit switches.	Set	1		
23	All type of panel keys	Set	1		
24	33KV FRLSOH Cable, 400 sq.mm, Copper (1 run of Single Core)	Km	0.5		
25	33KV FRLSOH Cable, 95 sq.mm, Copper (1 run of Single Core)	Km	0.2		
26	Pilot wire cable (FRLSOH)	Km	1		
27	Current transformer for each type	Set	1		
28	Straight through joint kit for 33KV FRLSOH Cable, 400 sq.mm	No	1		
29	End termination kit for 33KV FRLSOH Cable, 400 sq.mm	No	1		
30	End termination kit for 33KV FRLSOH Cable, 95 sq.mm	No	1		
31	CB timing kit	No	1		
32	Battery discharging kit	No	1		
33	Power analyzer (1A-500A)	No	1		
B	SCADA Spares				
1	One Spare Card of each type used for the installation as per TS Chapter 8D	Set	1		
2	One Spare Server **	No	1		

; Spare shall be procured only after the approval from the engineer. The quantity of spares given can be increased or decreased by the engineer. The equipments/kits supplied should be as per latest specifications/models and should be compatible with the system (ROCS & ASS) being installed in this contract. Approval for the specifications should be taken from engineer before placement of the order.

****** In case a separate server is provided by the vendor then the same spare server shall be provided.

CHAPTER 8 A
Auxiliary Network (Underground)

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1. AUXILIARY NETWORK

1.1 General

The various electrical and electro-mechanical installations in passenger stations are required to be provided with electrical power at 415 V 3 phase. For this purpose, power at 33 kV from the Auxiliary Main Substations (AMS) located in the premises of the High Voltage Receiving Substations (RSS), is transported to the Auxiliary Substations (ASS) located in the premises of passenger stations, through duplicate feeders made up of 33 kV insulated cables. The 33 kV power is transformed to 415 V power by means of 33 kV/ 415 V Dry type transformers of suitable capacity installed in the ASS's. The Auxiliary power Network essentially consists of the following:

- A 33 kV cable Network, comprising of duplicate 33 kV insulated cables of suitable capacity, laid in the Viaduct, tunnel or at-grade, as applicable.
- Connection of the 33 kV cables to the 33 kV panels/transformers located in the ASS
- 33 kV / 415 V Auxiliary Transformers of suitable capacity and associated 33 kV and 415 V Switchgear and other Auxiliary Equipment, installed in the ASS's at various passenger stations.

1.2 Broad Network Details for different Corridors

The Bid document covers the Underground Section of the Chand pole – Badi chaupar Corridor, The following are the Underground in the Line1 extension Chand pole to Badi chaupar) (The 33 kV Network of the entire Line -1 derives 33 kV power from 02 Auxiliary Main Substations (AMS) located at Sindhi camp, Mansarovar **(The Supply and Installation of Auxiliary Main Substations located in the premises of High Voltage Receiving Substations (RSS), is not within the scope of this Tender).**

Each AMS, under normal conditions, feeds 33 kV power to a specified number of ASS's located on either side of the AMS. The following “**Loop definition Table**” shows the details of ASS's fed from each AMS, via the particular Loop.

Power supply details of existing sections:-

Receiving Sub station	Location	Incoming Voltage	Power Source
RSS-1	Manasarovar	132 kV	Mansarovar GSS (220 / 132 kV)
RSS-2	Sindhi Camp	132 kV	GIS Substation, PWD Bungalow at Station Road (near RSRTC Bus Stand)

Loop Definition Table

AMS	Loop No.	Names of ASS fed by the Loop	
		Underground	Elevated
Mansarovar	1		Mansarovar Atish Market Vivek Vihar Shyam Nagar Ram nagar Civil line
Sindhi camp	2	Chand Pole Choti Chaupar Badi chaupar	Railway Station Sindhi Camp

1.3 General Description of Scope of Work

A general description of the broad Scope of Work, relating to 33 kV Auxiliary Network, covered in this Tender, is given below. **It shall, however, be clearly understood that the description is for the purpose of general guidance only and is not exclusive.** For complete appreciation of the Scope, the Specifications, Bills of Quantities along with their Explanatory Notes, Drawings and other relevant paragraphs of the Tender Documents shall be referred to.

1.3.1 In the Auxiliary Main Substations (AMS)

The Auxiliary Main Substation (AMS) is located in the RSS premises The JP/EW/1B/E2 Contractor will be required to supply and install the 33 kV cables from the outgoing 33 kV Switchgear at the Chand pole ASS upto the designated Choti chaupar and Badi cahupar ASS on the line.

1.3.2 In the Tunnel

The following works shall form part of this Tender:

- Supply, laying, jointing, termination, protection, testing and commissioning of all 33kV cables and line differential protection in Tunnels between ASS's and links to other Corridors, if any.

- The supply, laying, jointing and termination at either end, protection, testing and commissioning of 33 KV cables (LSOH) between, chandpole to choti choupar, choti choupar to badi choupar.

1.3.3 In the Auxiliary Substations (ASS)

The following works shall form part of this Tender:

Supply, erection, testing and commissioning of all equipments at all ASS's, including, but not limited to,

- 33 kV / 415 V transformers
- 33 kV GIS Switchgear
- 33 kV Cables
- All measuring and protective devices
- Emergency Tripping System (For underground Section only) and interface with signaling contractor and with relevant contractor
- Batteries and battery chargers
- Cable paths and earthing
- Safety equipment and

Supply and erection of any other items required for successful and satisfactory working of the ASS, at all ASS's shall be within the scope of this Tender.

1.4 MANNING OF COMMISSIONED ASS'S

The Employer may call upon the Contractor to provide skilled supervisors / skilled workers / unskilled workers in the ASS's already commissioned and handed over to the Employer, for manning the installations, before commencement of the Revenue operation of the line.

The Contractor shall provide the necessary staff team for the purpose. The staff team deployed at the ASS's shall be thoroughly conversant and competent to operate the various switchgear and systems and shall be able to provide auxiliary power, if so desired by the Employer, to other Agencies working in the Station area or elsewhere and also to provide power shut-downs of the commissioned systems, if so directed by the Employer. The Contractor shall be paid under the relevant BOQ item, for the services. It shall also be ensured by the Contractor that deployment of such staff team will not, in any way, affect the completion of other works within the specified Key Dates.

The Contractor shall follow/comply all labour laws irrespective of rates quoted.

2. MODIFICATION WORK AT EXISTING 33 KV NETWORK

2.1 Modification work at existing station Chand pole ASS's

The contractor should survey, access and conclude on the requirements of the modifications required at the existing ASS's of underground Chandpole station. 33 KV breakers for extension of power supply are provided at ASS-1 & ASS-2 of existing Chandpole station. The extension of existing 33 KV loop from Chandpole to all other stations shall be in the scope of the contract. The work includes, but not limited to the following:-

- (i) Control & Protection with Metering i/c all associated components such as pilot wire relays, over current relays, differential relays, directional relays as required as per protection scheme. The protection scheme as adopted for the contract shall be implemented & validated. Modification as required for SCADA i/c integration as required along with associated material if any.
- (ii) Providing 33 KV link feeders comprising of required numbers of single core 400 sqmm copper FRLSOH from Chandpole to the next station i.e Chhoti Chaupar i/c cable trays, supports brackets, hanging arrangement etc as required.
- (iii) Supply and installation of all types of C&M cables as required..
- (iv) All the materials required to carry out the work has to be included in this modification work.
- (v) Necessary civil work i/c shifting/rearrangement of the existing equipments at Chandpole shall be deemed as included in the contract.

For carrying out such modification works, the Contractor shall submit a specific programme i/c the sequence of work, time required, requirement of power block, man power plan etc, as required at least 15 days in advance.,

Upon approval of the employer the contractor shall carry out the work as per agreed program. The work shall be generally carried out during the non-operating hours of the Metro System. It shall be the contractor's responsibility to restore the existing installation to the original operable condition, so as to ensure resumption of metro services on the corridor. If, due to any reasons, the Contractor fails to restore the existing installations as above, a penalty of Rs 50,000/- per hour or part thereof, will be levied from the Contractor, without prejudice to any other claims of the Employer against the Contractor which may arise due to the Contractors inability to restore the installation to original operable condition.

It is recommended that the Bidder should inspect the site for understanding the scope of work before quoting the price and the price offered shall take into account all such contingencies. No claims other than the quoted price shall be acceptable in this regard.

3. AUXILIARY SUBSTATIONS IN UNDERGROUND SECTIONS

3.1 General

Auxiliary Substations (ASS), located in passenger stations is meant for transformation of power from 33 kV to 415 V through the 33 kV / 415 V distribution transformers and the 415 V protections.

In every Underground station, there are generally 02 Auxiliary Substations (ASS-1 and ASS-2) located near the ends of platform. In certain Underground Stations, there are 03 ASS's.

3.2 Locations of ASS

The following are the locations of ASS's in the Underground Stations, of the corridor.

Sr. No.	Name of Station	ASS Ref.	Tentative No. of transformer to be catered for at each ASS*	Location Level	Remarks
1	Chhoti chaupar	ASS-1	1X 3150kVA	Platform	
		ASS-2	1X 3150kVA	Platform	
2	Badi chaupar	ASS-1	1X 3150kVA	Platform	
		ASS-2	1X 3150kVA	Platform	

* The number and capacity of the transformers are tentative and is subject to confirmation.

3.3 General Technical Requirements

3.3.1 Location of ASS's

Each Underground Station will have normally 2 Nos. of ASS. In certain stations there may be more than 2 ASS's. The ASS's are normally located on the platform level at the ends. In certain cases they may be located on the concourse or ground level. For details of locations of ASS, refer para 2.2 above.

3.3.2 Electrical Switch Room (ESR)

3.3.2.1 Generally the ASS Room is combined with the Electrical Switch Room (ESR), which accommodates the LT equipments and panels. All equipments on the LT Panels, including 415 V Circuit Breakers (Incoming and Coupler) will be supplied and installed by the Station E&M Contractor. Connection between the 33 kV/415V Transformer Secondary and the LT Board, by means of cables or bus duct will also be done by the E&M Contractor. The Contractor shall maintain necessary interface with the E&M Contractor to ensure proper installation of LT Bus duct/cable. The Contractor shall

provide and ensure suitable interlocking arrangements between the above 415 V LT Incoming Breaker and the HT breaker and also the Auxiliary Transformer enclosure door.

The Contractor will provide the necessary protection relays for Transformer Protection eg. Differential relay and Restricted Earth fault relay. The Contractor shall also interface with E&M Contractor for matching the CT characteristics to ensure tripping of HT and LT breakers in case of Transformer fault within the zone of protection. In addition, Instantaneous and IDMT Overcurrent and Earthfault protection (50, 50N, 51, 51N) and Temperature protection shall be provided, to ensure that the Auxiliary Transformers are fully protected against any downstream electrical faults on the 415 V Distribution system in the station premises.

3.3.3 Room size

The Room for accommodating the ASS (and ESR) equipments will be built by other Agencies. Room sizes and shapes may be different in different stations. Layout of ASS is enclosed in the tender drawing. However, contractor shall review and examine the ASS equipment layout of each ASS and based upon the dimension of equipment selected, develop the working drawing of each ASS in coordination with Civil and E&M Contractor.

3.3.4 Cable cutout

Cable cut-outs for entry/exit of HT, LT and C&M cables will be provided by the Station Building Contractor (SBC). For this purpose the JP/EW/1B/E2 Contractor will have to maintain an interface with the SBC. If due to the JP/EW/1B/E2 Contractor changing the Equipment layout or for any other reason, the location of cut-outs are required to be changed, the JP/EW/1B/E2 Contractor, interfacing with the Station building Contractor shall ensure necessary changes to be made or if the cut-outs are already provided at site, shall make his own arrangements for providing new cut-outs and closing the cut-outs already made at site.

3.3.5 Equipment handling

In the case of Underground ASS's located at Platform level, the movement of heavy equipments, like Transformers and HT Panels will be via the track and knock-down walls will be provided in the ASS Room for entry of heavy equipments. In the case of those ASS's located in the Concourse level, a suitable Cut-out (Hatch) of approximately 3.5mx3.5m will be provided to facilitate the heavy equipments being taken to the Concourse level. The Contractor will interface with Station building Contractor for proper size and position of cutout along with hooks for lifting the equipments.

3.3.6 Cable paths

Cable paths required for management of HT, LT and C&M cables, inside the ASS Rooms, shall be provided by the Contractor.

3.3.7 Equipment mounting

The Station Building Contractor will provide a finished floor. The Contractor may, if required, fix equipments on the floor with the help of anchor fasteners. In general, no additional concreting is considered necessary to be provided in the ASS Rooms. If any concrete pedestals/foundations are required to be provided to mount transformers/equipment, the same shall be provided by the Traction Contractor, after obtaining approval from Employer.

3.3.8 Earthing in the Underground ASS

The JP/EW/1B/E2 Contractor shall provide an earth bus inside the ASS, using 50X6 mm G I. flats. The design and layout of the earth bus shall be submitted by the JP/EW/1B/E2 Contractor for Employer's approval. The Main Earth Terminals (MET) will be provided by the System Vide Contractor (E&M), generally 4 to 6. The Contractor shall make connections of the Transformer Neutral; Metallic bodies of equipments etc to the earth bus/MET, as per approved drawing. The Contractor shall comply the standards and rules and regulations as applicable:-

- a) IEEE -80 'IEEE Guide for Safety in AC Substation Grounding'
- b) IS 3043 'Indian Standard Code of Practice of Earthing'
- c) BS 7430 'Code of Parctice of Earthing'

4. 33 KV / 415 V AUXILIARY TRANSFORMERS

4.1 General

This specification defines the main technical characteristics required for the 33000/415-240 V dry type transformers to be used in Auxiliary Substations (ASS).

The transformer offered shall be complete in all respects with all parts and accessories necessary for their efficient operation in sub-stations. All such parts & accessories shall be deemed to be within the Scope of this Specification whether specifically mentioned or not.

Transformer shall satisfy the following requirements and shall also comply with standards in force when the transformers are manufactured, particularly IEC 60076, IEC 726 standards, BS 171 and IEC publication NO-1963 or latest and I E Rules and BEE Guidelines, applied in the manner altered, amended or supplemented by this specification, wherever applicable. In all cases, latest revision to these specifications referred to above shall apply.

The transformer shall be Cast resin type.

4.2 Characteristics

- Climatic conditions: indoor operation
- Operation: continuous
- Windings: Aluminium,

- Primary line voltage (across phases): 33 kV
- Secondary voltage, off-load line voltage at 33 kV primary : 415 V
- Secondary voltage at full load and power factor 0.8: 396 V
- Insulation rated voltage: 36 kV
- Frequency: 50 Hz
- Withstand at industrial frequency: 70 kV
- Voltage surge withstand: 170 kV
- Coupling: delta-star, separate neutral
- Cooling: natural
- Off load tap changer: 0, $\pm 2.5\%$ and $\pm 5\%$
- Insulation Class F

The voltage shall be adjusted by a 5 positions switch which can be used "dead" and provides -5%, - 2.5%, 0, + 2.5%, and + 5% settings. Cover on the Tap changer and Delta link to be provided.

The magnetic circuit shall be in low-loss oriented-grain silicon steel sheet.

The primary and the secondary windings shall be capable of withstanding a symmetrical three-phases short-circuit regardless of the tapping selected. The short circuit level at secondary side for various ratings of transformers shall be as follows:

630 kVA 21.9kA

1000kVA 24.0 kA

1600 kVA 37.1 kA

2000 kVA 46.4 kA

2500 kVA 58.0 kA

3150 kVA 63 kA

The terminals shall be of the 36 kV type.

Conductors insulated at 36kV shall realize delta connection on primary side.

Secondary neutral of transformers shall be solidly earthed.

4.3 Accessories

- Installed on rollers
- Lifting rings
- Nameplate
- Grounding terminal.
- Base channel

4.4 Temperature protection

Transformers shall be fitted with a temperature protection system that allows winding temperatures to be monitored.

This shall consist of two sensors placed on each low-voltage winding, i.e. three alarm sensors and three trip out sensors.

An indicator shall be installed on the front door of the bay to indicate continuously the winding temperature. This shall be installed on the middle low voltage winding.

4.5 Transformer values

The contractor shall confirm the following characteristics for each power transformer:

- Short-circuit voltage,
- No-load losses,
- Full-load copper losses

Efficiency at different load conditions:

- 1/4 - load: power factor = 1 (Minimum: 98.95%)
power factor = 0,8 (Minimum: 98.7)
- 1/2 - load: power factor = 1 (Minimum: 98.87%)
power factor = 0,8 (Minimum: 98.59%)
- 3/4 - load: power factor = 1 (Minimum: 98.67%)
power factor = 0,8 (Minimum: 98.34%)
- Full load: power factor = 1 (Minimum: 98.4%)
power factor = 0,8 (Minimum: 98%)

4.5.1 Transformer Cubicle

Transformers shall be installed in dismountable cubicle, wire-mesh type. Alternatively, the transformers may be supplied in a cubicle with enclosure and without any HV portions exposed minimum protection IP 2X. The door shall be provided with padlock arrangement & mechanical system interlock, to ensure that it is possible to open the door only when the protection circuit breakers on the HV side as well as LV side of the transformer are in 'Open' position. Transformer door shall be reverse interlocked, that is if any unauthorized person opens the Transformer door, Circuit breaker (HT & LT) on either side of Transformer shall trip automatically.

Temperature monitoring devices with two thresholds (alarm and tripping) must be provided and located on the upper part of the secondary windings.

The cubicle shall provide protection against direct contact with the power transformer. It shall include connections for the MV lines from the protection bay and connections for the low voltage circuit. The Traction contractor will provide suitable size stiffeners in

enclosure for connection of bus duct and to ensure that the enclosure does not deform due to Bus duct connection.

4.5.2 Description

Two doors containing two windows to allow observation of the transformer accessories shall be provided in the front face & rear side.

These doors shall be closed and locked to prevent access to the transformer while either the MV or the LV side is live.

Consequently, ventilation louvers shall be installed at the bottom of the front doors and in the bay rear panel and roof. The metal sheet of roof of the Transformer enclosure shall be strengthened properly to carry the load of bus duct and to avoid any buckling due to weight of bus duct.

Cable arrangement shall facilitate the exchange of either of the two Transformers without any difficulty; i.e. the cables shall be laid along each side and connected to the transformer in such a way that it will not block the passage for removal of any of the transformer during service.

4.5.3 Terminal Arrangements

The terminal arrangement for high voltage side shall be suitable for required size of cables with FRLS/FRLSOH outer sheath. Suitable arrangements shall be available for cable terminations so that the cable weight doesn't come on the terminals. The terminal on HV & LV shall be suitable for receiving XLPE cable end termination with cable gland and anodized hard wire for the cable termination. The terminals on the primary side shall be of the 36 kV type. The connection with different terminal of transformer shall be through the L/ C type connector for sufficient clearances from transformer winding.

4.5.4 Painting

All steel surfaces shall be painted which shall be suitable for polluted atmosphere and has to comply with ICE-60072-2-5 standard. After baring of all metal surface an Intel two coat of rust proofing and anti corrosive paint shall be applied then they will be covered with three coats of glossy oil & weather resistance non fading paint.

4.5.5 Nuts & Bolts

The threads and hexagons of all nuts, bolts and stud shall conform to relevant IS or BS. No bolt or stud shall project through its nut(s) more than 6mm (or) four threads, except when otherwise approved for terminating stud/bolts. If bolts and nuts are so placed that they are inaccessible by means of ordinary spanners. All terminals should be provided with suitable cadmium plated and passivated high tensile steel hard wires facilitate cables termination.

5. 33 KV SWITCHGEAR

5.1 General

The switchgear shall be of the single busbar with 3-phase enclosure indoor metal-enclosed extendable type, which, when erected, shall form a complete switchboard.

The metal-enclosed switchgear shall be gas insulated and the circuit interrupting device shall be of vacuum type.

The switchgear offered shall have a basic insulation level (BIL) of not less than 170kV peak.

The switchgear shall be capable of operating in class B environment stipulated in clause 1.13 of General Specification.

The 33kV switchgear shall comply with the following IEC standards:

62271-103, 62271-200, 60376, 62271-1, 62271-100, 6, 66044-1 & 6, 61869 60028, 60044-2 and 62271-102, 60529.

5.2 Switch gear cubicles

5.2.1 General Description

All non-welded assemblies shall be assembled by means of bolts and nuts with mandatory use of lock-washers. All panels, separating partitions and accessories shall be mounted similarly, in such a way so as to withstand indefinitely the vibrations transmitted, in particular by the resetting mechanism of the circuit-breakers and their actuation.

5.2.2 Electrical characteristics

Rated voltage:	36 kV
Operation voltage:	33 kV
Frequency	50 Hz
Rated busbar current	1250A
Rated current of feeders:	630/1250 A
Rated current of transformer feeders:	630 A
Rated short time withstand current	25kA – 1 sec
Rated short circuit breaking current	25kA
Rated short circuit making current	62.5kA
Lightning impulse test (BIL) voltage:	170 kVp
Power frequency test voltage:	70 kVrms
Auxiliary Supply Voltage:	110V DC
Degree of Protection (HV Compartment):	IP65
Degree of Protection (LV Compartment):	IP3X

5.3 General Requirement

- i) GIS supplier should have minimum experience of 05 years for manufacturing of similar GIS substations. The type of GIS offered should have been in satisfactory operation for at least three years. Contractor should submit performance certificate from the employer.
- ii) The 33kV equipment shall be built according to the SF6 gas insulation technology.
- iii) 33kV GIS as offered should be fully type tested as per latest IEC standards at the time of submitting the bid.
- iv) The equipment installed shall offer all necessary facilities for equipping and connecting the equipments sections to follow, without entailing any shut down of equipment already in service.
- v) In the event of arching in a compartment, the arches should not extend to the neighbouring compartment/Panel. Any failure to the enclosure of the compartment shall not lead to damages in the neighbouring compartments.
- vi) Suitable means of expansions should be provided in the metal enclosure and pipelines to absorb the actual thermal expansion and contraction of the SF6 equipment and to facilitate the alignment of the switchgear assembly.
- vii) The metal enclosure for the SF6 gas insulated equipment modules shall be made from aluminium alloy/ stainless steel.
- viii) GIS should be of modular design, and it should be possible to add feeder panels if required.
- ix) Inter-panel auxiliary and control wiring shall have terminals in each relevant cubicle so placed for the bus wiring to be readily run from unit to unit. Auxiliary and control wiring to be connected to other equipment shall be wired to terminals at the rear of individual cubicles, suitably located for the wiring to be extended via multi-core cabling run in floor ducts. All auxiliary and control wiring shall be separated from high-voltage conductors, even though the latter are insulated by earthed metal enclosures.
- x) All auxiliary and control cables and wirings shall have suitable marking, such as ferrule markers, which shall clearly identify their function and shall match the control schematic drawings and wiring diagrams. The markers shall fit firmly over the outer diameter of individual cable and each wire core. Marks shall be printed and legible. For easy identification, colour coding shall be used to differentiate various functions of the cable and wires. All auxiliary and control wirings shall also be complete with cable lugs for termination.
- xi) A relay and instrument compartment shall be located at the front of each switchgear unit and shall be provided with a hinged door for access to the internal wiring and terminals. Gaskets shall be used to provide close sealing. The height of the instrument panel above floor level shall not exceed 2,000mm unless

otherwise reviewed without objection by the Engineer who may require the Contractor to provide, at its own cost, suitable means for easy access to the instrument panel.

- xii) Anti-condensation heaters with humidity control function shall be installed for each switchgear panel.
- xiii) The switchboard shall be designed to cater for future extension.

5.3.1 Detail Description –Equipment & Accessories

5.3.1.1 Circuit Breakers

- 5.3.1.1.1 Circuit breakers shall employ vacuum interrupters and shall have busbar side integral isolation facilities, i.e. a 3-position isolator with On-Off-Earth positions.
- 5.3.1.1.2 The circuit breakers shall have rated operating sequence (duty cycle) of: O – 0.3s-CO – 3' – CO as per IEC 62271

The endurance class of Electrical, Mechanical & restrike performance operations of all breakers, earth switch isolator etc needs to mentioned in the GIS equipment proposal

5.3.1.2 Operating Mechanisms

- 5.3.1.2.1 The circuit-breaker and switch mechanisms shall be of spring-powered stored energy operation by means of a motor charged spring with manual and electrical released, or solenoid operated.
- 5.3.1.2.2 The mechanism shall be of the trip free type so that the circuit-breaker shall be free to open during the closing operation immediately after the operation of its tripping device. The circuit-breaker shall be capable of closing fully and latching, against its rated making current. The various parts shall be of substantial construction, carefully fitted to ensure free action, and designed to reduce mechanical shock during operation to a minimum.
- 5.3.1.2.3 In the event of a spring breaking, it shall still be possible to open the circuit-breaker safely and it shall be possible to close the circuit-breaker or switch adequately to carry its rated current in accordance with IEC60056.
- 5.3.1.2.4 Circuit-breaker spring operated mechanisms shall have the following additional features:
 - If the circuit-breaker is opened and the springs charged, it shall be possible to close, and then trip the circuit-breaker;
 - If the circuit-breaker is closed and the springs charged, there shall be sufficient energy to trip, close, and then trip the circuit-breaker;
 - Mechanical indication shall be provided to indicate the state of the spring; and

- Motor charged mechanisms shall be provided with means for charging the springs by hand. A shrouded push button for releasing the springs and an electrical release coil shall also be provided.

5.3.1.2.5 All circuit-breaker operating mechanisms shall be fitted with an electrical shunt trip release coil and a mechanical hand tripping device.

5.3.1.2.6 Tripping and closing circuits shall be provided with a fuse or miniature circuit breaker on each unit and shall be independent of each other and all other circuits. A trip circuit supervision scheme shall be incorporated for every circuit.

5.3.1.2.7 The electrical tripping and closing devices shall be operated satisfactorily, with a maximum temperature of 55°C inside the 33kV switchgear enclosure, over a DC voltage range as follows:

- Closing solenoids 85 to 120% of rated voltage
- Spring charging motor 85 to 120% of rated voltage
- Closing release coil 85 to 120% of rated voltage
- Shunt trip release coil 70 to 120% of rated voltage

5.3.1.2.8 All operating coils for use on the DC supply shall be connected in such a way that failure of insulation to earth does not cause the coil to become energised.

5.3.1.2.9 Auxiliary switches shall be provided in circuit breaker tripping circuits to interrupt the tripping supply as soon as the circuit breaker has completed the tripping operation. An auxiliary switch shall be provided in closing circuits to ensure that the closing circuit is open after a close has been made.

5.3.1.2.10 A proven positively-driven mechanically-operated indicating device shall be provided to show whether a circuit breaker is in the open or closed position.

5.3.1.2.11 Locking facilities shall be provided so that the circuit breaker, if required, can be prevented from being closed when it is open, and from being manually tripped when it is closed. It shall not be possible to gain access to the tripping toggle or any part of the mechanism which would defeat the locking of the manual trip.

5.3.1.3 Busbars and Connections

5.3.1.3.1 Busbars and connections between the pieces of apparatus forming the equipment of a cubicle shall be of high-conductivity copper. The conductivity shall not be less than 99.9% of that of a "Standard Annealed Copper", as defined in IEC Publication No. 60028.

5.3.1.3.2 Busbar connections and their supports shall be of an approved type, designed to withstand all normal and abnormal conditions arising in the System. They shall be capable of carrying the current equivalent to the breaking capacity of the switchgear for 3 seconds.

5.3.1.4 Insulation Gas

- 5.3.1.4.1 All live conductors shall be inside SF6 gas insulating medium & in a chamber with no gas handling requirement at site (prefilled at works). The joints of the busbar/panels should be of 36 kv rated voltage and type tested in assembled condition, Type test report should be provided at the time of vendor approval. The Contractor shall submit details on quantity, quality and density of SF6 gas to be used in the switchgear in accordance with IEC 60376.
- 5.3.1.4.2 The GIS shall be grouped into suitable gas compartments with each compartment fitted with a monitoring pressure gauge/sensors and a pressure relief device.
- 5.3.1.4.3 The gas shall still insulate the 33kV power frequency voltage when the SF6 gas pressure drops to 1 bar and the gas leakage rate shall be guaranteed to be less than 0.1% by mass per year.
- 5.3.1.4.4 The GIS shall be so designed that an internal arc fault in a compartment will not affect other gas compartments, and compartments for operating mechanism and protection relays. The high pressure gas or air from the GIS during an internal arc fault shall be directed or vented to a direction away from the operator. The Contractor shall provide type test reports for the internal arc test.
- 5.3.1.4.5 Internal insulation level between live parts and earth when the pressure of the gas goes to the atmospheric pressure should not be less than $1.2 \times 33/1.722$ kV.
- 5.3.1.4.6 SF6 Gas apparatus warning sign shall be provided on the GIS.
- 5.3.1.4.7 All special tools and equipment for installation, testing, commissioning, operation and maintenance of the GIS shall also be supplied by the Contractor. These include a suitable sized gas handling unit mounted on a trolley for purging, refilling and other gas works. The trolley shall be able to retain the SF6 gas purged from any gas zones of the GIS.

5.3.1.5 Switchgear Interlocking

- 5.3.1.5.1 Where a circuit breaker or other switchgear is fitted with means for mechanical or electrical operation, interlocks shall be provided so that it is impossible for the electrical and mechanical devices to operate simultaneously.
- 5.3.1.5.2 An electrical or a mechanical key interlocking system shall be provided whereby it is not possible to apply an earth to a section of the busbar until all circuit breakers which can feed that section are locked open.
- 5.3.1.5.3 The earthing devices shall be provided with interlocks to ensure correct operation in conjunction with the associated circuit breaker.
- 5.3.1.5.4 The isolators and the associated circuit breaker which are integral parts of the switchboard shall be equipped with mechanical interlocking to ensure that the isolators cannot be operated unless the associated CB is opened. For the same

reason, motorised isolator shall be installed with electrical interlock to provide the same interlocking logic.

5.3.1.5.5 Means shall be provided whereby the electrical tripping of the circuit breaker is rendered inoperative during earthing operations both when closing and when closed in the earthed position. It shall not be possible to return to the service position and close the circuit breaker until the electrical tripping is again operative.

5.3.1.5.6 Where interlocking over a distance is required, two independent criteria shall be used, e.g. absence of a voltage and remote feeding circuit breaker open. Indication of the remote condition shall be by single purpose circuit, care being taken that the conductors used are adequately screened and shielded to minimise both transverse and longitudinal voltages resulting e.g. from electromagnetic induction, differences in earth potential or other causes. The Contractor shall ensure that voltages dangerous to personnel or deleterious to correct operation shall not arise.

5.3.1.5.7 When there is provision for isolation of sections of cable between two "either-or" interlocked circuit breakers, a key-operated over-ride shall be provided to permit both circuit breakers to be closed at the same time provided that the circuit between them is broken. It shall not be possible to restore the connection without tripping one of the two circuit breakers and releasing the key.

5.3.1.5.8 The mechanical closing button of circuit breaker shall be interlocked with the closing conditions of the circuit breaker such that operation of the mechanical closing button shall be prohibited if the closing conditions of the circuit breaker are not fulfilled.

5.3.1.6 Locking Facilities

5.3.1.6.1 Padlocking facilities shall be provide for mechanical trip on circuit breakers to prevent manual tripping.

5.3.1.6.2 All cubicle access doors, other than those which are interlocked with a switching device, shall be provided with pad-lock type locking facility.

5.3.1.7 Earthing and Earthing Devices

5.3.1.7.1 All earth bars and terminals including those in the switchboard and inside the ASS shall be tinned copper.

5.3.1.7.2 All metal parts other than those forming part of an electrical circuit shall be directly connected to a high conductivity copper earth busbar which shall run the full length of and be bolted to the main frame of the switchboard.

5.3.1.7.3 At the position where joints or terminations occur, the earth busbar shall also be tinned. The earth busbar shall be rated to carry currents equal in magnitude and duration to that associated with the short circuit rating of the equipment.

5.3.1.7.4 The metallic cases of all instruments, relays or other associated components mounted on the switchgear shall be connected to the earth busbar by copper conductors of not less than 2.5mm² cross-sectional area.

5.3.1.7.5 When components are provided for mounting separately, each shall be provided with an earthing terminal of not less than 30mm² cross-sectional area.

The individual GIS panel should be with an PT isolation arrangement to conduct all the after installation test on H.T cabling system as per requirement of standards.

5.3.1.8 Control Facilities

5.3.1.8.1 All circuit-breakers shall be capable of being operated electrically from the OCC via the SCADA system.

5.3.1.8.2 Proven, positively driven mechanical indicating devices shall be provided on all equipment to indicate whether the primary equipment is in the OPEN or CLOSED position. Care shall be exercised in the design and fitting of these indicators to ensure that the indicating device and associated apparatus does not interfere with the correct operation of the circuit-breaker or isolator.

5.3.1.8.3 Each circuit breaker shall be provided with the necessary auxiliary contacts and internal wiring to permit remote control and indication.

5.3.1.8.4 Separate switches for local electrical operation shall be installed for each circuit breaker and they shall be of a proven pistol-grip type. They shall have CLOSE and TRIP positions, with a spring return to a NEUTRAL position. The switches shall be lockable in the NEUTRAL position by means of a padlock

5.3.1.8.5 A separate LOCAL / REMOTE CONTROL selector switch shall be provided for each circuit-breaker. In addition to the contacts in the control circuits, the switch shall have contacts closed in the LOCAL position for remote indication of switch positions. The switch shall have two positions, and shall be lockable at both positions by means of a padlock.

5.3.1.8.6 Electrical tripping and closing devices shall be suitable for operation from 110V DC batteries.

5.3.1.8.7 Exposed LV 220V AC terminals inside each Control cubicle shall be adequately shrouded to avoid accidental human contact.

5.3.1.9 Auxiliary Switches

5.3.1.9.1 Proven, positively direct-driven auxiliary switches shall be provided on all primary switching devices as required for indication, control and interlocking. Auxiliary switches shall be robust, shall have a positive wiping action when closing and shall be mounted in an accessible position clear of operating mechanisms. Three sets of spare switches comprising of normally-open and normally-closed contacts shall be provided on each unit.

5.3.1.9.2 Auxiliary switches shall be of the changeover type to be either normally-open or normally-closed, and shall be positively lockable in the desired position.

5.3.1.9.3 Auxiliary switches shall be designed to make, break and carry, without undue heating, the current of their associated circuit or a current of three amperes DC, whichever is the higher.

5.3.1.10 Cable entry

Cable connection shall be bottom entry. Cable termination shall be inner/outer cone plug in type. Suitable cover should be provided at the cable entry location of the GIS panel to avoid unintentional contact of the live parts by rodents etc. Contractor shall obtain approval from the employer for the above scheme.

Back side cover shall be required to be provided if no maintenance is recommended from the rear portion of GIS.

5.3.1.11 Testing Facilities

5.3.1.11.1 All fixed and moving portions of the switchgear shall be provided with facilities to enable high voltage tests to be carried out.

5.3.1.11.2 When current transformers and protective relays are fitted, facilities including but not limited to isolation links, test blocks and test plugs shall be provided for primary and secondary injection tests to be performed. These facilities shall be such that wires and connections need not be disconnected for the tests to be made.

5.3.1.12 Current transformers

5.3.1.12.1 When CTs are used for protection and measurement purposes, they shall have the appropriate ratio, class and burden in line with the functions they are used for.

5.3.1.12.2 All current transformers shall have a 3-second short-time current rating of not less than the maximum System fault level.

5.3.1.12.3 Current transformers shall have an output rating adequate to cater for the burden connected to them and shall function satisfactorily under the maximum system fault condition.

5.3.1.12.4 All current transformers shall be installed with the P1 terminals adjacent to the busbars.

5.3.1.12.5 All connections from secondary windings shall be brought out and taken by means of separate insulated leads to a terminal board mounted in an accessible position. Where multi-ratio secondary windings are required, a label shall be provided at the secondary terminal board clearly indicating the connections

required for each ratio. The connections and ratios in use shall be shown on all diagrams of connections.

5.3.1.12.6 Current transformers shall have the appropriate ratio depending upon their application.

5.3.1.12.7 Secondary connection wirings shall be provided with copper conductors FRLSOH Cables as per required size

5.3.1.12.8 The class of all protection CTs shall be as per GTP.

5.3.1.12.9 The Contractor shall prepare a schedule of CTs to be installed, and submit the same for the Engineer's review.

5.3.1.12.10 The secondary windings of current transformers shall adopt single point earthing. The earth connection shall be made at a terminal block via a removable link.

5.3.1.13 Voltage transformers

5.3.1.13.1 Voltage transformers of the metal-enclosed encapsulated type are preferred. Other types may be submitted to the Employer's Representative for review and approval.

5.3.1.13.2 The secondary windings shall be connected to the secondary circuit through a LV fuse or a miniature circuit breaker (MCB).

5.3.1.13.3 The nominal VT ratio shall be 33kV/110V.

5.3.1.13.4 For protection and measurement applications, the VTs shall be of dual Class 3P/0.5. The burden of VTs shall be decided by the Contractor with a margin of 40% for future additions of instrumentations, and submitted to the Employer's Representative for review and approval.

5.3.1.14 Paint-work

5.3.1.14.1 Painting should be suitable for polluted atmosphere and has to comply with IEC 60 721-2-5 standard

5.3.1.14.2 As a minimum, an initial coat of rust-proofing and anti-corrosion paint will be applied after baring of all metal surfaces; then they will be covered with two coats of paint and one finishing coat, colour to be defined. The Contractor shall submit to the Employer, the complete details of the Switchgear Cubicles Metal work and Paintwork details, including details of the structure, process of finish and painting etc, for Employer's approval.

5.3.1.15 Identification

The front of each cubicle shall carry a nameplate indicating its identification number and function. The text and type of nameplate shall be defined.

5.3.1.16 Fitting & Accessories

As a minimum following fittings and accessories shall be provided

a) Mechanically operated tripping and closing device

- b) Local / Remote /off control switch and indication lamps
- c) Operation counter
- d) Supporting frame if needed
- e) Name plate
- f) Foundation bolts
- g) Semaphore indicators
- h) Meters
- i) CTs & PTs as required
- j) Protection as required

5.4 Medium voltage switchgear interlocking

The medium voltage switchgear interlocking has several purposes:

- To avoid any paralleling between the both transformers of the AMS in remote control mode
- To avoid any paralleling between the both transformers of the AMS in local control mode
- To avoid the earthing of a cable under voltage presence

For this purpose, the 33 kV network is divided into suitable loops.

Normally, the ASS's connected to the various loops will derive power supply from the respective loop only. However, in an Emergency situation, when one of the AMS's is totally out-of-service and consequently the loop connected to this AMS is in itself not able to derive power from the AMS, it would be necessary to resort to linking of the loops. When this is required to be done, the linking circuit breakers which are provided for this purpose are closed in a sequence so as to ensure that the two loops are not linked when both loops are live. Suitable interlocking is provided for this purpose.

5.4.1 Interlocking in remote control mode

In remote control mode it shall be possible to operate any CB and ITC without any mechanical interlocking. That could be possible through the medium of the remote/local knob when in remote position.

5.4.1.1 1st Case, both RCCB closed

To avoid any paralleling between the both transformers of the AMS, the software shall authorise the closing of all CB and ITC of one loop except one (that is to say it shall be possible to close N-1 apparatuses on each loop)

5.4.1.2 2nd Case, only one RCCB is closed

In this case, there is no risk of paralleling between the both transformers. Consequently it shall be possible to close all CB and ITC. But it shall be impossible to close back the second RCCB until the correct configuration of the both loop, that is to say the opening

of one CB or one ITC on each loop, to reach to previous condition when the both RCCB are closed.

5.4.2 Interlocking in local control mode

In local control mode it shall be possible to operate any CB and ITC with a mechanical interlocking. That could be possible through the medium of the remote/local knob when in local position.

To avoid any paralleling between both the transformers of the AMS, the mechanical interlocking shall authorise the closing of all CB and ITC except one on each loop, including the relevant RCCB (that is to say it shall be possible to close N-1 apparatuses, including the RCCB, on each loop).

5.4.3 Loops coupling interlocking

Loops can be, if required, interconnected with the help of appropriate, apparatuses, with suitable interlocking to avoid any paralleling between transformers. The Loops are provided with an interconnection arrangement between their respective feeders (ie Feeder cable 1 and cable 2). The loop coupling interrupters shall be provided with interlocking so as to ensure that it is not possible to couple two loops when both loops are live.

5.4.4 Earthing interlocking

A mechanical interlocking linkage shall be built in to prevent the grounding switch being closed if the main circuit breaker is closed. Nonetheless, it shall be possible to operate the grounding switch with the compartment door open, but it shall be impossible to close the main circuit breaker when the grounding switch is closed.

On the other hand, a lock interlocking shall forbid the earthing isolator closing until the circuit breaker at the other extremity of the same cable of the nearest ASS is locked in open position.

5.4.5 Local Interlocking

- a) Each MV board shall include a non-return interlocking system, formed by security locks, to allow safe inspection of the transformer.

This interlocking system shall make it necessary to open a main LV circuit breaker (LVCB) and lock it open and unplugged before closing the protection bay ground isolating switch. Once this switch has closed, it shall be possible to open the door of the transformer bay.

- b) All 33 kV cable coupling bays shall include systems to interlock interrupters and grounding isolators to make it possible to work on a bay without cutting the main 33 kV cable.
- c) High-security locks shall form these interlocks.

5.4.6 Response to a Fault

5.4.6.1 *Fault on a 33 kV Incoming cable*

A fault may occur between phases on the MV cables or on the bus bars in the boards. In either case, it shall trip circuit breakers on either side of the fault via a Pilot wire protection.

5.4.6.2 *Fault on a Transformer 33 kV Supply*

A short-circuit inside the transformer, or in the transformer protection line or a short-circuit insufficiently isolated by the transformer downstream LV protection shall trip the Medium Voltage circuit breaker (MVCB).

5.4.6.3 *Grounding Fault on ASS MV 33 kV cables*

This fault shall trip the circuit breakers on either side of the fault.

6. **33 KV (MEDIUM VOLTAGE) CABLES (IN UNDERGROUND SECTIONS)**

6.1 **General**

33 kV Cables are required to be used in the Auxiliary Network, for Supply of power at 33 kV to various Auxiliary Substations located at Stations and in the Depot. The Auxiliary Network consists of duplicate 33 kV feeders, each feeder consisting of 3 Single core cables, assembled in twisted or cloverleaf pattern.

The cable shall be 19/33 kV (E), grade, shall be as follow,

- Single core 400 sq.mm stranded copper conductor, XLPE insulated, Tape armouring, FRLSOH (for Undergournd section) sheathed.
- Single core 95 sq.mm stranded copper conductor, XLPE insulated, Tape armouring, FRLSOH (for Undergournd section) sheathed.
- Single core 400 sq.mm stranded copper conductor, XLPE insulated, Tape armouring, FRLS (for Part of AMS to ASS connections) sheathed.

It shall conform to IEC 60502 Part 2 latest for construction and IEC 60840 for testing. The cable shall be manufactured by a company having ISO accreditation for quality. The manufacturing process of XLPE cable shall consist of conductor screen, insulation & insulation screen shall be extruded in a single process.(triple extrusion) and cross linked by VCV Process dry curing technology to ensure homogeneity and absence of micro voids. The cables shall be manufactured by "Dry Curing" Process

The Employer may decide to visit the works of cable manufacturer to confirm the manufacturing process mentioned. The technical requiriements of these cables are described in the following paragraphs.

6.2 Governing Specifications

The 33 kV Cables shall conform to IEC 502/1 and shall be of 19/33 kV (36). The cables shall be of dry-insulated, radial-field cable, based on proven technology. They shall be constituted by assembly of three single core cables in twisted or cloverleaf pattern.

6.2.1 Technical Particulars

6.2.1.1 Description

The cables shall be insulated with chemically cross-linked polyethylene, with semi-conducting screen over a copper conducting core, and insulating envelope and polyvinyl chloride protective sheath.

- operating voltage : 33 kV rms between phases,
- specified voltage : 19 kV rms (according to IEC 502/1)

6.2.1.2 Fire Retardant Low Smoke Zero Halogen

All cables shall be non-fire propagating, non-toxic and low-smoke producing and shall conform IEC 502-1 or equivalent and shall be of Zero Halogen.

6.2.1.3 Conducting Core

The conducting core shall be formed from stranded copper conductor, according to Class 2 as per Publication IEC 60228. The conductor shall be compact circular stranded.

The following shall be the cross-section of the conducting Core for different applications,

- Single core 400 sq.mm stranded copper conductor, XLPE insulated, Tape armouring, FRLSOH for the 33kV distribution Network cables in tunnels and Viaduct and for connections from the Network to the 33kV switchgear panels inside the ASS.
- 95 sqmm stranded copper conductor, XLPE insulated, Tape armouring, FRLSOH for connections from Transformer Circuit Breaker to the 33kV/415V Auxiliary transformer in the ASS.

The Contractor shall confirm the section of these cables as regard to:

- the route installation,
- the thermal conditions in service,
- the climatic conditions,
- the energy and currents flowing through this cables, taking into account the worst electrical conditions:
- operation under permissible overload conditions,
- operation when all 33 kV distribution are supplied by only one transformer, and on only one 33 kV cable.

6.2.1.4 *Conductor Screen:*

The conductor screen shall be provided over the conductor by extrusion of semi-conducting compound. A semi conducting tape (s) shall be provided below the extruded semi conducting conductor screen to prevent penetration of compound in to the under lying conductor. Nominal thickness of conductor screen shall be 0.7mm.

6.2.1.5 *Insulation:*

The conductor with screening shall be provided with cross linked polyethylene (XLPE) insulation applied by extrusion. The nominal thickness of insulation shall not be less than 9 mm and subject to tolerance as per IEC – 60840, clause 10.6.2.

The insulation compound shall be of high quality, heat, moisture, ozone and corona resistant. XLPE compound should be from Borealis, Sweden or NUC Japan or any other equivalent reputed manufacturer. The insulation shall be suitable for operation in wet or dry locations at conductor temperature not exceeding 90 deg. C for normal operation, and 250 deg. C for short circuit conditions.

The Insulation shall be applied by extrusion and vulcanized using dry curing process to form a compact homogenous body free from micro voids and contaminants.

6.2.1.6 *Insulation Screen:*

The Insulation screening shall be applied direct upon the insulation and shall be of a layer of extruded semi conducting thermosetting compound firmly and totally bonded to the insulation. . Semiconducting compound should be from Borealis Sweden or NUC Japan or any other equivalent reputed manufacturer. Nominal thickness of insulation screen shall be 0.7mm

The conductor screen, insulation & insulation screen shall be extruded in a single process (triple extrusion).

6.2.1.7 *Water Barrier, Longitudinal*

The water barrier shall be semi-conducting water swellable tape to be applied over the extruded insulation screening to block and prevent moisture propagation in a longitudinal direction. The semi-conducting tape shall be suitable for the operating temperature of the cable and compatible with the insulation.

6.2.1.8 *Metallic Screen:*

The metallic screen shall be plain copper round wires /copper tape applied helically over the semi-conductor bedding tape(s). The area of the copper wire/copper tape shall be should be able to withstand specified earth fault current. Bidder shall submit the calculations giving details of the area of copper wire screen/copper tape.

An annealed plain copper binder tape shall be applied in the form of an open helix, over the copper wire screen.

6.2.1.9 *Inner Sheath:*

An inner layer of FRLSOH tape shall be applied over metallic screen followed by PE laminated Aluminium tape.

6.2.1.10 *Armouring:*

Double Tape armouring should be applied over the inner sheath and the thickness of the same should be as per IEC 60502.

6.2.1.11 *Outer sheath:*

The outer sheath shall be extruded Red, Yellow , Blue colour, halogen free flame retardant polyolefin compatible with specified ambient and operating temperature. **The sheath shall be treated with anti termite and corrosion resistant compound.,** confirming to requirement of IEC specifications and extruded continuously.

The protective sheath shall carry the indications listed below, in letters and digits:

- designation of ownership,
- nature and cross-sectional area of conductors,
- specified cable voltage,
- phase numbering,
- Manufacturer's name.

33kV cable for use in underground section shall comply with following Test Standards in addition to IEC 60502.

1. IEC 332 Part 1 & 3, category A, test on single and bunched cables under fire condition.
2. Limiting Oxygen index of at least 30 as per ASTM D 2863
3. A Temperature index of 260°C as per ASTM D 2863.
4. Determination of the amount of halogen Acid Gases as per IEC 754 Part-II
5. 3 m cube smoke emission test, when tested in accordance to IEC 61034/BS 7622- Maximum smoke emission 30%
6. All Insulation is to be moisture and heat resistant, with temperature rating appropriate to the application conditions and in no case lower than 90°C
7. For FRLS cable maximum smoke emission should be 50% as per ASTM D 2843

6.2.1.12 *Short Circuit Rating of Metallic Sheath / Screen*

The area of copper wires/copper tape shall be designed to meet the requirement of the system short circuit rating of 1 KA for 3 Seconds. However 3 phase short circuit capacity of 33 kV cable shall be minimum 7 kA for 3 sec.

6.3 Connecting Junctions - MV Ends

6.3.1 Connecting Junctions

Connecting junctions shall reconstitute perfectly all elements of the MV cables, so as to obtain electrical and mechanical characteristics at least equal to those of the cable.

The Contractor shall submit to the client, for approval, a detailed description of the technique foreseen for execution of connections in MV lines.

However, maintenance and repair being able to be carried out only during a short period of time, at night, due consideration shall be given to connection processes having the following characteristics, quality being otherwise equal:

- quickness of execution,
- possibility of replacement without having to disturb the cable,
- small bulk.

All 33kV straight through joints shall be of Heat Shrinkable Type.

6.3.2 Cable Heads

MV cable heads shall be connected to cable junction boxes with the MV apparatus.

All 33kV Cable terminations shall be Heat Shrinkable Type. For Underground section for straight through joint/termination shall be made by using Halogen free Jointing kit.

6.4 Execution Rules

The entire supply shall be executed according to all Rules of the Art pertaining to professional-grade equipment, and in compliance with the technical specifications and specifications of the International Electrotechnical Commission relative to power supply cables (IEC 55-1, 55-2 and 502-1). The supply shall be delivered, upon request by the client, only after execution of in-plant inspection operations and satisfactory testing according to the technical requirements imposed.

The cables shall pass all the tests stipulated in the IEC 502 rules in force on the date of the order.

The sleeves and the insulating materials used shall meet the guarantee requirements imposed.

The equipment shall be capable of withstanding intensive use without alteration, and of performing its duty even after extended idle period.

6.5 Atmospheric and Climatic Conditions

The entire equipment shall be designed for operation in hot weather, according to the climatic conditions.

The equipment shall be sturdy and properly treated against corrosion. This protection shall be suited to the various environmental conditions encountered in the various parts of the network.

It must be noted that environmental conditions shall be very severe during construction; these conditions shall not be the cause of any alteration of equipment or material whether already installed or simply stored.

6.6 Cable Technical and Test Sheet

The tests shall be performed according to the corresponding IEC standard.

After completion of laying of the cable and its accessories, a dielectric test is carried out through application, for 15 minutes, of an alternating voltage equal to square root $3.U$ or a direct voltage equal to $4.U$ or the test shall be carried out as per latest standard in force.

6.7 Cable Laying Specification

6.7.1 General

MV cables shall be laid all along the line in tunnel, and in ground wherever required.

The cable laying shall be generally in accordance with IS-1255-1983 and manufacturer's recommendations.

They shall be supplied on reels, the standard of which shall be determined according to the laying conditions.

This specification defines all types of work related to installation of cable routings, paying out and laying of the cables, at grade, on viaduct.

The Contractor shall produce a stake-out plan at 1:500 scale, which shall indicate the precise laying position and the type of routing (in channel or inside duct), accounting for all specific location of the line (Track crossings and entry into electrical stations).

6.7.2 Not Used.

6.7.2.1 *Laying in Tunnels*

Cables shall be laid in the cable supports on the tunnel wall.

Supports/Brackets will be provided by E&M Contractor. The traction Contractor is to interface with E&M Contractor for route and location. The supply and installation of trefoil clamps is under the scope of this contract. 33 KV danger boards will be provided at every 100 m shall be provided and also at locations wherever cables have to cross under tracks

-Inside UG station, cables shall be laid inside ASS room, in undercroft/cellar, in HDPE pipes, along/across track, in cable galleries, etc.

6.7.2.2 *Cables Installation*

6.7.2.3 *Laying out*

The cables shall be supplied to the laying work site in suitable unit lengths, coiled on reels whose average weight shall not exceed about 8000 kg for copper-cored cables, as well as for aluminum-cored cable.

If cables are laid after the track is in position, then these reels shall be delivered by train as close as possible to the point of utilization, accounting for the constraints generated by the actual traffic on the existing line.

Paying out of the cables can be made manually or mechanically. The mechanical devices (electric or pneumatic) used for paying out the cables shall be so constructed that they would prevent damaging the cables. These devices shall be submitted to the client's representative for approval.

Should mechanical paying out not accepted, for whatever reason, the contractor shall execute paying out of the cables with the number of personnel deemed necessary by the client's representative.

The laying team shall be under the authority of a supervisor qualified for this type of work.

To execute paying out, this supervisor shall comply with the instructions given by the client's representative in charge of technical supervision of cable laying.

All necessary precautions shall be implemented during operation to prevent any deterioration of the cable; the cable shall not be subjected to any twisting around its axis, and not be bent to a radius smaller than the minimum bending radius specified by the cable manufacturer. It shall be subjected only to the traction efforts strictly required to pay it out. In no event may the cable bear against the ground or against fixed stops; it shall rest onto rollers, situated sufficiently close to one another.

The ends of two successive reel lengths shall overlap by about two meters to enable cropping the cable ends before execution of the connection sleeves.

When the client's representative estimates that paying out of cables in a single length 200 to 500 m risks generating abnormal strains in the cable, one or several looping may have to be made. A cable looping is defined as being any operation that requires previous paying out of the cable outside the channel or cableways.

When two cable courses are superimposed inside channels, each course shall be separated by means of isolating plates every 3 m.

6.7.2.4 *Tagging*

All cables laid inside channels, or on cable-tray shall carry an 8 x 5 cm Aluminum tag placed every 10 m and in specific locations such as connection sleeves, entry into and exit from ducts, possible pulling chambers.

These tags, fastened via two clamps, shall bear the labels approved by the Employer.

Tagging of cables plays a part in safety as regard identification of the cables in case of incident, and shall be made very carefully and the Contractor shall be responsible for any error or for any incident subsequent to such an error.

The tags shall be fastened right after the paying out of each reel.

- Sealing of cut- outs.
- Sealing of 33 KV cable and control cable cutouts in the station premises in the scope of work of traction contractor
- JP/EW/1B/E2 contractor shall interface with SBC for cable cutouts.
- JP/EW/1B/E2 contractor shall be responsible for sealing of unused cutouts, if any.

6.7.3 Sheath Voltage Limiter

The JP/EW/1B/E2 Contractor shall provide sheath voltage limiter.

6.7.3.1 General

In Medium Voltage power lines, three single core cables are used in place of three core cables. In the single core power transmission, the cables are usually covered with a metallic sheath to prevent ingress of moisture, protect the core from possible mechanical damage and create an earthed shield.

Unlike the three core cables, the Single core cable behaves like a transformer. The current carrying conductor of the cable acts as the primary winding and the metallic sheath as the secondary. The field of the current carrying conductor induces a voltage in the metallic sheath of the cable.

6.7.3.2 Sheath Induced voltage:

The magnitude of the EMF induced in the cable sheath is directly proportional to the magnitude of the load current carried by the conductor, the mutual inductance between sheaths of the cables, the spacing between the cables and the cable length.

$$E_s = 314. I. L \text{ volts/m}$$

E_s = Sheath Voltage.

I = Current in the conductor

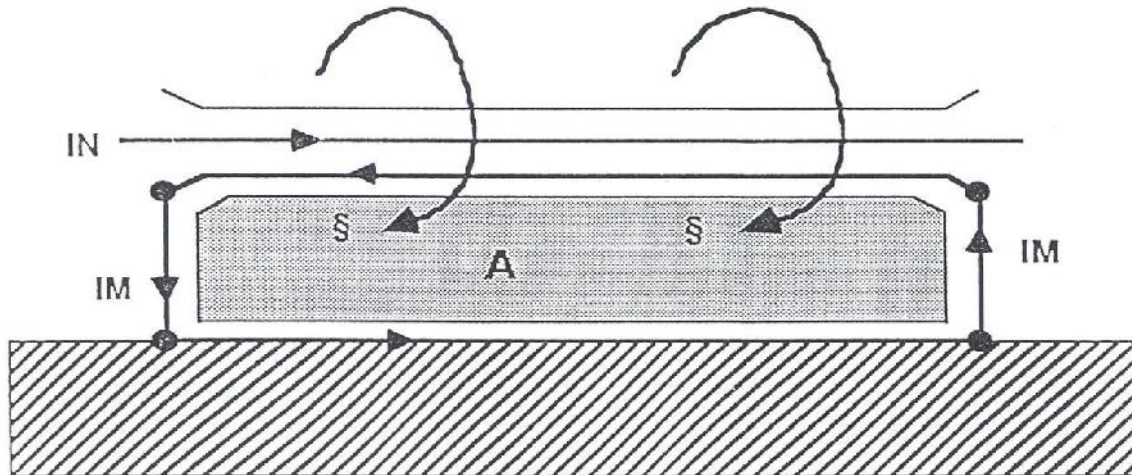
L = Mutual inductance between the sheaths of cables

This induced EMF causes a circulating current to flow in the sheath when both ends of the metallic sheath are bonded to the ground.

6.7.3.3 Circulating Currents:

Circulating currents are generated in the metallic sheaths of the cables when the cable's insulated conductor is carrying alternating current and its metallic sheath is bonded to ground at both ends. It doesn't matter what metal the layer is. If it's metal

and grounded at both ends there will be a current induced into it. The magnitude of this circulating current depends on the current in the conductor and the impedance of the loop formed by this layer and the ground path.



This sheath circulating current causes sheath-circulating losses and causes heating. In such cases, the cables must be de-rated to 70% of their normal conductor current.

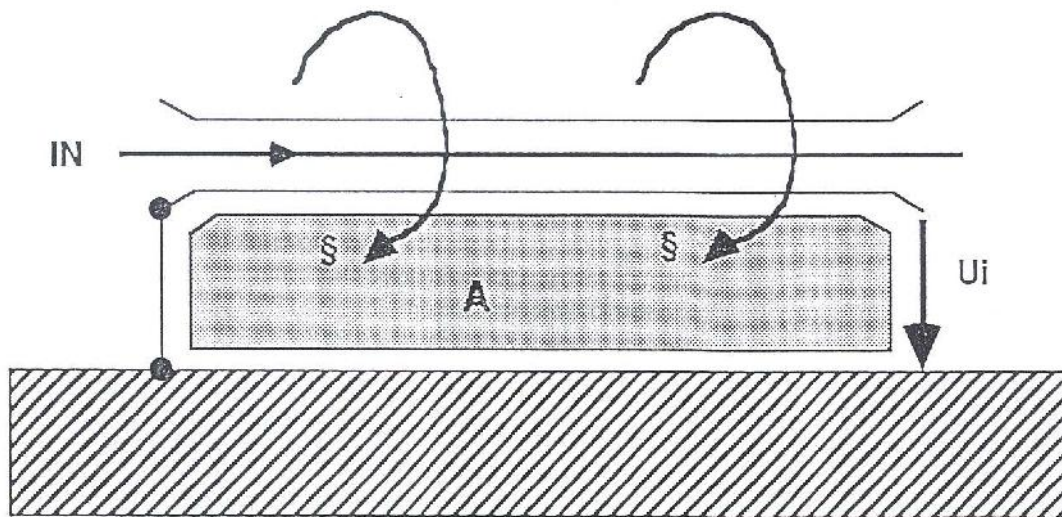
To utilize the full capacity of the cable, special bonding methods are employed.

Sheath Bonding methods:

- Single Point Bonding
- Mid Point Bonding
- Cross Bonding

6.7.3.3.1 Single Point Bonding

In single point bonding, one end of the sheath is grounded and the other end is kept floating. Usually the supply end is grounded.

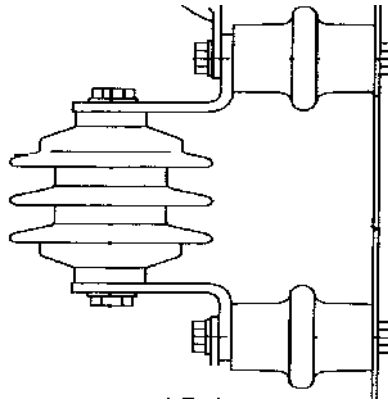


When the cable's Armour / sheath / concentric ground is floating at one end, a standing voltage will be generated on this metallic layer. The magnitude of this standing voltage is directly proportional to conductor current and to cable length. It's also proportional to the spacing between cables and how they're laid out (i.e. flat or trefoil), but current and length are the big factors. Generally standing voltage is not of concern except if the runs are long and / or conductor current is high.

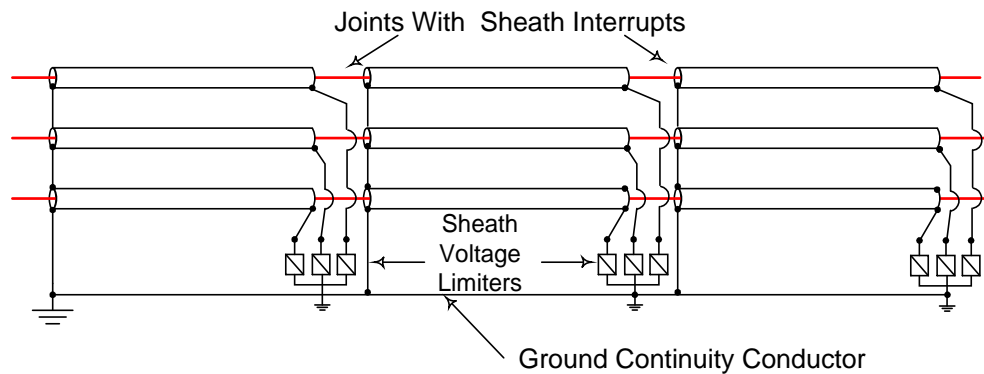
As per the earthing practices as laid down in IS 3043; Latest Version, this standing voltage should not exceed 65 Volts. Typically, Single point bonding is adopted for feeder lengths not exceeding 1km.

During installation care must be taken to ensure that cable jackets are not damaged. If they are damaged the Armour or sheath could make contact with ground along the run. This forms ground loops, which would, allow circulating currents to flow and this causes cables to overheat. Sparking and cable failures have also been observed at points where cable jackets have been damaged and these circulating currents are allowed to flow to ground.

The floating end should be insulated from the ground. A Sheath Voltage Limiter is installed at the floating end so as to ensure that sheath does not see very high voltages at the time of fault. If the sheath is damaged, moisture ingress & flow of circulating current shall happen.



For longer feeder lengths, multiple single point bonding can be carried out with a ground continuity conductor.



6.7.3.3.2 Mid point Bonding:

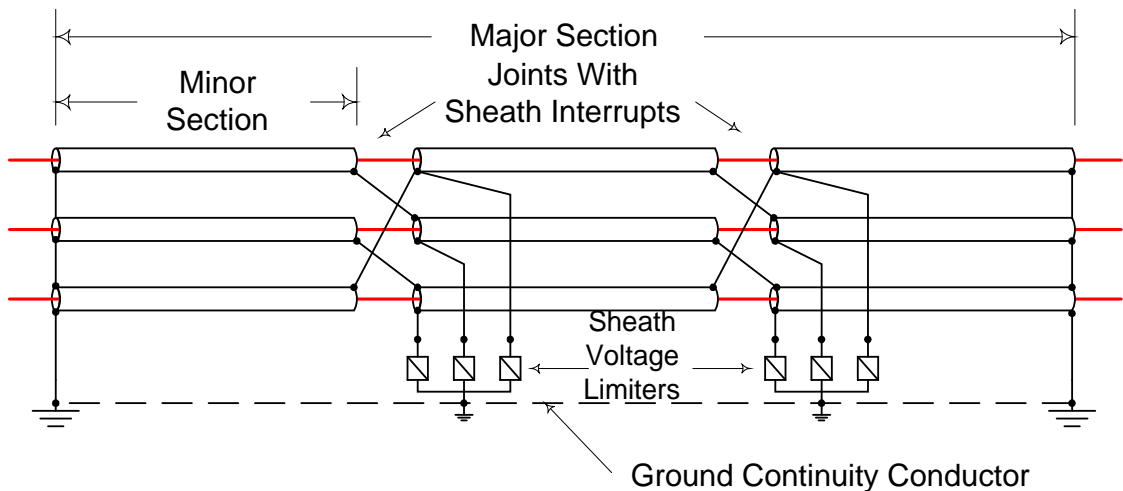
In this method, the bonding is carried out at the center of the cable feeder and the other two ends are grounded through SVL. This ensures that the sheath standing voltage is halved.

6.7.3.3.3 Cross-bonding:

For longer feeder lengths wherein the Sheath induced voltages are high, cross bonding of sheaths is to be carried out.

The sheaths are electrically transposed at every splice, reducing both currents and voltages. SVL's are needed at 2 out of 3 joint locations, and a ground continuity conductor is often installed (but not mandatory).

The sheath bonding Copper cables (3.3 kV) of appropriate size, link boxes, sheath



voltage limiters and other accessories are to be provided. The link boxes should be suitable for underground burial and shall be housed in a common bay near the jointing bay. The length of sheath bonding cables should not exceed 10 m.

Depending upon the route finally chosen, the JP/EW/1B/E2 Contractor shall prepare a design for Bonding, and shall establish that with the Bonding method adopted, the sheath voltages do not exceed the max permissible limit.

In case Cross Bonding becomes necessary, the sheaths have to be electrically transposed at every 'straight through joint' location and Sheath Voltage Limiters (SVL) may require to be provided at 2 out of 3 Joint locations. This shall be decided during the design of the Bonding method.

The JP/EW/1B/E2 contractor will be required to submit and obtain approval from DMRC for the calculation that bonding method selected by him, single point bonding/ mid point bonding/ cross bonding, ensures that the sheath voltage is limited to less than 65 V in case of ultimate full loading of cable i.e. considering short time overloading also. Generally, cross bonding is to be used if feeder length is more than 3 km.

7. LOW VOLTAGE SWITCH BOARD (LVSB)

The Low Voltage Switch Board (LVSB) is meant to provide and protect the 415 V / 240 AC Supply of the Station Building. **The LVSB will be supplied and erected by the E&M Contractor for the Stations.** The connection between the Secondary of the Auxiliary Transformers and the LVSB, in the underground stations (by means of cables or Bus duct) **will also be done by the station E & M Contractor.** The JP/EW/1B/E2 Contractor shall interface with the respective E & M Contractor to ensure that

- Adequate facilities are available at the Auxiliary Transformer Secondary side to receive cable / Bus-duct connection

- The Transformer Cubicle doors are provided with the necessary mechanical system interlock between the door, the LV Breakers and HV Breakers.
- LT CTs for differential protection

8. 110 V DC POWER SUPPLY SYSTEM

8.1 General

The 110 V DC Power required for the equipments at the ASS, shall be met from the 110 V DC Power Supply System provided at the ASS.

8.2 System Description

8.2.1 Type 1 System

The 110V DC Power Supply System shall consist of 1 Battery set and 2 battery chargers. The Battery set shall be designed to cater to the full requirement of 110 V DC power of all equipments in the ASS, with an 8-hours backup. The capacity of the battery shall be designed by the Contractor taking into account the permitted voltage tolerance of the individual loads, the power consumption of various loads, the length of time they are in operation and the manner in which they draw power. The precise capacity of battery shall be determined to ensure total autonomy of the station for 8 hours as required to retain the power supply of the standby lighting and of the control/monitoring auxiliaries in case of total failure of the AC sources. The battery capacity selected shall not be less than 180 AH, in any case. Of the 2 Battery chargers, one shall be in service normally and the other as Standby. In the case of failure of the 'In Service' battery charger, the 'Standby' battery charger shall come into service through an 'Automatic Changeover' system.

8.2.2 The automatic and manual change-over system from one source to the other, as provided shall operate as follows:

- Automatic mode:

When a circuit breaker trips by lack/absence of voltage, the system switches automatically to the other source, if this one is under voltage, by closing the coupling circuit breaker.

When the voltage comes back to the normal source then after a delay (delay is to ensure that the voltage has well come back) the system switches back automatically to the normal source by closing, first, the normal circuit-breaker, then by opening the coupling circuit-breaker. The parallel between the both sources shall be as short as possible.

- Manual mode with break:

In this mode, only two of the three circuit breakers should be closed simultaneously. It shall be necessary to open one circuit breaker before closing another one.

- Manual mode without break:

In this mode it shall be necessary to choose between which apparatuses the transfer shall be made:

- First source and coupling
- Second source and coupling

It shall never be possible to make a transfer directly between the first and the second sources.

The transfer shall be obtained by closing the circuit breaker which shall remain closed at the end of the operation. The opening of the other one shall be obtained automatically. The parallel between the both sources shall be as short as possible, but enough to ensure a good transfer.

The equipment supplied shall be highly safe and reliable; it shall be described in detail when submitting the relevant drawings (equipment characteristics, layout plan, protections, monitoring) and it shall be guaranteed to eliminate all risks of incidents which may occur during the change-over operation from one source to the other.

8.2.3 The batteries shall be of insulated pole type and wired in floating voltage mode.

In normal situation and for each normal battery-charger set, the charger shall supply the control and monitoring circuits and shall deliver the battery trickle charge. In the case of failure of the 'In Service' battery charger, the 'Standby' battery charger shall come into service through an 'Automatic Changeover' system.

In case of fade-out of the AC voltage, the battery shall immediately and without break replace the charger to ensure permanent power supply of the circuits and controls.

The entire 110 VDC distribution and the batteries shall be isolated from the earth; satisfactorily. The overall condition of this isolation shall be monitored permanently by a specific and highly reliable device.

Each battery shall also ensure supply of safety lighting as soon as appears simultaneous fade-out of the half station AC sources.

8.3 Other Technical Requirements

The fundamental demand on a DC system is that it must be robust, simple and clearly arranged.

The DC system shall be based on the following principles:

- High selectivity
- Main distribution board located adjacent to the battery room
- No common main fuse for battery
- An installation, which is free from the risk of, short-circuits between the battery and the main distribution board.

The DC system shall be earthed across a high resistance resistor, so that simple earth fault shall not cause tripping of the system.

The DC system shall be designed to allow unloading tests, boost charging and maintenance of each to be carried out during normal operation; this implies that provision shall be made for isolating the battery and the associated rectifier from the load.

Since the entire system cannot be designed so that short-circuit shall never occur, it must be provided with circuit protection, these shall provide absolute and safe selectivity, so that tripping is confined to the minimum. Only rapid protection characteristic may be used.

8.4 Equipment Specification

The following 110V DC Source equipment shall be provided in the ASS Room.

8.4.1 Battery

Batteries shall be of stationary compact, nickel-cadmium type consisting of 85 cells. They shall be maintenance free and if connection between batteries through the cables, cable shall be Fire Retardant Low smoke Type Zero Halogen. (FRLS OH) for Underground Section & fire retardant low smoke type (FRLS) for elevated section. The battery shall comply with IEC 60622/IEC 60623 & IEC 62259.

The battery protection shall be as close as possible to the battery and shall be contained in separate enclosure for negative and positive pole respectively. The enclosure shall be made of insulating material. The connection between the battery and its protection shall consist of single conductor and shall be run in such a manner so that they are protected from physical damage.

Each battery shall be connected through its own battery distribution board to the main board, and each battery section shall have its own supervisory equipment to indicate and alarm for the maximum and minimum voltage levels on float-charge and earth fault.

8.4.2 Battery Charger

AC Power Supply:

- Voltage	:	230V/415V \pm 10%
- Frequency	:	50 Hz \pm 3%
- Maximum short-circuit current	:	4000 A rms.
- Recharge to 80% of the battery capacity	:	8 hours

DC Output:

- Power supply voltage	:	110 V +0%, -15%
- Operating period after AC supply failure	:	8 hours

- Constant power drain: shall be decided by the Contractor, to deliver the full duty. The minimum capacity of the Battery shall not be less than 180AH.

Battery charger shall have the provision of Alarm in case of low battery and also have the feature of battery reverse polarity Protection. Battery charger shall have potential free contacts to indicated the status of battery charger at ASS as well as OCC through SCADA. Also potential free contacts shall be providing for giving Alarm signal to SCADA System for failure of main battery charger and Switching of the Load on the other Hot standby battery chargers. Ripple content in the out voltage in any shall not be more than 3%.

External/Internal cabling of the battery charger shall be Fire Retardent Low smoke Zero Halogen type (FRLS OH), for Underground Section & fire retardant low smoke type (FRLS) for elevated section.

Charger:

The charger shall comprise of an inlet transformer and silicon diode/thyristor or thyristor bridge.

The regulation system shall consist of plug-in modules fitted with polarization devices.

The charger shall include the following monitoring and measuring devices:

- Maximum and minimum DC voltages (threshold values to be defined)
- Charger shut-down due to an internal fault.
- General alarm for remote monitoring

The charger shall include the following control devices:

- a main On/Off switch,
- a normal/boost selector switch,
- a control deliberate discharge.

The AC and DC terminal strips shall be separated from each other.

Each battery charger shall be:

- designed to ensure operation according to the battery ratings as described below,
- installed in a sheet cabinet with feet, closed by panels.
- Ventilation shall be natural.

8.4.2.1 Characteristics

Major characteristics are described in the annexed technical sheet.

The chargers shall be diode and thyristors regulated type, wired as Graetz bridge.

8.4.2.2 *Operating and floating rates*

The voltage at the charger current output terminals shall be automatically kept within $\pm 1\%$ for variations of $+10\%$ / -15% of the AC voltage and of $+5\%$ of the frequency, whatever may be the output required.

The residual ripple ratio shall be as low as possible (less than 3,5%) so as not to disturb the various operating circuits.

Equalisation charge operation

This charge shall be able to take place up to the floating voltage within $+1\%$ under the same conditions as above.

Automatic change-over from floating to equalisation charge and conversely

Following any failure of more than five minutes of the AC supply network, the charger shall automatically revert to the charge position right upon return of the voltage and shall remain on this position throughout the time set by an adjustable timer (from 1 hour to 20 hours). After this time, the charger shall return to floating operation. The charger shall remain in floating operation if the network failure is shorter than five minutes.

Direct operation

The charger shall be capable of operating directly, without the battery, under the same conditions of accuracy as for the floating and charge modes.

Manually controlled operation

Operation in manual control shall be possible, i.e. it shall be possible to execute manual adjustment of the voltage in case of malfunction of the regulator.

Alarms

The status of all battery chargers shall be indicated at the OCC (through SCADA), as per the following convention:

Green – Healthy and in-service, Yellow – Healthy and standby, Red – Defective.

The change of status from “Healthy” to “Defective” shall be accompanied by an audible alarm/hooter, both at the ASS and in the OCC. However, if the ASS is unmanned, it shall be possible to nullify the audible alarm function at the unmanned AMS.

8.4.2.3 *Protections and monitoring*

The charger shall be fitted with the following protections installed at its rear:

- A device limiting the current output by the rectifier to its rated current value with sufficient capabilities of adjustment and possible pick-up of the set point value
- switching diodes,
- breakers with fuse elements for overall protection on the transformer primary,

- breakers with fuse elements in series with each rectifier component (diodes and thyristors).
- breakers for the various auxiliary circuits,
- an on/off switch controlling a three pole make-break switch with magneto-thermal protection on the AC circuit and a two pole make-break switch with magneto-thermal protection on the DC circuit.
- the specific protection to ensure satisfactory operation and protection of the set.

8.4.2.4 *Miscellaneous*

The battery charger equipment shall also include:

- a signalling light denoting the opening of the make-break switch on the AC side, controlled by the tripping of one of the Miniature Circuit Breaker protecting the various circuits of the apparatuses,
- a signalling light denoting the opening of the make-break switch on the DC side through actuation of the magneto-thermal relay,
- a voltmeter indicating the voltage on the AC side
- a voltmeter indicating the voltage on the DC side
- A centre-zero ammeters which shall indicate whether the battery is under charge or the battery is only delivering the load.
- the position of the various circuit-breakers and of the protection and fault relays shall be monitored through two flip-flop stages.
- An inspection light shall be fixed inside the charger compartment, which will automatically come "on" when the charger compartment is opened for inspection. This shall be independent of the "on/off" position of battery charger and shall be operative when the 415 V supply is available to the charger.

9. **110 V DC DISTRIBUTION BOARD**

9.1 **Description**

Distribution of the 110 V DC sources shall be gathered inside two specific cabinets or two halves of a single cabinet, one for each half station, called DC auxiliary IP-43.

These cabinets shall be equipped with doors, fitted with flexible seals, close via lock-bars and on which shall be installed a mimic diagram with signalling lights denoting the position of the main apparatuses.

9.2 **Equipments**

Each cabinet shall include the following (list not restrictive):

- Isolating switch/MCB
- Master power supply circuit breakers
- -

9.3 Outgoing Feeders

The outputs, protected by circuit-breaker, whose rating shall be selected according to the power of the installation services, corresponding to the distribution circuits intended to supplied.

An interlocking device prohibiting paralleling and position limit switches of the main apparatuses shall also be provided.

Bus bar of DCDB shall be Electrolytic copper with heat shrinking sleeves. Internal cabling/wiring of DCDB shall be Fire retardant low smoke Zero halogen type (FRLSOH) for underground section and fire retardant low smoke type (FRLS) for elevated section. Wiring of suitable sizing shall be selected to carry the full load current. MCB shall be selected for providing discrimination between incoming and outgoing feeders.

9.3.1 AC Distribution Board

For providing AC 415 V supply, AC Distribution Board shall be provided in the ASS. Incoming feeders of ACDB shall be provided with earth leakage circuit Breakers along with MCCB/MCB. Bus Bar MCB for all the feeders shall be sufficiently rated to provide the overloading and short circuit protection. Bus Bar of ACDB shall be electrolytic copper with heat shrinking sleeves. Internal cabling/wiring of ACDB shall be Fire retardant low smoke Zero halogen type (FRLSOH) for underground section and Fire retardant low smoke type (FRLS) for elevated section. Minimum Clearance between Phases and Earth/Neutral shall be 20 mm

Minimum IP rating of ACDB and DCDB shall be IP-43.

10. EMERGENCY TRIPPING SYSTEM - FOR UNDERGROUND SECTION

Every ETS Box consists of a unit which is fire protected and with a breakable glass, containing the emergency push button.

ETS Box will be cabled to the nearest PLC/RTU.

Emergency Trip System will house a blue location indicating light and a heavy duty telephone handset providing that any emergency conditions to push the button or for any other de-energising the request to call OCC. Telephone is a hot line telephone with heavy-duty handset. Each ETS box shall have 3-cable entrance for the following cable:

- Power supply Cable
- PLC/RTU Cable
- Telephone Cable

Some Technical specifications of ETS station are as follows :-

- Fire Protected Cover.
- Heavy duty telephone hand set
- Blue locations – indicating light and emergency push button
- Wall mounted ETS Box of approximate dimension 500 x 350 x 225 mm (Height x Width & depth)

- There will be no infringement of ETS Boxes with the moving dimensions of the Rolling Stock.
- Blue indication light shall be projected for easy visibility from a distance along track.
- Dual Lamp

NFPA – 130 (Fire Protection Standards for fixed guide wall transit system requirement will be considered for emergency trip system.)

Telephone line (hot line) for heavy-duty telephone hand set will be provided by S&T Contractor.

ETS Boxes will be placed at the following locations: -

- End of Platforms
- Station Control Room (SCR)
- Cross passage in each tunnel

Each ETS Station Boxes will be cabled to the nearest PLC/RTU. It means that each button on the ETS station will be digital input (DI) signal for the PLC/RTU. The ETS thus will be termed as addressable. The distance of the breakers to be tripped will be taken by the SCADA software centrally. This solution provides the quickest mechanism to transmit commands to a certain number of breakers simultaneously via different PLC/RTUs. Supply and erection of PLC/RTU will be in the Scope of JP/EW/1B/E2 Contractor.

The SCADA shall proceed through a predetermined programme of operation of circuit breakers and interruption to de-energize the OCS section where ETS plunger is activated and one section behind in the direction of train travel (in some cases). The work of SCADA from RTU on wards will be in scope of JP/EW/1B/E2 Contractor. The supply and erection of cables, ETS and any other material to complete the work is in Scope of JP/EW/1B/E2 contractor. Any equipment interface, device required for making operational the ETS system should be provided by JP/EW/1B/E2 contractor.

ETS cable system being an item of vital nature shall be protected from physical damage and shall be capable of withstanding temperature upto 950° C for 3 hour and in that condition not support combustion (category C - BS 6387).

11. PROTECTIONS

11.1 General Definition

The purpose of the protection equipment is to ensure insulation or de-energising of equipment whose operating conditions have become abnormal to avoid:

- Any major repercussions on the traffic
- Any damages or dangerous effects on person and equipment.

The Contractor shall supply and install the protection system as stipulated in this TS. The protection system based on modular sets must comply with a high performance standard.

- Safety of operation
- Safety is ensured by the means of:
- Cyclic self test ensuring general supervision on software of equipment.
- In case of fault, a watchdog is activated.
- All of inputs are insulated in galvanic and capacitive view and complemented

11.2 Performances required

The protection system shall deploy numerical relays and shall comply with a high performance standard regarding:

11.2.1 Reliability

This criterion defines the mean time between failures (MTBF) which has to be calculated for about 10 years.

11.2.2 Maintainability

This criterion represents the mean time for repairing (MTTR) and has to be considered only by replacement of faulty function or sub assembly.

The MTTR does not exceed 2 hours not including the dead time to reach the site.

11.2.3 Availability

This is expressed in terms of ratio using the formula:

$$\frac{MTBF}{MTBF + MTTR} \%$$

And has to represent a level of 99.95 %.

11.2.4 Safety of operation

Safety is ensured by the means of:

- Cyclic self test ensuring general supervision on software of equipment.

In case of fault, a watchdog is activated.

- All of inputs are insulated in galvanic and capacitive view and complemented.

11.2.5 Electro magnetic compatibility

Due to the consequent interference levels in the premises, protection equipment has to present sufficient level of immunity defined by the following standards:

- IEC 61000.4-2 Class 3,
- IEC 61000.4-4 Class 4,

- IEC 61000.4-5 Class 3.

Such criteria shall be obtained by using either digital type relays or specific PLC cards.

11.3 Description of Protection

11.3.1 Relays

11.3.1.1 General Description

All relays shall conform to the requirements of IS:3231/IEC-60255/IEC61000 or other applicable standards. Relays shall be suitable for flush or semi-flush mounting on the front with connections from the rear. Protection facilities with fast discrimination and reliable operation, base on micro-processor technology, shall provide the protection scheme logic

11.3.1.2 Draw-out / Plug-in Type

All protective relays shall be in draw out or plug-in type/modular cases with proper testing facilities. Necessary test plugs/test handles shall be supplied loose and shall be included in contractor's scope of supply.

11.3.1.3 Operation Voltage / Current

All AC operated relays shall be suitable for operation at 50 Hz. AC Voltage operated relays shall be suitable for 110 Volts VT secondary and current operated relays for 1 amp CT secondary. All DC operated relays and times shall be designed for the DC voltage specified, and shall operate satisfactorily between 80% and 110% of rated voltage. Voltage operated relays shall have adequate thermal capacity for continuous operation.

11.3.1.4 Auxiliary Relays / Contacts

The protective relays shall be suitable for efficient and reliable operation of the protection scheme described in the specification. Necessary auxiliary relays and timers required for interlocking schemes for multiplying of contacts suiting contact duties of protective relays and monitoring of control supplies and circuits, lockout relay monitoring circuits etc. also required for the complete protection schemes described in the specification shall be provided. All protective relays shall be provided with at least two pairs of potential free isolated output contacts. Auxiliary relays and timers shall have pairs of contacts as required to complete the scheme: contacts shall be silver faced with spring action. Relay case shall have adequate number of terminals for making potential free external connections to the relay coils and contacts, including spare contacts.

11.3.1.5 Reset

All protective relays, auxiliary relays and timers except the lock out relays and interlocking relays specified shall be provided with self-reset type contacts. All protective relays and timers shall be provide with externally hand reset positive action operation indicators with inscription. All protective relays which do not have

built-in hand-reset operation indicators shall have additional auxiliary relays with operation indicators (Flag relays) for this purpose. Similarly, separate operating indicator (auxiliary relays) shall also be provided in the trip circuits of protections located outside the board such as Buchholz relays, oil and winding temperature protection, sudden pressure devices, fire protection etc

11.3.1.6 Timers

Timers shall be of solid state type. Time delay in terms of milliseconds obtained by the external capacitor resistor combination is not preferred and shall be avoided

11.3.1.7 Denergisation of Control Relays

No control relay which shall trip the power circuit breaker when the relay is de-energised shall be employed in the circuits.

11.3.1.8 Isolation of Trip Circuit for Testing

Provision shall be made for easy isolation of trip circuits of each relay for the purpose of testing and maintenance

11.3.1.9 Shunt / Series Relays

Auxiliary seal-in-units provided on the protective relays shall preferably be of shunt reinforcement type. If series relays are used the following shall be strictly ensured:

- a) The operating time of the series seal-in-unit shall be sufficiently shorter than that of the trip coil or trip relay in series with which it operates to ensure definite operation of the flag indicator of the relay.
- b) Seal-in-unit obtain adequate current for operation when one or two relays operate simultaneously.
- c) Impedance of the seal-in-unit shall be small enough to permit satisfactory operation of the trip coil on trip relays when the D.C. Supply Voltage is minimum.
- d) Trip-circuit seal-in required for all trip outputs, irrespective of the magnitude of the interrupted current. The trip-circuit seal-in logic shall be only seal-in the trip output(s), but also the relevant initiation signals to other scheme function, (e.g. initiate signals to the circuit-breaker failure function, etc.) and the alarm output signals.
- e) Two methods of seal-in are required, one based on the measurement of AC current, catering for those circumstances for which the interrupted current is above a set threshold, and one based on a fixed time duration, catering for those circumstances for which the interrupted current is small (below the set threshold).
- f) For the current seal-in method, the seal-in shall be maintained until the circuit breaker opens, at which time the seal-in shall reset and the seal-in method shall not now revert to the fixed time duration method. For this seal-in method, the sealing shall be maintained for the set time duration. For the line protection

schemes, this time duration shall be independently settable for single and three-pole tripping.

- g) Seal-in by way of current or by way of the fixed duration timer shall occur irrespective of whether the trip command originates from within the main protection device itself (from any of the internal protection functions), or from an external device with its trip output routed through the main protection device for tripping.

Trip-circuit seal-in shall not take place under sub-harmonic conditions (e.g. reactor ring down).

11.3.1.10 Spare Pair of Contacts

All protective relays and alarm relays shall be provided with one extra isolated pair of contacts wired to terminals exclusively for future use.

11.3.1.11 Setting Ranges

The setting ranges of the relays offered, if different from the ones specified shall also be acceptable if they meet the functional requirements.

11.3.1.12 List of Installations using the types of Relays

The bidder shall include in his bid a list of installations where the relays quoted have been in satisfactory operation.

11.3.1.13 Phase Indications

All relays and their drawings shall have phase indications as R-red, Y-yellow and B-blue

11.3.1.14 Scope of Numerical Relays

For numerical relays, the scope shall include the following:

- a) Necessary software and hardware to up/down load the data to/from the relay from/to the personal computer installed in the substation. However, the supply of PC is not covered under this clause.
- b) The relay shall have suitable communication facility for connectivity to SCADA.

11.3.1.15 Communication Ports

The relays should have communication ports for local communication for relay settings, modifications, extraction and analysis of fault/event/ disturbance records from a laptop and for communication.

11.3.1.16 Facilities for fault analysis

The relays shall have the following tools for fault diagnostics

- a) Fault record

The relay shall have the facility to store fault records with information on cause of trip, date, time, trip values of electrical parameters.

b) Event record

The relay shall have the facility to store time stamped event records with 1 ms resolution.

c) Disturbance records

At least 5 secs of disturbance records shall be provided in the offered Numerical relays. Each record shall store data from at least 5 analogue channels and 16 digital channels. The data from DR function shall be available in IEEE/COMTRADE format and shall be compatible with the relay test kit being supplied under this contract.

11.3.2 Zones of Protection

11.3.2.1 The zones of protection shall overlap providing back-up protections. The scheme of protection shall be fully coordinated with the infeed network from DMRC.

11.3.2.2 The Contractor shall ensure proper coordination among different level of protection being applied in the design such that equipment failures will cause minimum disruption to the Railway System operation.

11.3.2.3 An interlocking and protection scheme that prevents inadvertent operation of switchgear resulting in electrical accident by inadvertent or spurious re-energisation of the supply shall be submitted to the Engineer's Representative for review and approval.

11.3.2.4 Any 33kV cable or switchgear faults in the 33kV ring-main system will be cleared first by incoming feeder panel circuit breaker and backup by the outgoing 33kV feeder circuit breaker at RSS side.

11.3.2.5 To detect the location of the fault in the 33kV ring-main system, a detection relay shall be installed for all 33kV feeder panels at each ASS which will send to the OCC an indication that it detects a fault. This will be seen on the screen of the OCC Equipment and the fault could be located between the last relay detecting the fault and the first relay not detecting the fault. With these indications, the operator will be able to take the necessary measure to isolate the faulty section and to Reenergize the healthy part of the network.

11.3.3 Hydraulic or thermal protections

These protections, such as lack of pressure or abnormal temperature, shall include measuring elements situated on the protected apparatus, actuating a contact (mandatory of flip-flop type) which represents the start of the protection line.

11.3.4 Electrical protections

11.3.4.1 *Protections through lack of monitoring voltage*

Each cut-out apparatus shall include a device controlling its opening and preventing it from any re-closing in case of lack of monitoring voltage.

11.3.4.2 *Protections through lack of AC voltage*

Ensured by means of phase - phase voltage measurements with adjustable threshold, possibly associated to time delay, adjustable as well. The measurement shall be supplied from the secondary of the voltage transformers.

11.3.4.3 *Protection against phase-phase short-circuits*

Ensured by means of current relays (primary current measurement relays with adjustable threshold, associated to time delay also with adjustable threshold). The current relay shall be supplied from the secondary of the current transformers.

11.3.4.4 *Over current protections*

This function ensures the tripping of concerned circuit breaker when the current values reach the highest allowable load on the network in instantaneous or delayed time conditions.

Following the network configuration, pre-set tripping thresholds could be commuted via automatic interlocking or voluntary action.

Tripping curves characteristics could be:

- At constant time,
- At dependant time following a characteristic:
 - Inverse,
 - Very inverse,
 - Extremely inverse.

11.3.4.5 *Protection against zero sequence faults*

At the output level, these shall be ensured by means of zero sequence current measuring relays (obtained through associating of the currents from the current transformers). These relays shall not be affected by the capacitive currents in the cables during unbalanced operating times which occur on the power supply (such as earthing fault of the other cables, etc.).

11.3.4.6 *Differential protections*

Based on the instantaneous comparison, for each phase between the bar set or transformer incoming current and outgoing current, through current transformers.

11.3.4.7 *Synchro-coupler relay*

This relay shall ensure the authorisation of closing a coupling apparatus. Its own functioning shall be into service only in the case of voltage presence on the both parts of the coupling apparatus.

When into service, it shall compare the phase, the frequency and the voltage of the both sources to be coupled.

Phase difference, frequency difference and voltage difference shall be settable.

11.3.5 Staging of the protections

Selectivity of the protection arrangements shall be provided so as to avoid all unwanted tripping.

The time delay of the various circuit breakers shall be set so as to ensure chronological selectivity of the tripping.

The supplier shall define precisely the minimum intervals between the various protection stages, accounting for the timings and for the actuation times of each one of the apparatus involved.

To avoid unwanted tripping, it shall be necessary, in particular, to account for transient phenomenon such as energising of transformers and engagement of cables.

11.4 33 kV Cable Protection

The entire 33 kV Cables Network shall be protected by means of Line Differential protection with Pilot wires, which will automatically trip the 33 kV Circuit Breakers on either end of the faulty Section of the Cable. Line Differential protection with Pilot wires shall also be provided for the Section of 33 kV cables between ASS1/ASS2 and ASS3 at the Underground Station. In addition not limited to, Instantaneous and IDMT Overcurrent and Earthfault protection (50, 50N, 51, 51N) shall be provided, Over Current relay with Directional/Non Direction as required , to ensure that the network is fully protected against any faults on the 33kV Ring Main Network. Therefore, the functioning of these protections shall trip the either end of circuit breaker of 33kV power supply network.

11.5 ASS Equipment Protection

11.5.1 Transformer protection

The transformer is protected against fault by the followings

- F 50: Instantaneous over current protection
- F 51: Time delayed over current protection
- F50 N: Instantaneous earth fault protection (zero sequence)
- F51 N: Time delayed earth fault protection (zero sequence)
- 87T Transformer Differential protection
- 51G Standby earth fault protection
- 64 : REF Protection (For UG and Depot ASS)

For Transformer differential protection, the JP/EW/1B/E2 Contractor shall provide the required Current Transformers in MV panels. In addition, the control cables between the MV breakers and LV Breakers shall also be provided by the JP/EW/1B/E2 Contractor. The necessary C&M cables for Transformer shall be supplied and installed by the JP/EW/1B/E2 Contractor. The E&M Contractor will provide the LT side CT. The E&M Contractor shall also interface with JP/EW/1B/E2 Contractor for matching

and Accuracy Class the CT characteristics to ensure tripping of HT and LT breakers in case of Transformer fault within the zone of protection.

The functioning of these protections shall trip the MVCB & corresponding LVCB.

Moreover, it shall be protected against heating by a two threshold temperature protection.

The first threshold shall transmit an alarm to the ECC as well as in the ASS.

The second threshold shall trip the respective MVCB and corresponding downstream LVCB and transmit an alarm to the ECC.

11.5.2 Low voltage protection

The low voltage circuit breaker supply and installation by the E&M Contractor shall be equipped with magneto-thermal protection to protect the main circuit against short-circuit, over-current and earth fault. This protection shall be thermal compensated to take into account the ambient temperature. This protection shall be equipped on the LVCB1 and LVCB2. The tripping of LVCB1 or LVCB2 shall also ensure tripping of the corresponding HV side breaker of the transformer (MVCB1 or MVCB2), by inter-tripping.

The selectivity shall take into account the time delay and the current level of the downstream protections.

12. LOW VOLTAGE CABLES AND WIRING

This specification is made to define the characteristics of low voltage cables used for distribution, control and monitoring. They shall be supplied either in A.C. or in D.C. They shall be used for electrical connection between apparatuses of RSS, TSS, SSP, AMS and ASS.

All LV cables, Control and Monitoring cables shall be Fire Retardant Low Smoke Zero Halogen Type (FRLSOH) for Underground section and Fire Retardant Low Smoke Type (FRLS) for Elevated section complying with BS 6724 for cables, BS 7211 for Wires.

12.1 General

Conductors supplied for low voltage or remote control lines shall have a bare or tinned copper core.

Semi flexible conductors shall be used; rigid conductors shall be prohibited.

The conductors' cross-section shall be a standard value, and shall never exceed 240mm^2 ; above this value, the appropriate number of conductors shall be connected in parallel.

The minimum cross-section of conductors shall not be less than 1.5 mm^2 .

The voltage rating of distribution cables shall be 1100 as per IS 7078 part-1 Volts.

Grounding conductors shall have green/yellow-stripped insulation.

Neutral conductors are to be deemed as being active conductors.

Cables and wires shall be treated to withstand flames propagation.

12.2 Cable Cross Section Determination

Determining the technical core section of a cable implies determining the smallest standard cross-section in the type of cable selected which, under the applicable environmental conditions, could satisfy the following criteria:

- (i) Normal temperature rise
- (ii) Maximum voltage drop
 - 3% for main distribution lines (between primary and secondary cabinets)
 - 3% for lighting circuits
 - 5% for power circuits
 - 12% for motor circuits during start-up
- (iii) Overload and short-circuit
- (iv) Protection against indirect contact
- (v) If heavy currents are to be carried, the economic section must also be taken into account.

12.3 Standards

All cables shall comply with the IEC standards (IEC 288 and IEC 227) in force and shall, at least, have satisfied the following tests:

- Dielectric strength,
- Insulation resistance,
- Core resistance,
- Flash-over voltage,
- Insulation stability in a conductive environment,
- Capacitance and differential capacitance,
- Smoke opacity: NBS chamber test,
- Combustion gas analysis,
- Calculation of conventional pollution index,
- Calculation of the conventional toxicity index,
- Measurement of insulation and cladding thickness
- Measurement of diameters,
- Composition and dimensions of the conductive cores,
- Cable construction and identification of cores,

- Tensile properties of insulating and protective cladding mixtures,
- Thermal aging of insulation and protective cladding mixtures,
- Resistance of insulation and cladding materials to pressure at high temperature,
- Resistance of cladding to mineral oils,
- Resistance of cladding to acids and alkalis,
- Resistance of protective cladding to tearing,
- Core bending,
- Coiling at low temperature.

And for the corresponding cables:

- Category C 2 cables (non-flame propagating),
- Category C 1 cables (non-fire propagating),
- Category CR1 cables (Fire-resistant cables).

12.4 Identification

All conductors, cables, wiring, terminals and apparatuses shall be identified according to the indications of the diagrams.

This identification shall be placed so as to be easily read from the accessible face of the cable or wiring

In all structures, cables shall be marked both at their ends and approximately every 20 meters over their full length, particularly when they change of direction, enter conduits, etc.

Along the track, cables shall be identified in the pulling chambers and at their ends.

The identification shall be realized with Tag-Holder providing the following guarantees:

- Easy fastening,
- Non flammable,
- Permanence of the marking
- Easy reading.

The tag-holder and its bi-directional marking type shall be submitted to the employers approval.

12.5 Connections

All connections, whether made by end-fittings, sleeves or terminals, shall comply with good trade practice.

The connection terminal blocks supplied by the contractor shall be identified and includes space enabling precise referencing of all terminals, also possessing all guarantees of permanence and fastening.

The crimped section of cables shall be insulated by heat-retractable sleeve.

The screen of screened cables shall be connected to ground and continuity shall be ensured.

12.6 Cable laying

In general, the cable laying shall comply with the principle of separation between the control and monitoring circuits and the auxiliary circuits of the building (lighting, power, and miscellaneous auxiliaries).

The routings and supports of the two circuit networks shall be wholly separated.

Depending on the room gone through and the runs used by the equipment wiring and links, their purpose (supply or distribution of the auxiliary circuit cabinets) or the nature of the specific element concerned (wiring, frame), several different arrangements may be selected to carry the cables and wires, however, in all cases, good care has to be taken to avoid contact between conductors and sharp edges of sheets, iron, ... etc.

Systematically, for control and monitoring cables, all the links of a section shall include 15% spare conductors with at least one spare conductor per cable.

12.6.1 Supports

12.6.1.1 *Cable-ways of Perforated Sheet*

This shall be the normal laying mode of the link conductors.

It shall be used systematically along wiring runs necessitating special mechanical protection, precaution or when it is necessary to carry several cable-way levels inside limited space.

Their width shall be defined to enable addition of at least 15% of the number of the cables initially foreseen.

In general, when sheets shall be superimposed, the clear heights between one another shall be defined so as to provide perfect accessibility to the cable layers they carry.

All necessary arrangements shall be taken to enable addition or possible replacement of a conductor in a layer and, consequently, to enable its pulling. Several superimposed layers of cables may use the same support sheet but superimposition shall be limited to cables of the same section. If crossings are required between cables or layers coming from different sections, a metal element shall be placed between the layers in way of the crossing. The extent and number of the fastening fittings shall be determined so as to avoid all distortions between rests. The anchoring process of the fittings shall be suited to the supporting element concerned.

12.6.1.2 *Cable-way on Fittings or Bridges*

This arrangement shall be used only for small layers, not justifying the use of slabs.

The fittings or bridges shall be sized accounting for possible addition of 15% additional cables.

One independent fitting shall be provided per set of conductors coming from a same section; in no event may conductors coming from different sections be fastened to a common fitting or bridge.

The number of fittings or bridges shall be determined so as to avoid all cable scalloping between fastenings.

12.6.1.3 *Insulating tubes*

When conductors are gathered in strands, they may be laid inside an insulating tube. This solution may be used only for short runs.

12.6.1.4 *Metal Tube*

Certain circuits may have to be protected by means of rigid steel tubes or flexible metal tube; all the necessary precautions shall be taken to insulate the fastening so as not to cause contacts between masses of different categories. These metallic tubes shall be properly earthed.

12.6.2 **Fastening of Cables and Conductors to their Supports**

Fastening of the cables to their supports, whether perforated steel, fittings or bridges, shall be made by means of loosening-proof clamps made of flexible insulating material and by mean of mechanical tightening.

If several cables of the same section use a common horizontal run, they shall be able to be gathered and clamped by the same fastening clamp.

Fastening of conductors shall always be provided immediately next to their connection ends. In no event may connection to a terminal block be deemed as being fastening and permanent strain may be exerted on the terminals.

12.6.3 **Mechanical Protection of Cables and Conductors**

In all cases when the layout of the conductors of bar set of the earthing circuits could render them vulnerable (floor crossings, vertical layers or horizontal crossings through service passages), the necessary mechanical protection for the cables and conductors shall be ensured.

These protections shall show sufficient strength to prevent any damage to the cables and conductors following impacts, which may occur during equipment handling operations; they shall also possess good resistance against corrosion.

For vertical layers, the contractor shall ensure supply and installation of sheet casing ensuring efficient protection up to a height of 2 meters above ground. In case of single or limited number of conductors a spare tube shall always be laid.

Whenever LV cables or conductors are placed along a run adjacent to or crossing MV cables, full steel protection on the LV cables shall be provided.

It shall enable possible pulling of the MV cables without risking to damage the insulating material of MV cable.

This metal protection shall be connected to the nearest LV earthing collector and shall ensure electrical protection in the event.

All cable trays and supports shall be suitably connected to Earthing system at two distinct and separate points.

13. INTERFACE WITH SCADA EQUIPMENTS

13.1 The various equipments provided in the ass shall be controlled and monitored by a Centralized Control Centre (OCC) installed at designated place. The necessary Supervisory Operation Control and Data Acquisition system (SCADA) including the Remote Terminal Units (RTU) at the ass will be provided by the JP/EW/1B/E2 contractor. The following works shall be in the scope of JP/EW/1B/E2 contractor

- Supply and installation of Interface Marshalling box in the Underground ASS's. The Marshaling Box shall provide for the input signal connections, including those from analog meters, from field equipments and the output signal connections to the field equipments. In addition, the Marshalling Box shall provide for the necessary connection from/to the RTU's. The Marshalling box shall provide facilities for interconnection between the signals to/from RTU and signals from/to the field units.
- The connection between the Marshalling box terminals and the field equipment terminals, via copper cables, shall be made by the JP/EW/1B/E2 Contractor. JP/EW/1B/E2 Contractor shall tag the either end/ of the cable with proper notification. All the connections between the Marshalling box terminals and the RTU and interconnection between the terminal blocks of the Marshalling Box, will be made by the JP/EW/1B/E2 Contractor.
- Details of SCADA specifications are provided in chapter 8 part D of this Technical specifications.
- The tentative I/O list for ASS (Underground) is shown below,

Sr. No.	Device	Event Description	Event Type			Alarm Class	Event Text	
			Digital Input	Digital Output	Analog Input		Normal State	Alarm State
1	Circuit Breaker (Incomer)	Local/Remote in Local	DI			P1	Remote	Local
2		Permission for Local Control	DI			P1	Banned	Permitted
3		110V DC Control Voltage Fail	DI			P2	Normal	Fail
4		Close Indication	DI			P0	Close	

Sr. No.	Device	Event Description	Event Type			Alarm Class	Event Text	
			Digital Input	Digital Output	Analog Input		Normal State	Alarm State
5		Open Indication	DI			P0	Open	
6		CB in Test/Service	DI			P2	Service	Test
7		CB Trip Circuit Unhealthy	DI			P3	Normal	Unhealthy
8		Trip Relay Operated	DI			P2	Normal	Operated
9		Spring Discharged	DI			P1	Charged	Discharged
10		Open Command		DO				
11		Close Command		DO				
12		SCADA Permissive For Local Control		DO				
13		O/C & E/F Relay faulty	DI			P3	Normal	Faulty
14		O/C Protection Operated	DI			P2	Normal	Operated
15		E/F Protection Operated	DI			P2	Normal	Operated
16		Reset of Master Trip Relay		DO				
16	PT	R-Y Voltage			AI			
17		Y-B Voltage			AI			
18		B-R Voltage			AI			
19	EIS	Close Indication	DI			P0		
20		Open Indication	DI			P0		

Sr. No.	Device	Event Description	Event Type			Alarm Class	Event Text	
			Digital Input	Digital Output	Analog Input		Normal State	Alarm State
21	Cable fault Detection	Pilot Wire Relay Communication Fail	DI			P3	Normal	Faulty
22		Pilot Wire Operated	DI			P2	Normal	Alarm
23	Circuit Breaker (Outgoing)	Local/Remote in Local	DI			P1	Remote	Local
24		Permission for Local Control	DI			P1	Banned	Permitted
25		110V DC Control Voltage Fail	DI			P2	Normal	Fail
26		Close Indication	DI			P0	Close	
27		Open Indication	DI			P0	Open	
28		CB in Test/Service	DI			P2	Service	Test
29		CB Trip Circuit Unhealthy	DI			P3	Normal	Unhealthy
30		Trip Relay Operated	DI			P2	Normal	Operated
31		Spring Discharged	DI			P1	Charged	Discharged
32		Open Command		DO				
33		Close Command		DO				
34		SCADA Permissive For Local Control		DO				
35		O/C & E/F Relay faulty	DI			P3	Normal	Faulty
36		O/C Protection Operated	DI			P2	Normal	Operated
37		E/F Protection	DI			P2	Normal	Operated

Sr. No.	Device	Event Description	Event Type			Alarm Class	Event Text	
			Digital Input	Digital Output	Analog Input		Normal State	Alarm State
		Operated						
38		Reset of Master Trip Relay		DO				
39	PT	R-Y Voltage			AI			
40		Y-B Voltage			AI			
41		B-R Voltage			AI			
42	EIS	Close Indication	DI			P0		
43		Open Indication	DI			P0		
44	Cable fault Detection	Pilot Wire Relay Communication Fail	DI			P3	Normal	Faulty
45		Pilot Wire Operated	DI			P2	Normal	Alarm
46	MVCB (Transformer Protection Breaker)	Local/Remote in Local	DI			P1	Remote	Local
47		Permission for Local Control	DI			P1	Banned	Permitted
48		110V DC Control Voltage Fail	DI			P2	Normal	Fail
49		Close Indication	DI			P0	Close	
50		Open Indication	DI			P0	Open	
51		CB in Test/Service	DI			P2	Service	Test
52		CB Trip Circuit Unhealthy	DI			P3	Normal	Unhealthy
53		Trip Relay Operated	DI			P2	Normal	Operated
54		Spring Discharged	DI			P1	Charged	Discharged

Sr. No.	Device	Event Description	Event Type			Alarm Class	Event Text	
			Digital Input	Digital Output	Analog Input		Normal State	Alarm State
55		Open Command		DO				
56		Close Command		DO				
57		SCADA Permissive For Local Control		DO				
58		O/C & E/F Relay faulty	DI			P3	Normal	Faulty
59		O/C Protection Operated	DI			P2	Normal	Operated
60		E/F Protection Operated	DI			P2	Normal	Operated
61		Transformer differential Protection operated	DI			P2	Normal	Operated
62		Reset of Master Trip Relay		DO				
63		Transformer differential relay faulty	DI			P3	Normal	Faulty
64		REF Protection operated	DI			P2	Normal	Operated
65		REF Relay Faulty	DI			P3	Normal	Faulty
66	TEIS	Close Indication	DI			P0		
67		Open Indication	DI			P0		
68	Transformer	Winding Temp High Alarm	DI			P3	Normal	Alarm
69		Winding Temp High	DI			P3	Normal	Trip

Sr. No.	Device	Event Description	Event Type			Alarm Class	Event Text	
			Digital Input	Digital Output	Analog Input		Normal State	Alarm State
		Auto Trip Alarm						
70		Transformer Door Open	DI			P3	Normal	Open
71	Gas Compartments (individual signal for each compartment)	SF6 Gas pressure low Alarm – compartments 1, 2, 3, 4.....	DI			P2	Normal	Low
72		Not used						
73	Isolator of each bay.(Individual signal for each isolator)	Open command		DO				
74		Close command		DO				
75		Open indication	DI			P0		
76		Close indication	DI			P0		
83	Bus Voltage	R-Y Voltage			AI			
84		Y-B Voltage			AI			
85		B-R Voltage			AI			
86	AC DB	Lack of 415 Voltage	DI			P1	Normal	Alarm
87	DCCB	Lack of 110 Voltage	DI			P2	Normal	Alarm
88	Battery Charger	Charger Status	DI			P1	Normal	Standby
89		Float/Boost	DI			P2	Float	Boost
90		Input MCB Trip	DI			P2	Normal	Trip
91		AC Fail	DI			P2	Normal	Fail

Sr. No.	Device	Event Description	Event Type			Alarm Class	Event Text	
			Digital Input	Digital Output	Analog Input		Normal State	Alarm State
92		Charger Fail	DI			P2	Normal	Unhealthy
93		DC Under Voltage	DI			P2	Normal	Alarm
94		DC Over Voltage	DI			P2	Normal	Alarm
95		Output MCB Trip	DI			P2	Normal	Trip
96		Battery Output Voltage			AI			

CHAPTER 8 – PART B

Auxiliary Network (Underground)

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1. 33KV GIS CRICUIT BREAKER**1.1 MVCB (FOR TRANSFORMER PROTECTION)**

Sr. No.	INDICATIONS	U	Values Required
1	Manufacturer		
2	Place of manufacture		
3	Standards		IEC 60694, 62271-100, 62271-102, 62271-200
A	CUBICLE		
1	- Class		Indoor
2	- Rated insulation voltage	kV	36
3	- Rated operating voltage	kV	33
4	- Rated frequency	Hz	50
5	- Rated short time duration power frequency withstand voltage	kV r.m.s.	70
6	- Rated lightning impulse withstand voltage	kV peak	170
7	- Cubicle rated current	A	1250
8	- Bar set rated current	A	1250
9	- Allowable overcurrent for 1 second	kA r.m.s.	25
10	- Instantaneous overcurrent	kA peak	62.5
11	- Number of flip-flop contacts for circuit-breaker plugging-in and plugging-out monitoring	minimum	
12	- Number of flip-flop contact for earthing isolator open/closed position monitoring	minimum	
13	- Number of flip-flop contacts for isolator open/closed position monitoring	minimum	

Sr. No.	INDICATIONS	U	Values Required
14	- Approximate dimensions of the cubicle - Width - Depth - Height - Depth with circuit-breaker plugged-out	mm mm mm mm	600 1330 2400
15	- Protection degree		IP65 for HV, IP 3X for LV
16	- Earthing isolator making capacity	kA	
17	- Overall dimension drawing number		

	INDICATIONS	U	Values Required
	2) CIRCUIT-BREAKER/ INTERRUPTER (Vacuum Type)		
	Three pole type		
1	- Rated insulation voltage	kV	36
2	- Rated operating voltage	kV	33
3	- Rated frequency	Hz	50
4	- Rated short time duration power frequency withstand voltage	kV r.m.s.	70
5	- Rated lightning impulse withstand voltage	kV peak	170
6	- Rated short time duration power frequency withstand voltage across isolating distance @	kV r.m.s.	
7	- Rated lightning impulse withstand voltage across isolating distance @	kV peak	

8	- Rated current	A	630
9	- Allowable overcurrent for 1 second	kA r.m.s.	25
10	- Instantaneous overcurrent	kA peak	62.5
11	- Breaking capacity	kA r.m.s	25
12	- Making capacity	kA peak	62.5
13	- Breaking mode:		
14	- Opening time	ms	≤70
15	- Breaking time	ms	≤80
16	- Closing time	ms	≤100
17	- Rated operating cycle		O-0.3s-CO-3 min-CO
18	- Breaking capacity of cable at no load	A	
19	- Number of auxiliary contact for open/closed position of the circuit-breaker	O/O O/C	
20	- Auxiliary supply voltage	V dc	110
21	Supply voltage for motor drive circuits	V dc	110
22	- Allowable variation range of supply voltage		+10%, -15%
23	- Power consumption of auxiliary	VA	
24	- Coils consumption: - engagement coil - release coil	A A	
25	- Consumption of arming motor	A	
26	- Maximum noise level during opening and closing actuation	dB	
27	Degree of protection for auxiliary circuit		IP3X

1.2 33kV GIS CIRCUIT BREAKER (for Ring Main Feeder)

Sr. No.	Particulars	Unit	Technical Particulars
A	Switchgear Panel		
1.	Standard		IEC 60694, 62271-100, 62271-102, 62271-200
2.	Class		Indoor
3.	Type		GIS
4.	Nominal system Voltage	KV	33
5.	Highest System Voltage	KV	36
6.	Frequency	Hz	50
7.	Nominal Current Rating	A	1250
8.	One Minute Power frequency withstand Voltage	kV (rms)	70
9.	1.2/50 microsecond Impulse withstand Voltage	kV (peak)	170
10.	Rated short time duration power frequency withstand voltage across isolating distance @	kV r.m.s.	
11.	Rated lighting impulse withstand voltage across isolating distance @	kV Peak	
12.	Symmetrical breaking capacity	kA	25
13.	Making Capacity	kA	62.5
14.	Short time current for 1 sec	kA	25
15.	Degree of Protection		IP-65 for HV, IP-3X for LV

16.	- Approximate dimensions of the cubicle		
	- Width	Mm	600
	- Depth	Mm	1330
	- Height	mm	2400
	- Depth with circuit-breaker plugged-out		
B	CIRCUIT BREAKERS		
	Type		Vacuum
1.	Reference Standard		IEC 60694, IEC 62271-100, 62271-102, 62271-200
2.	Rated Voltage	KV	33
3.	Rated Frequency	Hz	50
4.	Rated Insulation Voltage	KV	36
5.	No of Poles		3
6.	Nominal current rating	A	1250 A
7.	One Minutes Power frequency withstand Voltage	KV (rms)	70
8.	1.2/50 microsecond Impulse withstand Voltage	KV (peak)	170
9.	Allowable Overcurrent for 1 sec	KA	25
10.	Opening time	ms	<=70
11.	Breaking time	ms	<=80
12.	Closing time	ms	<=80
13.	Arcing time (max)	ms	
14.	Rated operating cycle		O-0.3s-CO-3min-CO

15.	Breaking capacity of cable at no load	A	
16.	Number of auxiliary contact for open/closed position of the circuit-breaker	O/O O/C	
17.	Auxiliary Supply voltage	V dc	110
18.	Supply voltage for motor drive circuits	V dc	110
19.	Allowable variation range of supply voltage		+10%, - 15%
20.	Coils Consumption: - engagement coil - release coil	A	
21.	Consumption of arming motor	A	
22.	Maximum noise level during opening and closing actuation	dB	
23.	Degree of protection for auxiliary circuit		IP 3X

2. SECTIONALIZER & BUS RISER PANEL (GIS)**2.1 33 kV Interrupter Cubicles (ITC)**

Sr. No.	INDICATIONS	U	Values Required
1			
2	Manufacturer		
3	Place of manufacture		
A	Standards		IEC 60694, IEC 62271-100, 62271-102, 62271-200
1	1) CUBICLE		
2	- Class		Indoor
3	- Rated insulation voltage	kV	36
4	- Rated operating voltage	kV	33
5	- Rated frequency	Hz	50
6	- Rated short time duration power frequency withstand voltage	kV r.m.s.	70
7	- Rated lightning impulse withstand voltage	kV peak	170
8	- Cubicle rated current	A	1250
9	- Bar set rated current	A	1250
10	- Allowable overcurrent for 1 second	kA r.m.s.	25
11	- Instantaneous overcurrent	kA peak	62.5
12	- Number of flip-flop contacts for circuit-breaker plugging-in and plugging-out monitoring	minimum	

Sr. No.	INDICATIONS	U	Values Required
13	- Number of flip-flop contact for earthing isolator open/closed position monitoring	minimum	
14	- Number of flip-flop contacts for isolator open/closed position monitoring	minimum	
15	- Approximate dimensions of the cubicle		
	- Width	mm	600
	- Depth	mm	1330
	- Height	mm	2400
	- Depth with circuit-breaker plugged-out	mm	
16	- Protection degree		IP65 for HV, IP 3X for LV
17	- Earthing isolator making capacity	kA	
18	- Overall dimension drawing number		

	INDICATIONS	U	Values Required
	2) INTERRUPTER (Vacuum Type)		
	Three pole type		
1	- Rated insulation voltage	kV	36
2	- Rated operating voltage	kV	33
3	- Rated frequency	Hz	50
4	- Rated short time duration power frequency withstand voltage	kV r.m.s.	70
5	- Rated lightning impulse withstand voltage	kV peak	170

	INDICATIONS	U	Values Required
6	- Rated short time duration power frequency withstand voltage across isolating distance	kV r.m.s.	
7	- Rated lightning impulse withstand voltage across isolating distance	kV peak	
8	- Rated current	A	1250
9	- Allowable overcurrent for 3 second	kA r.m.s.	25
10	- Instantaneous overcurrent	kA peak	62.5
11	- Breaking capacity	KA r.m.s	25
12	- Making capacity	kA peak	62.5
13	- Breaking mode:		
14	- Opening time	ms	≤70
15	- Breaking time	ms	≤80
16	- Closing time	ms	≤100
17	- Number of auxiliary contact for open/closed position of the circuit-breaker	O/O O/C	
18	- Auxiliary supply voltage	V dc	110
19	Supply voltage for motor drive circuits	V dc	110
20	- Allowable variation range of supply voltage		+10%, -15%
21	- Power consumption of auxiliary	VA	
22	- Consumption of arming motor	A	
23	- Maximum noise level during opening and closing actuation	dB	

	INDICATIONS	U	Values Required
24	Degree of protection for auxiliary circuit		IP3X

3. CURRENT TRANSFORMER (GIS)

3.1 33KV CURRENT TRANSFORMER (TCT) FOR MVCB CELL

INDICATIONS	U	Values Required
Manufacturer		
Place of manufacture		
Port of embarkation		
Standards		IEC 44-1
- Rated insulation voltage	kV	36
- Operating voltage	kV	33
- Rated frequency	Hz	50
- Rated power frequency short duration withstand voltage	kV	70
- Rated lightning impulse withstand voltage	kV	170
Actual transformation ratio	A	200-100-50/ 1-1-1
Secondary Core 1 - Protection - Accuracy class - Rated output	VA	5P20 10
Secondary Core 2 - Measurement - Accuracy class		0.5, M5

INDICATIONS	U	Values Required
- Rated output	VA	10
Secondary Core 3 - Protection		PS
- Accuracy class		
- Rated output	VA	10
Short-circuit current allowable for 3 seconds	kA	12.5
Permanent operation without danger	In	
Overheating	In	
Overcurrent class		

3.2 PROTECTION CT (PCT) FOR CUT-OFF MOTORIZED CIRCUIT BREAKERS

INDICATIONS	U	Values Required
Manufacturer		
Place of manufacture		
Port of embarkation		
Standards		IEC 44-1
- Rated insulation voltage	kV	36
- Operating voltage	kV	33
- Rated frequency	Hz	50
- Rated power frequency short duration withstand voltage	kV	70

- Rated lightning impulse withstand voltage	kV	170
Actual transformation ratio	A	800-400 / 1/1/1
Secondary Core 1 - Protection - Accuracy class - Rated output	VA	5P15 10
Secondary Core 2 - Measurement - Accuracy class - Rated output	VA	0.5, M5 10
Secondary Core 3 - Protection - Accuracy class - Rated output	VA	PS 10
Short-circuit current allowable for 3 seconds	kA	12.5
Permanent operation without danger	In	
Overheating	In	
Overcurrent class		

4. 33 KV VOLTAGE TRANSFORMERS (GIS)

4.1 FOR SECTIONALIZER PANEL & BUS RISER PANEL AT ASS (VTCL)

INDICATIONS	U	Values Required
Manufacturer		
Place of manufacture		
Port of embarkation		
Standards		IEC 186

INDICATIONS	U	Values Required
- Primary insulation voltage	kV	36
- Operating voltage	kV	33
- Rated frequency	Hz	50
- Rated short-time duration power frequency withstand voltage	kV	70
- Rated lightning impulse withstand voltage	kV	170
Actual transformation ratio - Primary winding - secondary winding	kV V	$33/\sqrt{3}$ $110/\sqrt{3}$
Accuracy class		3P
Rated output	VA	30

5. AUXILIARY TRANSFORMERS

5.1 AUXILIARY TRANSFORMER 3150 KVA (FOR METRO STATION / DEPOT POWER SUPPLY)

INDICATIONS	U	Values Required
Manufacturer		
Place of manufacture		
Port of embarkation		
Manufacturer drawing reference		
Standards		IEC 60076

INDICATIONS		U	Values Required
Insulation type			Cast resin
Rated power	AN	kVA	3150
Cooling mode			AN
Primary rated insulation voltage		kV	36
Primary operating voltage		kV	33
Secondary rated operating voltage		V	415/240
Rated short duration power frequency withstand voltage for primary winding		kV	70
Rated lightning impulse withstand voltage for primary winding		kV	170
Short-circuit voltage		%	7%
Voltage setting (off load tap changer)		%	0.±2.5±5
Vector Group			Dyn11
Maximum noise level		dBA	65 dB at 1.5 meter
Maximum iron losses @		kW	As per Manufacture (Efficiency required is defined in Chapter-8)
Maximum load losses @		kW	As per Manufacture (Efficiency required is defined in Chapter-8)
Dimensions (maximum) *			
- Length		mm	2200
- Width		mm	3000
- Height		mm	2350

INDICATIONS	U	Values Required
Weight (maximum)	kg	8500

* Dimensions shown are indicative only

6. 110 V DC BATTERY CHARGER

INDICATIONS	U	Values Required
Manufacturer		
Type of battery charger		Float Cum Boost Charger
Standards		IEC 146
3 Phases power supply	V AC	415
Frequency	Hz	50
Rated DC voltage	V DC	110
Power conversion		Silicon diode/thyristor or thyristor bridge (Full Wave) for converting 3-phase supply to DC voltage.
Cooling		Natural cooling
Allowable output voltage variation - for +10% variation of supply voltage - for +5% variation of frequency		+1% +1%
Average winding Temperature rise over Ambient	Degree	90

INDICATIONS	U	Values Required
Internal Cabling /Wiring		FRLSOH (For Underground) and FRLS for elevated section
Residual ripple ratio		Less than 3 %
Recharge to 80% of the battery capacity		8 hours
Meters		
Voltmeter on AC side		To be provided
Voltmeter on DC side		To be provided
Ammeter on DC side		To be provided
Alarms		To be provided
AC Main Fail		To be provided
DC Overvoltage		To be provided

INDICATIONS	U	Values Required
DC Under Voltage		To be provided
Charging fail		To be provided
Battery low		To be provided
Battery Output Voltage		To be Provided
One pair of Potential Free Contact grouping all fault to be provided for remote Annunciation at OCC		To be provided
Protections		

INDICATIONS	U	Values Required
Current Limit Protection		To be provided
Soft start feature		To be provided
Surge suppressor		To be provided
HRC Fuse at rectifier Output		To be provided
Battery Reverse Polarity protection		To be provided
Automatic Changeover feature To be provided		To be provided
Switchgear		
Input Side		MCCB/MCB &
Output side		MCB &

7. 110 V BATTERIES

INDICATIONS	U	Values Required
Manufacturer		
Place of manufacture		
Port of embarkation		
Standards		IEC 622
Type		Ni-Cd in Polypropylene Container
Stationary compact		
Maintenance free		

INDICATIONS	U	Values Required
Capacity offered for 10 hours discharge duration	Ah	*
Voltage per cell	V	
Number of cells		
Rated operating voltage	V DC	110
Maximum output current	A	
Documentation to be supplied		
Dimensions		
- Length	mm	
- Width	mm	
Total weight	kgf	

* The capacity of the battery shall be designed by the Contractor taking into account the permitted voltage tolerance of the individual loads, the power consumption of various loads, the length of time they are in operation and the manner in which they draw power. The precise capacity of battery shall be determined to ensure total autonomy of the station for 8 hours. Battery capacity shall not be less than 180 AH, in any case.

CHAPTER 8 – PART-C

Auxiliary Network (Underground)

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1.1 Auxiliary Transformer

INDICATIONS	TYPE of TEST			
	Type	Routine	On site	Specials
Temperature rise*	X			
Lightning impulse withstand voltage test*	X			
Separate-source voltage withstand test		X		
Measurement of winding resistance		X		
Measurement of voltage ration and check of phase displacement		X		
Measurement of sound pressure test (Noise level)		X	X	
Measurement of no load loss and current		X		
Visual inspection		X	X	

* For these type tests, the Contractor could provide a report on similar equipment

1.2 Battery Chargers

INDICATIONS	TYPE of TEST			
	Type	Routine	On site	Specials
Temperature rise		X		
Rated short duration power frequency withstand voltage		X		
Floating operation mode test		X		
Equalization operation mode test		X		
Direct operation mode test		X		

INDICATIONS	TYPE of TEST			
	Type	Routine	On site	Specials
Protection devices operation		X		
Setting test		X		
Visual inspection		X	X	

1.3 110 V DC Battery

INDICATIONS	TYPE of TEST			
	Type	Routine	On site	Specials
Electrical specifications checking (on one cell)	X			
Visual inspection		X	X	
Capacity measurement			X	
Endurance test	X			

1.4 AC and DC Auxiliary Cabinets

INDICATIONS	TYPE of TEST			
	Type	Routine	On site	Specials
IP rating of equipment	X			
Rated short duration power frequency withstand voltage test		X		
Operation checking		X	X	
Visual inspection		X	X	

CHAPTER 8 D
SCADA System Technical Specifications

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1. PURPOSE OF THE SYSTEM

1.1 Broad Scope

The Supervisory Control and Data Acquisition (SCADA) System covered under this bid, is required to supervise, control and acquire the various specified data from the “Controlled Stations”, such as Auxiliary Substations, Switching Stations (FP, SS, SP, SSP etc) along the Line, under JP/EW/1B/E2 contract.

System description

The Power Supply Tele-supervision System SCADA provides the highest level of observation control and command of the Power Supply system. It is the operational nerve centre which allows the personnel in charge of the Operations and Energy management to get a real time status of the installations, to make relevant measurements, and to take the appropriate actions during the normal operation as well as during unusual occurrences when efficiency and swift responses are required.

To achieve this aim, the OCC system shall ensure all the possible facilities to:
monitor the whole line,
help the Operation team to make the most suitable decisions upon occurrence of an untoward incident,
Ensure the transmission of the corresponding controls to the equipment on line.

This function allows the Power Operator to control and monitor the HV (High Voltage), MV (Medium Voltage) and LV (Low Voltage) equipment. The purpose of this function is to manage:

the incoming lines to provide reliable electrical supply to all the equipment,
the Auxiliary power supply sub-stations: transformers from high voltage to medium and low voltage,
the traction power supply sub-stations: transformers from high voltage to 25 kV traction power. The control of the Traction Power shall be done through the Traction Power Supply function.

The Power as a whole is managed from the Operational Control Centre OCC, from where centralised Operation of the line is carried out.

1.2 Interface with other Contractors

The JP/EW/1B/E2 Contractor shall interface with the S&T Contractor who is responsible for providing OFC links between the OCC and other locations, with regard to

Channel requirement

Speed

Protocol

Master Clock requirement at OCC

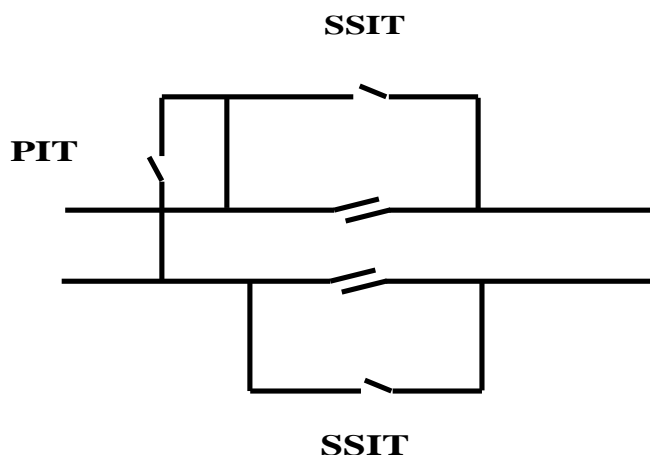
2. POWER SUPPLY SYSTEM DESCRIPTION

2.1 Power Supply System Architecture

As shown in the block diagram below, the Power System covered in the contract is divided into the following subsystems:

Sub-Sectioning and Paralleling posts (SSP)

At crossovers, junctions or switched overlap, Sub Sectioning and paralleling Post will allow separation of the various adjacent traction subsections and where needed ensure paralleling between the two tracks of a sub section.



Subsectioning and paralleling Post simplified diagram

For operation purpose, the Traction Line shall be divided into longitudinal OHE sub-sections.

The Sub sectioning Posts ensure this division and where required also ensure the paralleling of OHE sub-sections.

2.1.1 Control of paralleling switches (PIT) or Bridging Interrupters

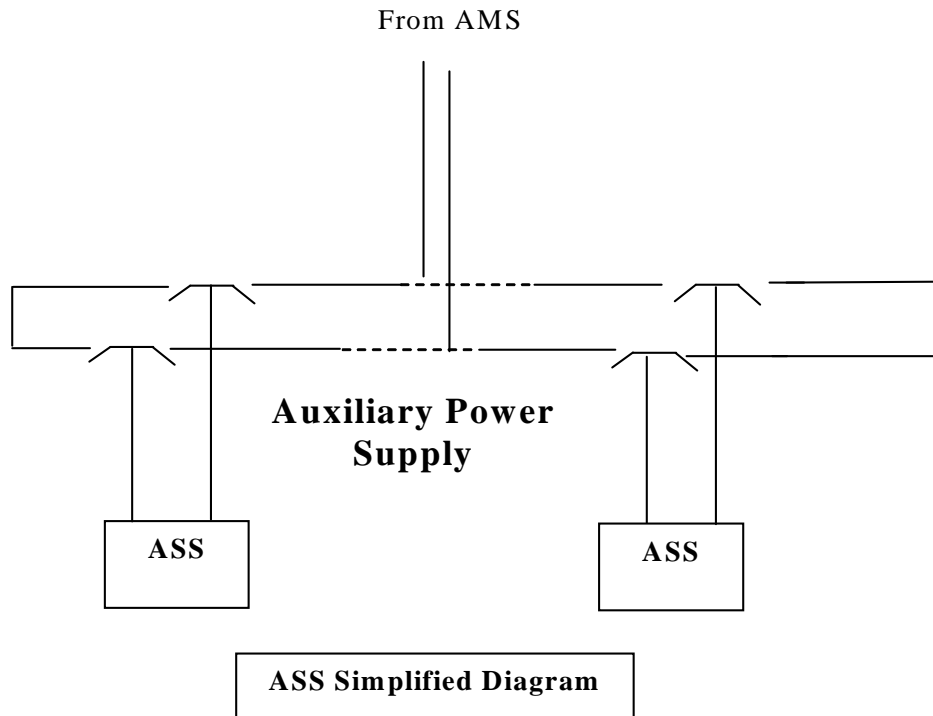
Automatic opening of a PIT (ring opening) when the tracks are de-energised. This allows rapid troubleshooting by the power operator who does not have to open all PITs one after the other to isolate tracks. Under these conditions, when resetting, it will be possible to locate the fault since the tracks are electrically independent.

2.1.2 Auxiliary substations (ASS)

In addition to the traction network, there is an Auxiliary network as required by all fixed low voltage electrical installations and all fixed electromechanical installations on the Line.

This network is connected to the high voltage Receiving Sub Station by means of medium voltage (33kV) cables, feeding 33000 / 415V transformer stations (ASS).

ASS shall be fed from the Loop of ring main at chand pole, by main 33 kV cables consisting of two cables passing through each substation in 33 kV cable cut-off modes.



The 33 KV auxiliary Network will be divided into various loops to utilise power from different RSS available in the section.

On the loop only **N-1** switchgears should be active. This restriction is applicable when AMS CB1 and CB2 are closed. Where **N** is the maximum number of switchgear of the loop including the end ones.

If one is close and the other alienated, then all the switchgears of the loop can be closed simultaneously. Closing of all switchgear simultaneously with both CB closed is forbidden.

The 33KV/415 V transformer will be feeding 415 V Bus of MDB Panel via Low voltage switchgears LVCB1, LVCB2 & LVCCB. Power Supply Management

The field of activities of the Power Supply Management team comprises:

- Traction power management at the line side TSS, SSP, SP, FP
- , the Auxiliary power supply management in the stations

The main functions shall be:

- to visualise the condition of the power supply network, as well as the visual monitoring panel,
- to control the pieces of equipment,
- to inform the operator of any change in the status of power supply network,
- to indicate several electrical parameters (voltage, power...),
- to print a pre-determined log of events and data,
- to store log of events.

The Power Supply management can be divided in two main functions:

- the traction power supply management,
- the auxiliary power supply management.

Both of these are under the responsibility of the same Power Operator.

2.2 Traction Power Supply Management

The Power is supplied to the catenary system at 25 kV AC, which is fed directly to the Metro trains.

The power supply is separated between up and down tracks to allow service to run on one track while work is being done on the other.

Basically, the Traction Power Supply Management function allows the Power Operator to energise or de-energise the different Traction Power sections of the line on demand of the Traffic Operator.

The controls related to the Power Supply equipment are performed:
either from the Power Workstation or the Traction Desk,
or locally from the equipment.

The equipment under supervision shall be:
Paralleling and sub-sectioning stations,
Catenary voltage supervision.

2.3 Auxiliary Power Supply Management

Power is supplied to the various types of equipment used in the system, such as:

escalator, elevators,
pumps,
fans, ventilators, air-conditioning,
lighting,
low voltage distribution,
heavy maintenance tools in the depot, etc.

Basically, the Auxiliary Power Supply Management function allows the Power Operator to energise or de-energise the various sections of the Auxiliary Network.

3. RTU REQUIREMENT & EQUIPMENT TO BE CONTROLLED & MONITORED

3.1 Traction Switching Stations

The switching Stations are of the following types namely Sectioning Post (SP), Sub sectioning posts (SS) and Sub sectioning and Paralleling Posts (SSP). RTUs installed in ASS shall collect data from these posts for control and monitoring and transmitting the data to the Main and backup Control centres. No Separate RTU is to be provided; RTU in ASS will house the required I-O modules to cater with requirement of switching section. Automatic Opening of Paralleling Interrupters shall be implemented through ASS RTU only. The detail of signals to be controlled and monitored for the SP, SS & SSPs equipments are given in TS of ROCS Chapter 11.

3.2 ASS at Underground Stations:

The control and monitoring of all the 33 kV feeders catering to the auxiliary power supply on at the Metro underground Stations are categorised under this. RTUs shall be installed at these stations for control and monitoring and transmitting the data to the Main and backup Control centres. The scope of the control and monitoring at these ASS stations include Circuit Breakers on the 33 kV Bus, 33 kV incoming feeders up to the 33 kV /415 V transformers (Transformers included). The details of signals to be controlled and monitored are given in TS of ASS Chapter 8A.

4. SCADA SYSTEM & MAN MACHINE INTERFACE REQUIREMENTS

4.1 Description

The following functionalities are to be achieved by the SCADA system proposed to be installed/integrated at Mansarovar OCC:

Remote monitoring: The remote monitoring functions covers the monitoring of equipment status as per the IO list

Remote control: The SCADA system shall provide facility to open /close the breakers, interrupters etc as per the IO list

In case of an emergency or abnormal situation, the TPC controller shall be able to control the various items of equipment, typically:

Isolation of the faulty sections or circuit

Restoration of the normal configuration after the fault has been remedied.

Tele-measuring: The voltage and currents measurements as per IO list, shall be covered in scope of the RTU. The RTU shall be provided with necessary analogue input modules to receive the 4 to 20 mA signals from the transducers mounted in the Control and relays Panels.

Logics & Interlocking

Transfer, to handle the opening/closing of switchgears in bridges

4.2 Remote Monitoring Requirements:

4.2.1 Process Display & Power Supply Views:

The SCADA software shall be designed with necessary process display screen to provide a graphical depiction of the power supply network for the Rail/Metro Corridor. This shall include the Auxiliary and Traction power distribution..

4.2.2 Network colouring:

The SCADA software proposed shall support necessary bus bar colouring feature by which the dynamic status of the bus bar can be depicted during charged and uncharged condition. The bus bar colouring shall be provided for the ASS over view diagram, Traction Over view Diagram, Traction individual screens.

Following Colouring Scheme shall be followed as per existing SCADA logic :

1. Green for Charged section
2. Red for Discharged section
3. Yellow for Earthed Section

4.2.2.1 Auxiliary Network

PTs have been provided at Loop End Stations, The colour of each loop In ASS overview diagram, the bus bar colouring has to be done based on the breakers and isolators status

4.2.2.2 *Traction Network*

Colouring of Traction Network should be done based on Voltage of Traction Line coming from PTs. PTs are provided in every individual elementary section. When the Voltage of Section is > 18.5 KV, it has to be shown in green colour. When the voltage of section is >7.5 & < 18.5 it should change to Orange colour and when Section voltage is less than 7.5 KV its colour should change to red colour.

4.2.2.3 *Equipment other than Battery Charger Colouring*

Normally all power equipments reflecting in various screens should be in green colour unless and otherwise any alarm, Blocking and communication Fail event is associated with the equipment. Close and Open State should not be considered as a alarm state for a switchgear and in both cases it should be shown in Green colour. In case of occurrence of other alarms its colour should change to Red.

4.2.2.4 *Battery Charger*

The status of battery chargers shall be indicated in SCADA as per the following conventions
 Green-Healthy and In-service
 Yellow-Healthy and Standby
 Red-Defective

4.2.2.5 *Alarm status*

Normally all devices should show in green colour, unless and otherwise any alarm associated with the device appears from field or it is blocked by operator. In case of alarm occurrence colour of device should change to red.

4.2.2.6 *Blocking Status*

In case of operator blocks control of any device or section, colour of the blocked device should change to brown.

4.2.2.7 *Communication Failure*

In case of communication failure of a installation, all equipment of the installation should change to pink colour.

4.2.3 *Event management*

The SCADA system shall collect the operator's request and field information changes. Any change on the field or any operator request shall be processed as an event. The SCADA system may generate additional events resulting from the processing of the filed information and/or operator request. All events processed by the SCADA system shall generate an update of the related dynamic display objects and also be recorded in logging list. The logging list shall contain all the events in chronological order that occurred within a certain period of time. All the events shall have a time stamping of 1 msec. Furthermore, alarm types events shall be recorded in the alarm list and generate an alarm procedure initialisation.

The event Logging System of SCADA system shall support the following features and options:

- Historical Storage of events with facility to retrieve the same later
- Configurable layout: columns, fonts, toolbars, Colouring, and so on.
- Configurable scrolling behaviour
- Configurable presentation modes: log mode /event mode, latest at top/bottom
- Updating/Frozen presentation modes.
- Easy navigation through scrolling, go to date, time filters.
- Filtering (By Station, Device, and Period etc.)
- Extensive filtering that can be stored and easily called up later

- Find, Sorting by column, Copy/Paste of events to other windows application
- Printing
- Commenting of events by operator

4.2.4 Alarm management

An Alarm is an important event that the operator needs to be informed of immediately so that prompt corrective action may be implemented to ensure the operational safety and integrity of Power Supply. High priority visual and audible warnings appear on the current operator work station and an acknowledgement request is made to ensure that the operator has received the alarm information. Alarm may result from field information changes or from processing of field information, operator and system actions. Alarms may be configured as major and minor alarms

The SCADA system shall be able to handle various types of alarms, typically:

- Alarm generated due to change in field information.
- Alarm generated due to fault in SCADA system equipment and communication link.

4.2.4.1 Alarm procedure

The purpose of the alarm procedure is to draw the operator's attention and ensure that the information is taken into consideration, whatever activity being performed when the procedure is initiated. The alarm procedure shall generate a specific visual effect and audible warning on the operator work station. The activation of the audible warning shall be configurable for major alarms. It shall be possible to disable the audible alarms. Alarm procedures may be generated in the following cases:

- Alarm appearance
- Alarm disappearance

Alarm appearance procedure:

Any change from "normal" to "alarm" value of a alarm shall be considered as an alarm appearance event and shall generate an alarm procedure.

Alarm disappearance procedure:

Any change from "alarm" to "normal" value of a alarm shall be considered as an alarm disappearance.

4.2.4.2 Alarm list

All alarm appearance events shall generate a record in the alarm list. The alarms can be removed from the Alarm List if

- Alarm is not present any more,
- Alarm has been acknowledged by the operator.

Alarm disappearance events, which generate an alarm procedure, shall also generate a record in the alarm list. This record shall only be erased by the SCADA system when the concerned operator has acknowledged the alarm disappearance. All alarms which appear in the SCADA screen shall be logged in the Log mode and shall not be erasable.

4.2.4.3 Audible warning cancellation

The possibility of implementing an "audible warning cancellation" facility shall be provided. When an alarm procedure has been initialised, this facility shall allow the operator to stop the audible warning prior to alarm acknowledgement. The audible warning cancellation shall have no other consequence on the alarm procedure (the

visual warning shall remain until alarm acknowledgement) and shall not interfere with the management of the alarm list.

Any new alarm procedure after the audible warning cancellation shall reset the audible warning.

4.2.4.4 *Display of Alarms and Events*

The digital inputs signals being monitored by various RTU shall be categorised as P0, P1, P2 & P3 categories. The method of configuration for these alarms shall be as below:

P0 (events)

P0 category signals are non severe signals that need not be configured as alarms. These are to be stamped in event list only.

P1 (Alarms and events)

P1 category signals also fall under non severe category but which requires attention of operator from the process point of view. The same shall be configured as visual alarms.

P2 (Alarms & Events)

P2 alarms are used for major and critical alarms that require acknowledgement from the operators and shall be attended so that the system can operate / function smoothly. These are to be configured as alarms & events. Audible alarms are required to be configured for this category signals.

4.3 Remote Control Requirements:

4.3.1 Automatic / Manual control

It shall be possible to control the breakers and interrupter via Operator request or via automatic control procedures. The control functions shall be Close/Open of the equipments as per IO Lists. The operator initiated Open/Close control functions shall be possible using Select- Check – Execute sequence.

4.3.2 Control command Logging

The SCADA system shall log the control operations by the operators in the event list so that any closing opening other than issued by the operator from SCADA can be differentiated from the Event list.

4.3.3 Permissive for Local Operation:

In order to facilitate local maintenance of the equipments and to prevent unauthorised local operations, Permissive for Local operation shall be provided for each equipment so that the field operator can carry out operation of the power equipment only after the above permission is granted from the Control Centre. SCADA system should ensure that no operation is performed without permission from Operator..

4.3.4 Remote control inhibition management-Alienation of a Power Supply Equipment

The operator at Mansarovar OCC shall be able to inhibit /block the control from SCADA system. This blocking action shall be available in the blocking list. The control inhibition/ control blocking shall be possible individually for each equipment being processed. The operator shall be possible to cancel the blocking also. The user performing the blocking / deblocking shall be logged in the event list. The blocking and deblocking actions shall be available in the SCADA system in the form of blocking list:

Identification of the blocked equipment, status of equipment when it has been alienated, time of blocking

The details of the user /operator who have carried out the blocking action shall also be logged in the Event List in the SCADA system.

4.3.5 OHE isolation

For the protection of maintenance works, the Traction Power Controller may set the isolation of any OHE subsection of the line. Such action shall involve opening of a group of interrupters in the elementary sections of the Traction Line. The menu provided in SCADA for OHE Isolation shall have a drop down list for selection of elementary sections to be isolated. Once the operator selects the elementary section and select the button to start the isolation, the SCADA system shall trigger an automatic control procedure which will initiate the opening command from the SCADA to the respective BMs. The isolation action by the operator shall be logged in the Event/Alarm list with details of user as well as time of action. It shall be possible for the operator to close the BMs from the SCADA system subsequently through normal control function. It should be possible to cancel the isolation of an elementary section.

4.3.6 Level of Control

The following levels of controls should be possible

- a) Centralised Control from Main control centre- Mansarovar OCC.
- b) Local mode from the equipment

4.3.6.1 Centralised control from Main or Backup Control Location

4.3.6.2 *The control shall be possible as default design from the Main control centre OCC at Mansarovar Depot Area.* Local mode from the equipment:

It shall be possible to operate the equipments locally from the control panels by selecting the local / remote selector switch in Local Mode and after taking the SCADA permissive from the OCC. This selection shall be logged by SCADA in the event list.

4.4 Tele Metering

The SCADA system at Mansarovar OCC shall display and log the analogue parameters from the SCADA system as per the IO list for SCADA. n

4.5 Logics & Interlocking

4.5.1 Control of paralleling switches (PIT) or Bridging Interrupters

Automatic opening of a PIT (ring opening) when the tracks are de-energised. This allows rapid troubleshooting by the power operator who does not have to open all PITs one after the other to isolate tracks. Under these conditions, when resetting, it will be possible to locate the fault since the tracks are electrically independent.

4.5.2 Interlocking scheme:

For safer operation interlocking has to be implemented in SCADA system. The following interlocks mainly to be provided.

- a) Breaker-Isolator interlocking – It should not be possible to operate Isolator when the corresponding breaker is in Close condition and breaker operation should not be possible when isolator is in open condition.

- b) 33 KV Network Inter Loop-interlocking: - When Potential Transformer of adjacent loops is showing voltage, Extending power from one loop to other should not be possible.
- c) Interlocking at SPs: - When Potential Transformers on both sides of SP is showing voltage, Extending power from one section to other should not be possible.
- d) **(N-1)** interlocking in a 33 KV Network Loop .

4.6 Operation Aids

4.6.1 Log-on / Log-off:

4.6.1.1 Log-on

Before commencing work on a workstation, operator identification to the system shall be required. Log on window with password protection shall be provided for the purpose. After suitable display prompts the operator shall enter his name, password, and validate them, system access shall be granted to the authorised sessions.

4.6.1.2 Log-off

The operator shall log off to end the active working session on a workstation. After the current operator has logged off and with no other operator logged on, no supervisory, control, monitoring or other action on the SCADA system shall be possible from the workstation.

4.6.2 Reporting

The SCADA software shall support configuration of time related measurement reports. Measurement Report is used within SCADA's library applications for various types of time related reports, such as hourly, daily, weekly, monthly and yearly reports. The reports shall be based on time-related follow-ups of process, metered, entered or calculated data. The data for the reports shall be stored in real time. Report data is collected and calculated cyclically or triggered by events. The most common method is to fetch raw data from the process, and thereafter to scale and store it in the report database. All the events/reports are shall be automatically written in text files and stored on hard disk in the reports folder of the application. Periodic back ups of reports shall be possible.

The Measurement Reports supports the following time related reports:

- Hourly report (time resolution: 3 minutes)
- Daily report (time resolution: 15 minutes)
- Daily report (time resolution: 30 minutes)
- Weekly report (time resolution: 1 day)
- Monthly report (time resolution: 1 day)
- Yearly report (time resolution: 1 month)

Printers that are connected to the Master Stations shall be used for printing of reports. Automatic periodic printing of reports can be configured for the Master. On demand printing of reports shall also be possible.

4.6.3 Trends

The SCADA shall support trends for performing time related follow up of process data. The trends shall be possible for both digital as well as analogue parameters. The trend shall support a maximum of 10 trend parameters. The trends shall be possible in both graphical and tabular forms which shall share the same database.

The x- axis and y-axis of the graphs shall be configurable in scale. It shall be possible to have different scan time variable in single display. The trend display shall support the following features:

- Support of Graphical or tabular view modes with zooming facility
- Shall support Scrolling with scroll bars and panning
- Configurable axes, line properties and legend
- Update interval options from 30 seconds to 10 minutes
- Trends for Calculation formulas; direct, mean, sum and difference shall be possible
- Shall have Printout option
- Depiction of Update/Frozen modes
- Facility to Copy to clipboard and export to CSV File

4.7 Man-Machine Interface

The energy supervision shall be carried out by means of the Visual Display Panel and the Workstations. The Visual Display Panel which will receive the single line diagram of traction and auxiliary supply, shall be a monitoring device only. It shall reflect the drawing showing General Feeding arrangement.

The workstation functions described here after shall offer monitoring and control possibilities.

4.7.1 Work Station overview

The SCADA man / machine interface shall be through the following:

1 SCADA workstation 1

The Two workstation for the SCADA control in the OCC operations room shall be each composed of single screen with a single keyboard and pointing device. The keyboard shall be able to select different views of power equipments for monitoring purposes.

4.7.2 General concept of the workstation screens

The display of views, controls and the event resolution shall be possible from the same screen.

The screens shall be organised into different sections for processing the operator activity information. There shall be no overlap between the various sections at any time that may obscure vital information.

The active sections shall have dynamic information displayed. Each active section shall manage and update the alarms, processing and controls that shall be displayed in it. Every status change shall be shown within the active sections and the relevant display updated.

Each view shall display the necessary tools and options for the processing or management of events.

Hourly and daily programming tools, which allow the completion of automatic reports according to the option chosen by an operator, shall be provided.

Any section of the screens displaying text shall have scrolling abilities. The management of any overflows of alarms and various data, i.e. when the number of alarms exceeds the capacity of the section on the screen, shall use these scrolling facilities.

One pointing device shall be provided for all screens. This device shall allow working on both screens by simply moving the device, without any additional action. This arrangement shall allow the operator to view the two screens as a single control screen.

4.7.3 Typical Workstation screen design

4.7.3.1 *Alarm List (AL)*

The alarm list may show detailed alarms in comprehensible text format with the date and time of their occurrence. They shall be displayed in chronological order, commencing with the most recent.

A scrolling facility shall enable the operator to scan the list.

Each alarm in the list shall be displayed with different colour or shape attributes according to the alarm level and acknowledgement status.

The alarm list shall have various filter facilities to enable the operator to display different format of events.

The operator shall be able to print the alarm list.

4.7.3.2 *Logging List (LL)*

The logging list shall show detailed events in comprehensible text format with the date and time of their occurrence. They shall be displayed in chronological order.

A scrolling facility shall enable the operator to scan the list.

The logging list shall have various filter facilities to enable the operator to display different format of events.

The filter keys shall typically include:

- location
- equipment group
- time period
- event category (ordinary event, minor and major alarm ...)
- other options

Any combination of the filter keys shall be possible.

Each event in the list shall be displayed with different colour attributes according to their category

- event class as in clause of this chapter
- Operator or system action

The operator shall be able to print the logging list or the filtered logging list.

4.7.3.3 *View Selection*

A view selection bar may be permanently displayed on each screen to allow the operator to select various available images.

Some detailed images may not be selectable from the view selection bar but be selected directly from other displays.

4.7.3.4 *Graphic Display*

The graphic display shall display images as requested by the operator.

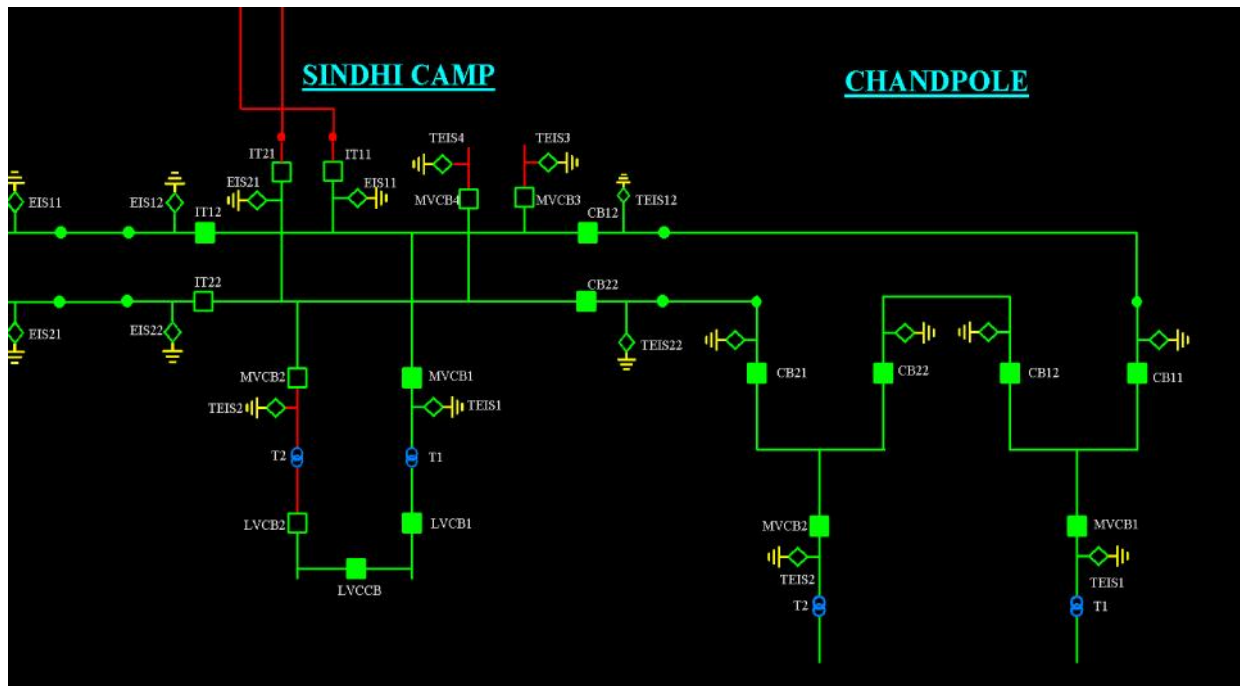
4.7.3.5 *Control facilities*

Equipment control may be managed by designating the equipment on the screen. This action may open a dialogue box requiring the operator to select:

- one possible control mode for the equipment
- setting remote control inhibition on the equipment
- cancelling remote control inhibition on the equipment

After selecting the control action, the operator shall either validate or cancel the action.

If validated, the control action shall be performed.



5. SCADA SYSTEM REQUIREMENTS:

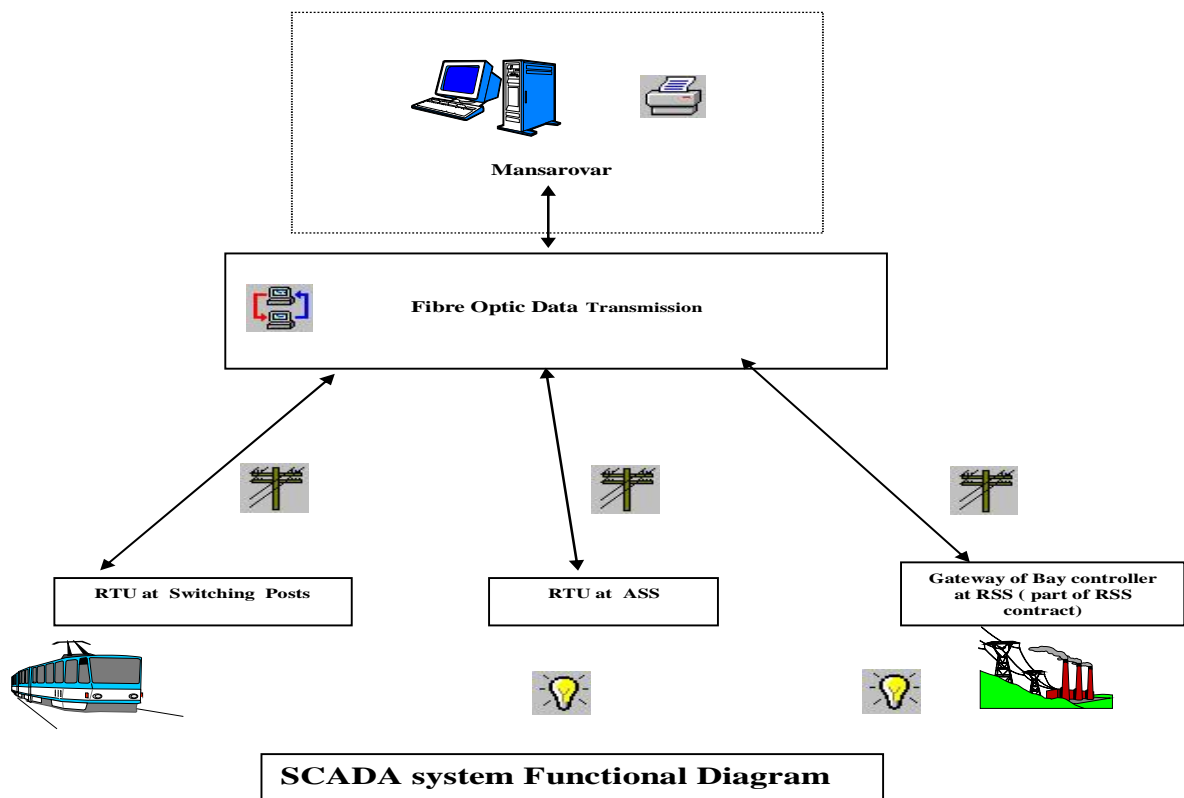
The SCADA system acquires data from the RTU installed at various locations via Data Transmission network:

5.1 Data transmission network :

It picks up data also called the Remote Monitoring on site, i.e. ASS, SSP and brings them to OCC Data Processing system. On the other direction, all the operator's instructions are sent to the remote terminal units by means of Remote Controls.

5.2 Data Processing system :

The RTU installed at the ASS, OHE posts will act as the data processing equipments. These RTUs acquire the process information and transmit the same to the Control Centers.



5.3 Communication Protocol:

The SCADA system shall support the following communication protocol

IEC 870-5-104 / for communication with the RTUs

5.4 Time synchronisation

The Time synchronisation system required at Mansarovar OCC will be made available by the other agency. Bidder shall interface with the agency for GPS signal for time synchronization. The new servers can acquire the time synch messages from the LAN via NTP protocol. The SCADA servers will be synchronised with the GPS Master Clock which in turn will synchronise the RTU with the required design periodicity.

Apart from periodically synchronising the RTUs, the SCADA servers will synchronise the RTU during start-up or after recovering from communication failure.

5.5 Communications

5.5.1 FO Communication network

The RTU shall communicate with the Control centre via Fibre optic network installed by the communication contractor. The FO terminal equipment will have required ethernet ports to interface to the RTU. A group of RTUs adjacent to the ASS stations shall be multi dropped and terminated to the FO equipment in TER room. The Main and redundant RTU shall be multi dropped in different channels. Each RTU shall have three ports terminated to the equipment. Two channels for data communication with the Control centres and one channel for Remote Downloading from the Main Control centre.

5.5.2 LAN Network at Control centre:

The SCADA servers and workstations that would be supplied at Mansarovar OCC shall be interconnected using redundant Ethernet switches. The Ethernet switches shall have necessary ports to hook up the new servers and workstations.

5.6 Performance requirements

The performance of the system must enable the operators to operate the line under satisfactory conditions. More precisely, the following targets must be reached:

5.6.1 Transfer time

The time required to transmit the status information and alarms at the SCADA system within 2 seconds. The sequent of events information which are mainly for analysis purpose and is stored in RTU memory can be polled at a lesser priority.

5.6.2 System Capacity

The new SCADA servers that are to be installed at the Mansarovar OCC shall be suitably sized to handle data communication up to 225 RTUs in one set of redundant servers.

6. EMERGENCY TRIP SYSTEM (ETS)

The RTUs installed at Underground ASS stations shall provide necessary interface to the Emergency Tripping system.

The Emergency trip system (ETS) will implement an electrical tripping scheme to de-energize relevant OHE sections during emergency conditions. **ETS shall cover the underground section of OHE only.** ETS will comprise emergency trip stations connected through cables to programmable logic controllers (ETS PLC). Every emergency trip station will consist of a unit with robust fire protected cover having breakable seal to contain a plunger switch with tripping contact, a blue location – indicating light and provision to contain a heavy-duty telephone handset. The emergency trip stations will be provided and installed at the following locations for UP/DN line separately. Details of ETS specifications provided in clause 10 of chapter 8A of TS ASS.

- a) Close to the cross passages in each tunnel
- b) Ends of platform
- c) Station Control Room (SCR)

7. I-O REQUIREMENTS

The I-O requirements for RTU's located at various Power Supply installations are listed in TS of ROCS Chapter 11 for switching post equipments and TS of ASS Chapter 8 A for ASS equipment. The requirements shown are only tentative and the minimum requirement. The Contractor shall provide adequate number of I/O cards to cater to the actual requirements of I-O Signals and the required spares (Spare card of each type utilised for the SCADA system should be made available by the contractor. The manufacturer of the SCADA cards should provide the replacements/updated version of the SCADA control cards).

8. TECHNICAL REQUIREMENTS OF SCADA SYSTEM

8.1 DESIGN CRITERIA FOR SCADA SYSTEM

The SCADA system proposed shall be a proven system based on Windows platform in line with the existing JMRC system and shall have reference installation in India and Abroad specifically in Metro Railway Traction Power Control Applications. The product shall have windows look and feel and shall support the features listed later in this chapter.

The SCADA system vendor shall have the necessary domain experience in implementation of the complex functional requirements for the Traction Application.

9. The Detailed Technical Specifications For Each Of The Components In The Proposed Scada System Shall Be As Specified Below. System Architecture

The system architecture for SCADA system to be installed as part of this Contract shall be as below. The contractor shall assess the site conditions before submission of the proposal to Employer/Engineer. For new section under this contract a Central Control Station, hereinafter referred to as **Operational Control Centre (OCC) will be established in the Mansarovar Depot.**

COMMUNICATION INTERFACE

The SCADA servers shall communicate with the RTUs via IEC 870-5-104 protocol.

The servers shall be connected to the OLTE equipment installed at Mansarovar OCC via IEC 870-5-104 interface. Necessary redundancy switches shall be provided by the bidder.

The Redundant Ethernet switches for networking the servers and workstations and existing systems shall be considered in the scope.

9.1 COMMUNICATION MEDIUM

The Control and Monitoring System covered under this Bid, is required to supervise, control and acquire the various specified data from the 'Controlled Stations' along the Line, such as Auxiliary Substations, Traction and Auxiliary Networks, Metro Stations, Switching Stations (SP, SSP etc) along the Line, etc. The SCADA at OCC Mansarovar Depot will communicate with the RTUs via Fibre Optic Link. The necessary communication channels, which shall be in the form of Optic Fire Cable (OFC), will be provided by some other Agency, between the OCC and the Telecom Equipment Room at Stations/. The cables required for connection between the RTU at the station ASS's and the Telecom Equipment Room and SCADA Room and Telecom Equipment Room at Mansarovar Depot will require to be supplied and installed by JP/EW/B1/E2 Contractor.

10. TECHNICAL SPECIFICATIONS FOR REMOTE TERMINAL UNITS

The RTU proposed shall be modular in nature and scalable upto maximum of 2000 data points. The RTU shall support distributed processing intelligence with decentralised structuring with the task of preprocessing of inputs distributed to the IO modules.

The detail of I-O requirement for RTU is given in Chapter 8A for ASS and in chapter 11 of TS rigid OHE (ROCS). RTU shall be further capable of incorporating +10 % increases in I-O requirement. The RTU shall support the following technical features which are very critical for ensuring the functional requirements for a critical application like Metro Railway Traction Power Control.

10.1 CENTRAL PROCESSING UNIT

The Central processing unit shall have minimum 32 bit microprocessor and shall have a dedicated peripheral bus controller for handling the IO functions. The CPU module shall have non volatile memory. It shall have necessary ethernet ports for communication with atleast 3 control centers i.e. 1 control centers presently and 2 control centre in future on IEC 870-5-104 protocol. The RTU shall support synchronization with relays at ASS or Switching posts on MODBUS/IEC 870-5-103 protocol on one port and the same shall be sent to OCC on IEC 870-5-104 protocol . The RTU shall have one MMI port which can be used for configuration purpose.

10.2 TIME SYNCHRONISATION

The accuracy and resolution of the time stamping is very critical for analysing the events that occurs across various stations. To achieve this, RTU should be provided with clock which shall support time synchronisation from master station via periodically initiated synchronisation messages of communication protocol. The SCADA system shall also initiate Time Synchronisation messages when the communication with the RTU is restored after a communication failure. RTU shall be provided with dedicated back-up power for clock, so that in the event of RTU getting off due to power failure, the clock shall be updating the time.

10.3 COMMUNICATION WITH MASTER CONTROL CENTRE

The RTU shall be provided with necessary Ethernet ports for interfacing with the OLTE equipments which will be installed at the various ASS stations. The OLTE equipments will be available at the ASS stations. The RTU installed at the nearby locations(Depot FP) to the ASS stations has to be multidropped on an Twisted Pair Shielded, Armoured FRLS Low smoke Halogen Free 16 core (8 pair) cable and terminated to the Ethernet interface available on the TER room at the stations. The average distance between the locations which would be multidropped on the electrical cable would be an average 600 meters. The cables required for multidropping the RTUs and terminating at the OLTE equipments would be in the scope of the SCADA vendor. The MMI programming port of the nearby RTUs shall also be multidropped and terminated to the OLTE equipment for termination to the OCC for remote programming facility (Refer Fig 1).

10.4 REMOTE PROGRAMMING FACILITY

The RTU shall support remote programming facility using RTU programming utility software from the Master Control centre. The MMI port on the RTU shall be terminated to the Master Control centre via one communication channel. The MMI

ports of nearby RTU shall be multidropped on a Electrical cable and terminated at the OLTE room at the ASS stations to facilitate Remote programming facility:

10.5 I/O MODULE SPECIFICATIONS

10.5.1 DIGITAL INPUT MODULE

The Digital input module shall have 16 optically isolated channels per modules and shall support time stamping with time resolution of 1 ms. The digital input module shall support configuration of inputs for the following options:

- Single Indications
- Double Indications
- Digital Measurands

The digital input module shall support the following features:

Programmable parameters like

- Bounce Filter (Suppression Time)
- Settling time for reliable digital measured value
- Chatter suppression
- Suppression of intermediate position
- With / Without time tagging shall be a configurable feature
- Configurability of message transmission priority

Indication processing of

- Group or Common alarms shall be configurable from Individual alarms by Boolean operations
- Acquisition of events in chronological order with a time resolution of 1 ms
- Buffering upto 3 changes per input

10.5.2 ANALOGUE INPUT MODULE

The Analogue inputs module shall have 8 channels per module and shall support Dual Slope integration A/D conversion. The Analogue module shall support the following features

- Unipolar Measured values
- Bipolar measured Values

Programmable parameters like

- Live zero conversion coefficient
- Cyclic Transmission or threshold value
- Forced zero pint conversion coefficient
- Limit Values
- Smoothing factor
- Threshold values
- Cyclic duration
- Priority of Transmission

Other parameters:

- Inputs shall be configurable for 4 to 20 mA / bipolar or live zero

- Accuracy - $\leq 0.1\%$
- Common Mode Voltage : ± 8 V DC
- Line Interference suppression : > 100 dB for $f_n = 50$ or 60 Hz

10.5.3 DIGITAL OUTPUT MODULE

The Digital Output module shall support 16 digital output channels per module. The output module shall support the following features

Programmable Parameters shall include

- Duration of Output Pulse
- Release disconnection delay time at response indications
- Select before execute
- Cyclic duration
- Priority of Transmission

10.5.4 REDUNDANCY

The RTU offered for the ASS, Traction & Receiving Substations shall be duplicated in all respects of CPU, IO cards & power supply. Two sets of Main & redundant RTUs, Both shall communicate with the Master Control centre on two different communication channels.

10.5.5 PLC PROGRAMMING FACILITY

The RTU has to program for several logic functions which are required for the metro power supply distribution application. Hence the RTUs offered shall support PLC programming facility as per IEC 61131-3 standards. Necessary programming tool shall be offered.

10.5.6 TRANSDUCERS

The RTUs will acquire analogue signals like voltages and currents from the transducers via 4 to 20 mA analogue inputs. The transducers would be supplied by the SCADA vendors.

10.5.7 RTU & MARSHALLING PANELS

The RTU panel which houses RTU hardware mainly consisting of the CPU & IO racks & power supplies, Interface converters etc shall be of IP54 protection class for ASS Station.

10.5.8 ENVIRONMENT CONDITIONS

The RTU hardware shall meet the following environmental requirements:

EMC Immunity: As per IEC 60870-2-1 Level 3 or 4

EMC Emission: As per IEC 60870-2-1 Class A

Temperature : -10 to 55 deg C as per IEC 60870-2-2

Humidity : 5 to 95% as per IEC 60870-2-2

10.5.9 ANALOGUE SIGNAL MEASUREMENT

The RTUs will acquire analogue signals like voltages and currents from the transducers via 4 to 20 mA analogue inputs. The transducers would be supplied by the SCADA Vendors.

11. SCADA SYSTEM

The architecture for the SCADA systems at OCC is as shown in figure 1 and 2 respectively.

11.1 SCADA HARDWARE REQUIREMENTS

The SCADA System at OCC shall preferably be integrated with the existing SCADA system at OCC, Mansarovar Depot, already provided by ABB. If the same is not feasible the bidder may bid for an independent SCADA System as detailed below:

The detailed specifications for the servers, workstations, printers etc proposed at the Control centers shall meet atleast the functional requirements mentioned in this chapter. The SCADA system at Main Control Centre shall be based on Hot Standby system with redundant LAN configuration. The Servers at OCC shall be terminated to the Fibre Optic terminal equipments via Ethernet. The hardware supplied for the SCADA system shall consist of all necessary hardware for networking LAN between the servers and workstations, redundancy switches and converters required for interconnecting the Ethernet ports of the servers to Fibre Optic Line Terminal Equipment. The OLTE will be provided with necessary Ethernet ports for termination to the servers.

The SCADA software proposed for the Metro application shall be based on windows operating system. The SCADA system architecture shall consist of the following:

- 2 SCADA servers in redundant configuration for SCADA functions with single 17 inch TFT Monitors
- 2 Nos of SCADA workstations with Single 19 inch TFT monitors.
- 1 No of Engineer workstations with 19 inch TFT monitor.
- Video wall integration workstation
- Dual LAN network equipment.
- Interfacing equipment as required.
- Printers - A4 size Laser jet printers (B/W and color) – 1 No each.
- Furniture for SCADA System as per Clause 11.4 of TS

TIME SYNCHRONISATION

The SCADA servers shall be synchronised with the GPS Master Clock provided by S&T via NTP protocol. Acquiring Master Clock time sync from S&T via LAN shall be in scope of SCADA vendor. The SCADA system shall be synchronised with all the RTUs via fibre optic communication medium. The SCADA system shall issue time synchronisation messages to the RTUs at regular periodicity that shall be configurable. The time synchronisation messages shall also be initiated by the SCADA before start of communication or when the communication with the RTU is restored after failure. When communication with an RTU is interrupted, all data from that RTU shall be marked with invalid time till the time synchronisation with the RTU is established again.

11.2 Communication with RTU

The RTU will be connected to the OLTE equipment using star network. The RTU shall be fitted with necessary converters for termination to the OLTE equipments. Redundancy switches and converters required for interconnecting the ethernet ports of

the SCADA servers to Fibre Optic Line Terminal Equipment shall be considered in the scope of the SCADA system. The OLTE will be provided with necessary Ethernet ports for termination to the servers.

11.3 FURNITURE

The contractor shall consider suitable and aesthetically designed furniture at Mansarovar ECC to house the new servers and workstations . The servers have to be housed in separate cabinets to prevent from dust and there should be easy access for the cables.

11.4 SCADA SOFTWARE

The technical features of the SCADA software shall meet the following minimum technical features:

11.4.1 PROCESS DISPLAYS

The SCADA software shall support flexible process displays for continuous & effective monitoring of power supply network of the Metro Railway

The process display feature shall facilitate depiction of Single Line Diagrams with flexible choice of colours for the process objects and backgrounds. The Process Displays shall support zooming & panning facility. The process display features shall be flexible enough to build the complete Traction network and the auxiliary network as a single Mimic Display with facility to navigate using mouse from one end of the network to the other. It shall also be possible to zoom portions for picture for getting a magnified view of the Single Line Diagram.

11.4.2 ALARM MANAGEMENT

Alarm Management System to alert operator & maintenance staff during equipment malfunctions or any other system alarms likely to cause disruption to operation of the railways. The alarm management function shall support

- Two types of Alarm List templates
- User-friendly filters, Alarm List setting tool for Colours and text layout
- Updating/Frozen presentation modes
- Alarm acknowledgement, Alarm reset function
- Authorization support
- Help in all dialogs
- Visible Alarm Class
- Locate Object
- Column sort, Find, Fields indicating the number of active and unacknowledged alarms
- Field indicating the use of filters
- Field indicating the current presentation mode
- Current/total page number indication on both lists

11.4.3 EVENT LOGGING SYSTEM:

Event Logging System for displaying and logging sequence of event recording with 1 millisecond resolution for the various field inputs configured at the RTU. The Event List contains the following features and options:

- Historical Storage of events with facility to retrieve the same later
- Configurable layout: columns, fonts, toolbars, Colouring, and so on.
- Configurable Colouring of events

- Configurable scrolling behaviour
- Configurable presentation modes: log/event order, latest at top/bottom
- Updating/Frozen presentation modes
- Easy navigation through scrolling, go to date, time filters, and so on.
- Extensive filtering that can be stored and easily called up later
- Find, Sorting by column, Copy/Paste of events to other windows applications
- Printouts
- Commenting of events by operator

11.4.4 MEASUREMENT REPORTS

The SCADA software shall support configuration of time related measurement reports. Measurement Report is used within SCADA's library applications for various types of time related reports, such as hourly, daily, weekly, monthly and yearly reports. The reports shall be based on time-related follow-ups of process, metered, entered or calculated data. The data for the reports shall be stored in real time. Report data is collected and calculated cyclically or triggered by events. The most common method is to fetch raw data from the process, and thereafter to scale and store it in the report database. All the events/reports shall be automatically written in text files and stored on hard disk in the reports folder of the application. Periodic back ups of reports shall be possible.

The Measurement Reports supports the following time related reports:

- Hourly report (time resolution: 3 minutes)
- Daily report (time resolution: 15 minutes)
- Daily report (time resolution: 30 minutes)
- Weekly report (time resolution: 1 day)
- Monthly report (time resolution: 1 day)
- Yearly report (time resolution: 1 month)

Printers that are connected to the Master Stations shall be used for printing of reports. Automatic periodic printing of reports can be configured for the Master. On demand printing of reports shall also be possible.

11.4.5 TRENDS

The SCADA shall support trends for performing time related follow up of process data. The trends shall be possible for both digital as well as analogue parameters. The trend shall support a maximum of 10 trend parameters. The trends shall be possible in both graphical and tabular forms which shall share the same database. The x- axis and y-axis of the graphs shall be configurable in scale. It shall be possible to have different scan time variable in single display. The trend display shall support the following features:

- Support of Graphical or tabular view modes with zooming facility
- Shall support Scrolling with scroll bars and panning
- Configurable axes, line properties and legend
- Update interval options from 30 seconds to 10 minutes
- Trends for Calculation formulas; direct, mean, sum and difference shall be possible
- Shall have Printout option
- Depiction of Update/Frozen modes
- Facility to Copy to clipboard and export to CSV File

11.4.6 CONTROL FUNCTIONS

The SCADA system shall support control function based on automatic & manual control of power and traction equipment. The manual control of equipments shall be possible using select- check- execute sequence. The open/close function for the operator control action shall be possible to be passed through protective interlock functions.

11.4.7 SAFETY TAGGING

The SCADA software shall support the feature of safety tagging upto atleast 2 levels by the addition of note marker. The note marker shall be inserted into any of the pictures and shall be saved even on the condition of change over. The operator shall be able to give some specific instructions to the shift operator using this functionality.

11.4.8 BLOCKING LIST

The SCADA software shall support feature of Blocking List which shall depict the blocking status of update, Control, Alarm and event for the various data base points along with the name of the Signal text used in the SCADA system.

11.4.9 BUS BAR COLORING

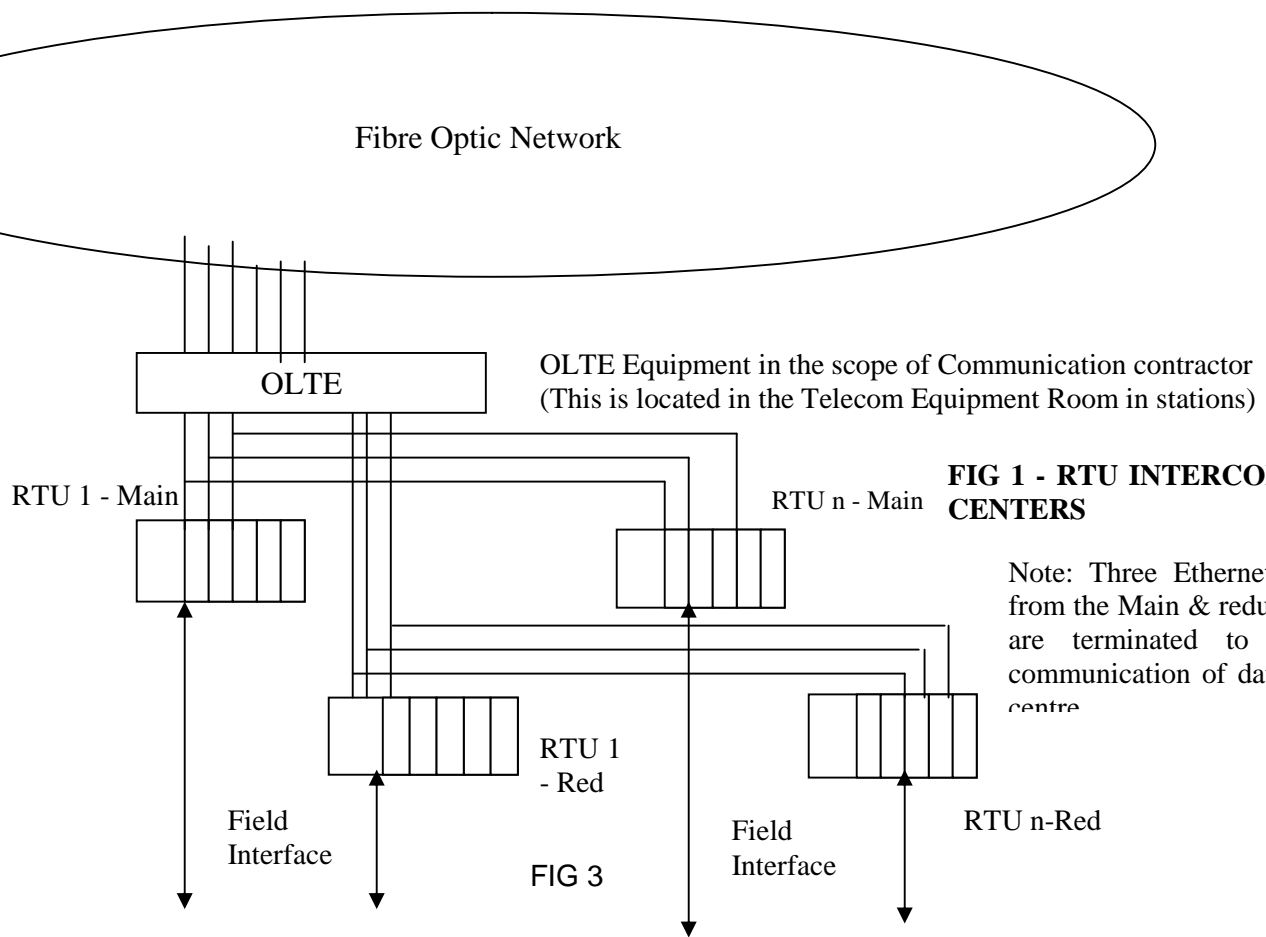
The SCADA software proposed shall support necessary busbar coloring feature by which the dynamic status of the busbar can be depicted during charged and uncharged condition. The bus bar coloring shall be provided for the ASS over view diagram, Traction Over view Diagram, Traction individual screens.

12. UNINTERRUPTED POWER SUPPLIES & AUXILIARY POWER SUPPLY DISTRIBUTION

The UPS supply shall be tapped from existing (UPS) Auxiliary Power Supply Distribution Board in SCADA room at OCC Mansarovar Depot. The contractor shall interface with existing SCADA vendor, if required. The tapping of power supply shall be in scope of JP/EW/1B/E2 contractor. The JP/EW/1B/E2 contractor shall provide Auxiliary Power Supply Distribution Board etc required for distribution of supply to its SCADA system. (Additional DB shall not be required in case of intergation of new section in existing SCADA system provided at OCC, Mansarovar Depot.

13. VISUAL DISPLAY PANEL

The JP/EW/1B/E2 Contractor is required to integrate new sections in existing large screen visual display panels to show traction and auxiliary power supply network of all the lines in real time mode. Additional interface workstation and other peripherals required for integration shall be in scope of JP/EW/1B/E2 contractor. Design, supply, installation testing and commissioning of this system is within the responsibilities of the JP/EW/1B/E2 Contractor.



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APPENDIX A

DEFINITIONS AND LIST OF ABBREVIATIONS

APPENDIX A**DEFINITIONS AND LIST OF ABBREVIATIONS****APPENDIX A1****DEFINITIONS**

In this Technical Specification, the following defined terms shall have the meanings ascribed to them below:

Standard Terminology	In general definitions applied to traction power and protective relay functions conform to the British Standards (BS) or the American National Standards (ANSI) or IEC (International Electromechanical Commission) standards or BIS (Bureau of Indian Standards).
Additional Terminology	Additional terminologies used in this document are as follows:
Air Gap	Term used for rigid traction overhead current collection system where two discontinuous sections of conductor rail run parallel to each other for smooth passage of pantograph.
Available Fault	The maximum fault current at rated voltage that the power system can deliver to a point in the system.
Contact wire	Electric conductor of an overhead current collection system with which the train pantographs (current collectors) make contact.
Rail bonding	The term used to describe insulated or bare conductors that electrically link longitudinal or transverse sections of rail to ensure continuity of the traction return current and reduce voltage drop in the running rails, as well as potential to earth.
Earthing	Synonymous with grounding. The connection of equipment enclosures and non current carrying metal parts to earth to provide safety to personnel, public and to the equipment.
Earth Fault	Failure of insulation of a conductor having a potential above earth resulting in a short circuit to earth.
Earth	Means the Conducting mass of the earth or any conductor in direct electrical connection there with.
Earth Mat	A system of bare conductors and/or bare driven conductor rods/pipes usually installed as a totally interconnected grid and buried in the earth to provide a low impedance and high current capacity connection to the earth
Earthing Switch	25 kV manually operated switch to earth the OCS/ OHE. The switch is interlocked with the associated isolating switch /interrupter against earthing of a live OHE/OCS.

Earth Bus	An uninsulated electrical conductor to intentionally provide multiple low resistance connections from the equipment enclosure (s) to earth.
Ground/Grounding	Synonymous with earth/earthing.
High Speed Circuit	A direct current circuit breaker protecting the positive output side breaker of a rectifier.
High Voltage	As applied for this Contract, the high voltage is 25 kV, 33kV ac or 66 kV or 220 kV ac line to line.
Headway	The time interval between following trains.
Interrupter	25 kV load break, fault making switch generally remote control.
Interrupting Capacity	This is the capability to interrupt a maximum rated short circuit or fault current at a rated maximum voltage. It is usually expressed in, kilovolt amperes, or megavolt amperes or kilo-amperes at rated voltage.
Low Voltage	As applied to this Contract, low voltage refers to voltage not exceeding 1000V ac between conductors.
Overlap	Used for flexible overhead equipment where two tension lengths of OHE run parallel to each other for smooth passage of pantograph.
PCU (Protection and Control Unit)	PCU is an intelligent microprocessor based, self-diagnostic, protection, control and metering unit. The PCU consists of Protection relay module, control module and metering module functioning as a complete unit for continuous controlling, monitoring, metering and protection of the system.
PLC (Programmable Logic Controller)	PLC is a programmable controller, which utilises ladder diagram programming and advanced instructions for use in Automation environment.
RTU (Remote Terminal Unit)	Interface unit between PCU and SCADA
Receiving Substation	Receiving Substation receives incoming supply at 220 kV or 66 kV from DVB Power Grid (local power utility company) and transforms distributes the supply at 33kV and 25 kV for auxiliary and traction power respectively for distribution to MRT system.

Return Conductor	Means a conductor which carries a proportion of return current from the tracks to the substation.
Rail Bond	Means an electrical Connection across a joint in or between adjacent lengths of running rail.
Sector	Term used for 25 kV ac traction and denotes the section of OCS being normally fed by one power source.
Sub Sector	Term used for 25 kV ac traction and denotes the smallest section of OCS controlled by remote operated switchgear (interrupter/circuit breaker).
Switchgear	Means Isolator Switches, Circuit Breakers, Interrupters, Cutouts and other apparatus used for the operation, regulation and control of electrical circuits.
Withstand Capability	Rated capability of equipment to survive without damage the mechanical forces of a short circuit or the thermal effects of a short circuit down stream from the equipment. Also the rated capability to withstand without damages for a short time a specified power frequency over voltage and/or a specified voltage surge or impulse.
System	Receiving, traction and auxiliary power supply systems and SCADA system for Metro Corridor.

END OF APPENDIX - A1

APPENDIX A2 LIST OF ABBREVIATIONS

A or Amp	Ampere
AC or ac	Alternating Current
AFC	Automatic Fare Collection
AIR	All Indian Radio
ANSI	American National Standards Institute
ASS	Auxiliary Substation
ASTM	American Society for Testing and Materials
ATP	Automatic Train Protection
ATO	Automatic Train Operation
ATS	Automatic Train Supervision
AWG	American Wire Gauge
BIL	Basic Impulse Level
BIS	Bureau of Indian Standards
BIT	Built in Test Diagnostics
BWA	Balance Weight Assembly
cm ²	Square Centimetre
CATC	Continuous Automatic Train Control
CB	Circuit Breaker
CBT	Computer Based Training
CD ROM	Compact Disk Read Only Memory
CT	Current Transformer
dBA	Decibels (A Scale)
DC or dc	Direct Current
DCC	Depot Control Centre
JDA	Jaipur Development Authority
DIN	Deutsches Institut für Normung
DOT	Department of Telecommunications
DP	Double Pole
DPCS	Digital Protection Control System
RVB	Rajasthan Vidyut Board

EEPROM	Electrically Erasable Programmable Read Only Memory
EMI	Electro Magnetic Interference
EMC	Electro Magnetic Compatibility
ETI	Employer's Training Instructor
ETS	Emergency Trip System
FRLS	Flame Retardant Low Smoke
FP	25 kV Traction Feeding Post
FRLSOH	Fire Retardant Low Smoke Zero Halogen
g/m ²	Grams per metre squared
G5/3	Limits for Harmonics in the United Kingdom Electricity Supply System.
GI	Galvanised Iron
GIS	Gas Insulated Switchgear
Hr, h	Hour
HT	High Tension
Hz	Hertz
IR	Indian Railway
IRJ	Insulated Rail Joints
JTC	Joint-less Track Circuit
kA	Kilo Amperes
kg	Kilogram
kgf	Kilogram force
km	Kilometre
km/h	Kilometres per hour
kPa	Kilo Pascal
kV	Kilovolt
kVA	Kilovolt Ampere
kVAR	Kilovolt Ampere Reactive
kVp	Kilovolt pulse (peak)
kW	Kilowatt
L/R	Ratio of Inductance to Circuit Resistance
LAN	Local Area Network

LBS	Load Break Switch
LED	Light Emitting Diode
LSOH	Low Smoke Zero Halogen
LT	Low Tension
m	Metre
m/s/s	Metres per second per second
m/s/s/s	Metres per second per second per second
MBCC	Microprocessor Based Communication Controller
MC	Motor Coach
MCB	Miniature Circuit Breaker
MCCB	Moulded Case Circuit Breaker
MCJ	Municipal Corporation of Jaipur
MDP	Main Distribution Panel
mm	Millimetre
MRT	Mass Rapid Transit
MRTS	Mass Rapid Transport System
MS	Mild Steel
MSL	Mean Sea Level
MTNL	Mahanagar Telephone Nigam Limited
mV	Mill volt
MVA	Mega volt Ampere
MW	Megawatt
N	Newton
NC	Normally Closed
NDTs	Non Destructive Tests
NO	Normally Open
°C	Degree Celsius
OCC	Operations Control Centre
OCS	Traction Overhead Current Collection System pertaining to rigid conductors.
OHE	Traction Overhead Current Collection System pertaining to flexible conductors.

O and M	Operation and Maintenance
ONAF	Oil-Immersed Forced Air Circulation Cooled
ONAN	Oil-Immersed Natural Air Circulation Cooled
OVPD	Over Voltage Protection device
PC	Power Controller: Traction/auxiliary
PCU	Protection and Control Unit
P.E.	Professional Engineer
Ph	Phase
PLC	Programmable Logic Controller
PS	Technical Specification
PRF	Pulse Repetition Frequency
PT	Potential Transformer
PWD	Public Works Department
QRA	Qualified Risk Assessment
QRA	Quantified Risk Assessment
RAMS	Reliability, Availability, Maintainability and Safety
RCC	Reinforced Cast Concrete
RDSO	Research Design Standards Organisation (IR)
RF	Radio Frequency
RMS	Root Mean Square
RRSW	Running Rail Sectionalising Switch
RSS	Receiving Substation for 25 kV ac traction and 33 kV auxiliary supply
s	Second
S/S	Substation
SCADA	Supervisory Control and Data Acquisition System
SCB	Shunt Capacitor Bank
SCR	Station Control Room
SE	System Earth
SEM	Structural Electrical and Mechanical Drawings
SF6 or SF ⁶	Sulphur Hexa-floride
SPS	Small Steel Parts

Sq m	Square metre
Sq mm	Square millimetre
SRU	Shop Replacement Unit
SP	25 kV ac traction sectioning and paralleling post
SS	25 kV ac traction sub-sectioning.
SSP	25 kV ac traction sub-sectioning and paralleling post
tc	Trailer Coach
TEFC	Totally Enclosed Fan Cooled
TP	Triple Pole
TSS	Traction Substation
µsec	Micro second
V	Volt
VA	Volt Ampere
VCB	Vacuum Circuit Breaker
VDU	Visual Display Unit
VSNL	Videsh Sanchar Nigam Limited
VT	Voltage Transformer
VVVF	Variable Voltage Variable Frequency
XLPE	Cross-linked polyethylene

END OF APPENDIX - A2

CONTRACT PACKAGE JP/EW/1B/E2

APPENDIX B

LIST OF STANDARDS

APPENDIX B LIST OF STANDARDS

Following is the List of National, International standards of other countries which have been referred to in the various specification. However, this list is not exhaustive. Other lists of standards exist elsewhere within the Specification.

List Consist of:

- I Indian Standards
- II IECs
- III American Standards
- IV British Standards
- V Other Standards

The latest edition with amendments shall be used.

Indian Standards

IS NO.	Title
10028	Code of Practice for selection, Installation and maintenance of transformers
10118-1982	Codes of practice for selection, installation and Maintenance of switch-gear and control-gear
10136-1982	Code of Practice for selection of disc insulators fittings of highest system voltages of 72.5kV and above.
10561 - 1983	Application guide for power transformers
10810	Test Methods for cables
11171-1985	Dry type Power Transformers
11353-1985	Guide for uniform system of marking and identification of conductors and apparatus terminals
1248 (Pt I to IV)	Direct acting indicating analogue electrical measuring instruments and their accessories
1255-1983	Codes of practice for installation and maintenance of power cables up to and including 33kV rating
1271-1985	Thermal evaluation and classification of electrical insulation
13947 – 1993	Low voltage and Medium voltage switchgear
1554 (Pt I-1988)	PVC insulated (Heavy Duty) Electric cables for working voltage up to and including 1100V

IS NO.	Title
1570	Schedule of wrought steels
1646-1997	Codes of Practice for fire safety of Buildings (general) - Electrical Installation
1818-1972	Alternating current isolators (disconnectors) and earthing switches
2026 (Pt I to IV)	Power Transformer General, Temp Rise, insulation level and dielectric tests, terminal marking
2071	Methods of tapping and connections of High Voltage Testing
2074-1992	Ready mixed paint, air drying, red oxide, zinc chrome, priming
209 – 1992	Zinc ingot
2099-1986	Bushing for alternating voltage above 1000V (with amendments No2)
2121-1962	Fittings for Aluminium and Steel Cord Aluminium conductors for overhead power lines
2147-1962	Degrees of Protection provided by enclosures for low voltage switchgear and control gear
2165	Insulation Co-ordination
2208-1962	HRC Cartridges fuse links for voltages above 650V
226-1975	Structural Steel
2274-1963	Code of Practice for electrical wiring installations system voltage exceeding 650V
2309-1989	Practice for the protection of buildings and allied structures against lightning (Code of Practice)
2339-1963	Aluminium Paint for general purposes in dual container
2516	Circuit breakers
2551-1982	Danger notice Plates
2667-1988	Fittings for rigid steel conduits for electrical wiring
2705-1992	Current Transformers (with amendments)
2713 (Pt. I - III) 1980	Tubular steel poles for overhead power lines
2959-1985	Conductors for voltages not exceeding 1000V ac or 1200V dc
3034-1993	Fire safety of industrial building, electrical generating and distributing stations: Code of Practice

IS NO.	Title
3043 –1987	Codes Practice for Earthing
306-1983	Tin Bronze Ingots and Castings
3070	Lightning arresters for alternating systems
3072-1975	Code of Practice for Installation and maintenance of switch gear
3156-1992	Voltage Transformers
3188-1980	Characteristics of string insulator units
3231	Electrical relays for power system protection
325-1996	3 Phase Induction motors
3347	Dimensions for porcelain transformers bushings for use in lightly polluted atmosphere
335-1993	New Insulating oils
3427-1997	AC Metal enclosed switchgear and control gear for rated voltage above 1000V and up to and including 52 kV
3534 – 1976	Outline dimensions of electric lifts.
3618-1966	Phosphate treatment of Iron and Steel for protection against corrosion.
3637-1966	Gas operated Relays
3639-1966	Fittings and Accessories for Power Transformers
3716-1978	Application guide for insulation co-ordination
375	Marking and arrangement for switch gear, bus bars, main connections and auxiliary wiring
3837-1976	Accessories for rigid steel conduits for electrical wiring
3842 (Parts 1 to 12)	Application Guide for electrical relays for ac systems
3895-1966	Mono-crystalline semi conductor rectifier cells and stacks
3961 (Pt II)	Recommended current ratings for PVC insulated and PVC Sheathed heavy duty cables
3975-1988	Mild Steel wires, formed wires and Tapes for armouring of cables
398	Aluminium conductors for overhead transmission purposes
4064-1978	Air Break Switches, air break disconnectors, air break switch disconnectors and fuse combination units for voltages not

IS NO.	Title
	exceeding 100V ac or 1200V dc
4146-1983	Application guide for voltage transformers
4201-1983	Application Guide for Current Transformers
4540-1968	Mono-crystalline semi conductor rectifier assemblies and equipment
4710-1968	Switches and Switch isolators above 1 kV but not exceeding 11 kV (with amendment 1)
5082-1998	Wrought aluminium and aluminium alloy bars, rods, tube sections, plates and sheet for electrical applications
5133 (Pt II) 1969	Boxes for enclosures of Electrical Accessories : made of insulating materials
5133(Pt I) 1969	Boxes for enclosures of Electrical Accessories Steel and Cast iron Boxes
5216-1982	Guide for safety procedures and practice in electrical works
5547-1983	Application guide for capacitor voltage transformer
5561-1970	Electric Power Connectors
5578-1984	Guide for marking or insulated conductors
5621-1980	Hollow insulators for use in electrical equipment
5728-1970	Guide for short Circuit calculation
5831-1984	PVC insulation and Sheath of Electric Cables
617-1994	Aluminum and aluminium alloy ingots and castings for general engineering purposes
6380-1984	Elastomeric insulation and sheath of electric cables
6600-1972	Guide for loading of oil immersed transformers
6619-1972	Safety codes for semi conductor rectifier equipment
6875	Control Switches (switching devices for control and auxiliary circuits including contactor relays) for voltages up to and including 1kV ac and 1200V dc
7098	XLPE insulated PVC sheathed cables for working voltages upto 220kv
Part I, II and III	
722	AC electricity meters
731- 1971	Porcelain insulators for overhead power lines with a nominal voltage greater than 1kV

IS NO.	Title
7987-1976	Guide for selection of high voltage ac circuit breakers
800-1984	Code of Practice for General Construction in Steel
808-1989	Dimensions for hot rolled steel beams, column channel and angle sections
8468-1977	On load tap changers
8623-1993	Low voltage switchgear and Control Gear assemblies
8686-1977	Static Protective Relays
8828-1996	Electrical accessories – circuit breakers for over current protection for household and similar installations
9537 (Pt II)	Conduits for electrical installations: Part 2 - Rigid Steel Conduits (with amendment 1)
9921	A C Disconnect (Isolators and earthing switches for voltage above 1000V)
9968	Elastomeric insulated cables
SP 30-1985	National Electrical Code

II INTERNATIONAL ELECTRO TECHNICAL COMMISSIONS (IECs)

IEC NO.	Title
IEC 60 296	Specification for unused mineral insulating oils for transformers and switchgear
IEC60 034	Rotating electrical machines
IEC60 038	IEC standard voltages
IEC60 44-1	Current Transformers
IEC60 44-2	Voltage Transformers
IEC60 050	International electromechanical vocabulary
IEC60 051	Direct acting indicating analogue electrical-measuring instruments and their accessories
IEC60 056	High-voltage alternating current circuit breakers
IEC60 060	High-voltage test techniques
IEC60 071	Insulation Co-ordination
IEC60 076	Power transformers
IEC60 077	Rules for electric traction equipment

IEC NO.	Title
IEC60 085	Thermal evaluation and classification of electrical insulation
IEC60 099-4	Surge arresters – Part 4: Metal oxide surge arresters without gaps for ac systems
IEC60 129	Alternating current disconnectors (isolators) and earthing switches
IEC60 137	Insulating Bushings for alternating voltages above 1000V
IEC60 156	Insulating liquids – Determination of break down voltage at power frequency – Test Method
IEC 60 185	Current Transformer
IEC60 214	On-load tap changers
IEC60 228	Conductors of insulated cables
IEC60 230	Impulse test on cables and their accessories
IEC60 255	Electrical relays
IEC60 258	Direct acting recording electrical measuring instruments and their accessories
IEC60 265	High voltage switches
IEC60 269	Low-voltage fuses
IEC60 287	Electric cables - Calculation of the current rating of cables (100% load factor)
IEC60 298	AC metal-enclosed switchgear and control gear for rated voltages above 1kV and up to and including 52kV
IEC60 332 Part 1	Tests on electric cables under fire conditions-Part 1: Test on a single vertical insulated wire or cable
IEC60 332 Pt. 3	Tests on electric cables under fire conditions-Part 3: Test on bunched wires or cables
IEC60 354	Loading guide for oil-immersed power transformers
IEC60 376	Specification and acceptance of new sulphur hexa-fluoride
IEC60 420	High voltage alternating current switch fuse combinations
IEC60 439	Low-voltage switchgear and control gear assemblies
IEC60 502	Power cables with extruded insulation and their accessories for rated voltages from 1kv up to 30 kV
IEC60 517	Gas insulated metal enclosed switchgear for rated voltages of 72.5kV and above.

IEC NO.	Title
IEC60 521	Class 0.5, 1 and 2 alternating-current watt-hour meters
IEC60 529	Degrees of protection provided by enclosures (IP code)
IEC60 542	Application guide for on-load tap changers
IEC60 551	Determination of transformer and reactor sound levels
IEC60 664	Insulation co-ordination for equipment within low-voltage systems
IEC60 694	Common specifications for high-voltage switchgear and control gear standards
IEC60 722	Guide to the lightning impulse and switching impulse testing of power transformers and reactors
IEC60 726	Dry type Power Transformer
IEC60 754-2	Test on gases evolved during combustion of electric cables-Part 2: Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity
IEC60 811	Common test method for insulating and sheathing materials of electric cables
IEC60 859	Cable connections for gas-insulated metal-enclosed switchgear for rated voltages of 72.5kV and above
IEC60 871-1	Shunt capacitors for ac power systems having a rated voltage up to and including 1000V
IEC60 904-3	Photo voltaic devices. Part 3: Measurement principles for terrestrial photo voltaic (PV) solar devices with reference spectral irradiance data
IEC60 913	Overhead Electric Traction Lines – Clearances.
IEC60 947-1	Low-voltage switchgear and control gear. Part 1: General rules
IEC60 947-2	Low-voltage switchgear and control gear-Part 2: Circuit breakers
IEC60 947-3	Low-voltage switchgear and control gear-Part 3: Switches disconnectors, switch disconnectors and fuse-combination units
IEC60 947-5-1	Low-voltage switchgear and control gear-Part 5: Control circuit devices and switching elements. Section 1Z: Electromechanical control circuit devices
IEC60831	Shunt power capacitors of the self-healing type for ac systems having a rated voltage up to and including 1000V
IEC61 000 5-1	Electro magnetic compatibility (EMC) Part 5: Installation and mitigation guidelines – Section 1: General Considerations

IEC NO.	Title
IEC61 000-4-8	Electromagnetic compatibility-Part 4: Testing and measurement techniques. Section 8: Power frequency magnetic field immunity test basic EMC publication
IEC61 034	Measurement of smoke density of electric cables burning under defined conditions
IEC61 131	Programmable Logic Controllers.
IEC61 133	Electric traction – Rolling stock – test method for electric and thermal/electric rolling on completion of construction and before entry into service

III AMERICAN

(A) IEEE

IEEE 48 (1996)	IEEE Standard test procedures and requirements for high-voltage alternating current cable terminations.
IEEE 383	Standard for type-test of Class E electrical cables, field splices and connections for nuclear power generating stations.
IEEE 404 (1993)	Cable and joints for use with extruded dielectric cable rated 5000 to 13800 V and cable joints for use with laminated dielectric cable rated 2500 V to 50,000 V (50kV)

(B) MIL

MIL-STD-880C	Military standard system safety program requirements (VSA)
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(C) NFPA

NFPA 70	National electrical code
NFPA 70 E (1988)	Standard for electrical safety requirements for employee workplaces
NFPA 130	Standard for fixed guide way transit systems
NFPA 258	Standard research test method for determining smoke generation of solid materials
SS 299	Specification for fire resistant cables

(D) ANSI

ANSI C3716(1988)	Relays and low voltage power circuit breakers and AC power circuit protectors
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(E) ASTM

- ASTM D 2863 Method for measuring the minimum oxygen concentration to support candle like combustion of plastic (oxygen index)
- ASTM B 173-64 Specification for rope lay-stranded copper conductors having concentric members, for electrical conductors

IV BRITISH STANDARDS

- BS 88 Specification for cartridge fuses for voltages up to and including 1000 V AC and 1500 V DC
- BS 142 Information and requirements for all protection relays
- BS 159 Busbars and busbar connection
- BS 729 Specification for hot-dip galvanized coatings on iron and steel articles.
- BS 731 Flexible steel conduit and adapters for the protection of electric cable.
- BS 951 Specification for clamps for earthing and bonding purposes
- BS 2692 Fuses for voltages exceeding 1000 V AC
- BS 4444 guide to electrical earth monitoring and protective conductor provision.
- BS 4568 Specification for steel conduit and fittings with metric threads of ISO form for electric installation
- BS 5372 Specification for dimensions of cable terminations for 3-core and 4-core polymeric insulated cables of rated voltages 600/100 V and 1900/3300 V having aluminum conductors
- BS 5472 Specification for low voltage switchgear and control gear for industrial use. Terminal marking and distinctive number, general rules.
- BS 5493 Code of practice for protective coating of iron and steel structures against corrosion
- BS 6231 Specification for PVC insulated cables for switchgear and control gear wiring
- BS 6290 Lead-acid stationary cells and batteries
- BS 6360 Specification for conductors in insulated cables and cords
- BS 7430 Code of Practice for earthing
- BS EN 6012994 Specification for alternating current disconnectors and earthing switches

V European (CENELEC)

- EN50052 Standards for pressure vessel construction
- EN50121-5 Railway Applications – Electromagnetic Compatibility

Part 5: Fixed Power Supply Installations.

EN50122-1 Railway Applications, Fixed Installations, Protective Provisions relating to electric safety and earthing

EN50124-1 Railway Applications – Insulation Coordination.

EN50163 Supply Voltage of Traction System.

VI OTHERS

ISO 1459 Metallic Coatings- Protection against corrosion by hot dip galvanizing – Guiding principles

ISO 1460 Metallic Coatings- Hot dip galvanized coatings of ferrous materials – Gravimetric determination of the mass per unit area.

ISO 1461 Hot dip Galvanized Coating on fabricated ferrous products – specification

ISO 2064 Metallic and other non-organic coatings definitions and conventions concerning the measurement of thickness.

ISO 2177 Metallic Coatings measurements of coating thickness - coulometric method by anodic dissolution.

ISO 2178 Non-magnetic on magnetic substrates – measurements of coating thickness – magnetic method

ISO 2859 Sampling procedures and tables for inspection by attributes.

UL 94 Tests for flammability of plastic materials for parts in devices and appliances

UL 508 Industrial control equipment

UL 746C Polymeric materials used in electrical equipment evaluations

VDE 0115 Part 1 Traction systems general construction and safety

VII RDSO (Indian Railways)

ETI/OHE/3 (2/94) Annealed stranded copper conductor jumper wire.

ETI/OHE/13 (4/84) Galvanisation of steel structures

ETI/OHE/14 (9/94) Stainless Steel wire rope

ETI/OHE/37 (12/73) Hard drawn Copper catenary wire.

ETI/OHE/42 (6/97) Hard Drawn grooved Copper contact wire.

ETI/PSI/116 (4/88) 220 / 132 / 110 / 66 kV DP / TP SF⁶ gas circuit breakers

ETI/PSI/117 (7/88) Current Transformers

ETI/PSI/122 (3/89) 245 / 145 / 123 / 72.5 kV double pole and triple pole isolators

ETI/PSI/137 (8/89) metal oxide gapless type lightning arrestors.

END OF APPENDIX B

APPENDIX C

INTERFACE BETWEEN

SIGNALLING AND TELECOM

AND

JP/EW/1B/E2

INTERFACE REQUIREMENTS BETWEEN TELECOM CONTRACTORS (All signalling & telecom contractor deputed for Jaipur 1B works, GSM/CDMA, AFC) AND E&M/ TRACTION/ OHE CONTRACTORS FOR STATIONS/ DEPOTS/ TUNNELS/ RSS

Following requirement are listed for installation/ provision by E&M/ Tunnel/ OHE contractors for Telecommunication work for Lighting, Air-conditioning, Cable tray/ladder, earthing, etc. requirements at Stations/Depot/Tunnels/RSS.

A. General Interface Requirement:-

1. Cable Trays connectivity from TER to Various location of Station and Tunnel as per Combined Services Drawing (CSD).
2. During handover of TER availability of following items are to be ensured, as a minimum - AC power, Cable tray Risers, Air-conditioning, Lighting, AC power sockets, data /power tray connectivity.
3. Telecom Data and Power trays to be marked with distinct colour codes to avoid any ambiguity between telecom and other services trays.
4. Cable tray junctions and T points should not have sharp bends and edges to avoid cable damage. The bending radius of minimum 1.5m shall be provided.
5. Data and power tray should have separation of at least 150mm between them at any place and if crossing is required there should be provision of a bridge to cross the cable tray. No electrical tray closer than 300mm should be provided near Telecom trays

B. Lighting requirement

6. AC power points, indoor lighting facility and fire protection system to be done in TER, UPS, GSM/CDMA etc. Minimum 300 lux. level of lighting at FFL to be provided with some lights with emergency supply.

C. Cable Tray installation requirement

7. Data and Power cable trays are to be provided from TER to Concourse, Platform, Road level areas, All Station Entrance/Exits, Technical Rooms, SCR, TOM, EFO, Security Room, Ancillary Buildings, DG Room, Pump Room, Undercroft in underground stations etc. Cable tray Risers/Droppers to be provided in TER and S&T shafts with connectivity from nearby Telecom trays provided.
8. Cable Tray connectivity from Optical fibre cut-outs in platform beam is to be provided up to TER with dropper up to floor level with route diversity.
9. Data / Power Cable tray risers / droppers up to FFL to be provided in TER, TOM, EFO, SCR, Platform supervisory booth/Panel and any other Room with connectivity from nearby Telecom trays.
10. Provision of Telecom Trays connectivity at Road level to be done for parking areas.

11. In case there is double height area at PF level, the provision of cable trays and mounting structures for GSM/CDMA antennas, CCTV cameras and PAS/ PIDS/ Clock equipments should be designed at appropriate height away from PF edge. Cable Trays should be provided in a manner so that minimum no. of sleeves/cut outs is required for Telecom equipment installations.
12. Provision for Telecom Data and Power Cable/ Cable tray connectivity to be done in all the utility buildings in Depots (All levels) with connectivity from the S&T trench.
13. Data/Power Tray Riser/Droppers in TER, DCC, S&T shafts and other locations to be provided in connectivity of nearby telecom tray in Depots.
14. Data/power tray connectivity is to be provided in all utility building (All levels) including main gate in Depots from the pull pit connected with the trench. Data/Power Cable tray risers / droppers to be provided in TER, DCR etc.
15. Telecom Cable Tray connectivity for Platform Supervisory Booth/Panel (PSB/PSP) from the nearest S&T Tray.
16. Provision of cable trays connectivity is to be done on portals for installation of clocks, speakers, CCTV cameras in workshop, inspection bays and stabling yards etc in Depots.
17. For stations with radio base equipments, cable tray connectivity for two different locations (with route diversity) from TER to open sky at ground level to be provided for installation of GPS antennas.

D. Earthing requirement

18. At Elevated Stations/Depot, Provision & Extension of Main earth (<2 ohm) to be done from Main Earth Mat location to TER, UPS (S&T) Room and SCR. Copper Bus bar with min.20 holes (10 per row) to be provided in TER, UPS (S&T) Room, SCR and DCC in Stations and Depots. Main earth extension with copper earth strip to be done in the GSM and CDMA Rooms.
19. At underground stations, extension of Clean Earth (<1 ohm) & Main Earth (<2 ohm) to be done from Earth Mat (Provided by Civil) to TER. Copper Bus bar with min.20 holes (10 per row) to be provided in TER.
20. In tunnel main earth strips at cross passages for emergency telephones to be provided.

E. Air conditioning Requirements.

21. Air conditioning to be installed for TER & UPS rooms. Drainage system of Air conditioning should be installed outside TER, & UPS rooms and only air outlet is to be provided inside rooms to maintain temperature nominal 25 degree continuous.

22. Clear height of 3 meter should be available in TER for telecom equipments installations. Installations of other contractors' equipments (Air conditioners etc) shall be above 3 meter height.
23. There should not be any water flow or drainage pipe passing through TER.
24. Confirmation of Fire Safety Provisions.

F. TSS/RSS requirements.

25. **For providing Telecom facilities at TSS/ RSS (Out side the JMRC Premises), connectivity either by trench or by trenchless is to be provided by traction contractor along with their own cable route.**
26. Telephone cabling inside the TSS/ RSS buildings to be provided by E&M.
27. In RSS/ TSS building control room, table for providing telephone, telephone rosette with connectivity required.
28. Provision of Cable trough/ Trench with one bracket inside RSS boundary for laying telecom cable.
29. Provision of AC 230V for telecom (CCTV, CLOCK etc) equipments.

In addition to above following requirement to be installed/ provided at underground stations & Tunnels:-

30. Brackets/hangers are to be provided on tunnel inner edge for laying of optical fibre cable, emergency telephone cables, GSM/CDMA Cables.
31. Cable tray connectivity is to be provided from Telecom brackets in tunnel to telecom cable trays in nearest S&T shaft.
32. Data/ power cable tray connectivity is to be provided in mid shaft with connectivity from Telecom brackets in tunnel.
33. Provision of Temporary power and illumination in Tunnel to be provided for installation of emergency telephone and stand offs for LCX cable of GSM/ CDMA/ TETRA system. Temporary lighting in Tunnel should not be provided in space reserved for GSM/ CDMA/TETRA cables in Tunnel.

G. GSM/CDMA requirements.

34. During handover of GSM and CDMA rooms availability of following items are to be ensured, as a minimum:- AC power, Air-conditioning , Lighting, AC power sockets, power supply cables, Main Earth (<2ohm) copper strip with min.20 holes (10 per row)
35. GSM/CDMA cable trays are to be provided from GSM/CDMA Room to Concourse, Platform, under croft level areas and riser/droppers in S&T shafts etc. as per GSM/CDMA requirements.
36. Cable tray connectivity from GSM/CDMA room to open sky at ground level to be provided for installation of GPS antennas as per GSM/CDMA system requirements.

37. Provision of Power supply to be done in GSM and CDMA equipment Rooms as per GSM/CDMA operator equipment load requirements.
38. Clear height of 3.5 meter should be available in GSM/CDMA room for their equipments installations.

Signalling and Traction Supply Interfaces

1. INTRODUCTION

1.1 Definitions and Scope

- 1.1.1 This specification covers the interface requirements between Train Control & Signalling Contractors and Traction Power Distribution and Overhead Line Contract(s).
- 1.1.2 In this Specification, unless otherwise stated, the term “Contracts” refers to the Signalling Contractors, Traction Supply Contract(s) and the term “Contractors” refers to Signalling Contractors, Traction Contractors. The individual Contractor is referred to by the corresponding Contract number.
- 1.1.3 This document shall be read in conjunction with the relevant paragraphs of the General Specification. The Contractors shall ensure all requirements of the General Specification and PS pertaining to interfaces are fully resolved and implemented.
- 1.1.4 In the event of a conflict between any Technical Specification and this specification, the requirements of the Technical Specification shall prevail.

2. CONTRACTORS' RESPONSIBILITIES

2.1 Coordination and Interfacing

- 2.1.1 This specification outlines the Contractors' interface requirements, which are based on the Technical Studies carried out during the early stages of the Project. However, the requirements herein specified are by no means exhaustive and it remains the Contractors' responsibilities to develop, update and execute jointly Interface Management details during design & throughout the execution of Works, to ensure that:
 - (i) All interface issues between the two contracts are satisfactorily resolved
 - (ii) Supply, installation and testing of equipment and software are fully coordinated
 - (iii) All equipment supplied in the contracts are fully compatible with each other

2.2 Interface Management

- 2.2.1 Each contractor shall establish a structured process to integrate with other sub-systems to ensure safe, reliable and efficient operations under both normal and degraded conditions to the satisfaction of the Employer's Engineer.
- 2.2.2 Each contractor shall ensure that the equipment supplied under this Contract are properly interfaced and integrated with other systems in JMRC.
- 2.2.3 Each contractor shall appoint competent and experienced person with no fewer than 5 years of railway project experience who shall be the single point of

contact for all interface design and testing works with the interfacing contractors and the Employer's Engineer.

- 2.2.4 Each contractor shall be responsible for interface identification, establishment, construction and testing works either in the capacity as the Lead Contractor or Participating Contractor.
- 2.2.5 Signalling contractor shall be the lead contractor. The Lead Contractor will be responsible to initiate, plan, coordinate and produce jointly with the Participating Contractors all the required interfaces and interface design documents and interface progress reports for submission to the Engineer for acceptance. The Lead Contractor will also prepare and submit all interface meeting minutes and interface progress reports to the Employer's Engineer for information.
- 2.2.6 Traction contractor will be the participating contractor. The Participating Contractor shall collaborate fully with the Lead Contractor in the development and finalization of the interface design, joint production of the interface documents and interface progress reports.
- 2.2.7 The costs for all interface design and testing works shall be deemed to be included in the Contract sum regardless of the actual extent of effort required or expended by the Contractor.
- 2.2.8 The Contractors shall be fully responsible for the management and control of his sub-contractors in relation to all interfacing activities carried out under the Contract.

3. PHYSICAL INTERFACE

3.1 Signal and Mast Locations

- 3.1.1 Signalling Contractors shall provide chainages of signal posts and radio mast to Traction contractor(s). The Traction Contractor(s) shall provide the Signalling Contractors with the location of all OHE masts & their staggering arrangement in the Depot, and Main line. Signalling contractor may use the OHE mast for fixing radio equipment. Wherever OHE mast is used, the radio equipment fixtures will be provided by the signalling contractor. The signalling contractor will ensure that (a) the radio equipment so provided are immune to EMI/EMC affect of 25 kV, single phase over head equipment (b) the radio equipment is protected against any physical or mechanical damage. The signalling contractor shall provide suitable procedure and arrangement for maintenance of radio antenna equipment fixed on the OHE mast.
- 3.1.2 The Signalling Contractors shall receive the information of OHE mast location from the Traction contractor(s) and shall ensure that signals are mounted in locations where these are not hidden by OHE masts or other hardware.
- 3.1.3 The contractors shall co-ordinate for ensuring the minimum safe distance between any signalling field installation and the live OHE contact point for the purpose of human safety apart from EMI/ EMC considerations.

4. ELECTRICAL INTERFACE

4.1 Traction Return

- 1) The Traction contractor(s) shall advise the Signalling Contractors of the normal and worst short circuit current levels.
- 2) The Signalling Contractors shall advise the Traction contractor(s) of the locations of the track circuits. The Contractors shall agree on the final location of cross bonds/ impedance bonds and other rail connections related to traction return current.
- 3) Signalling Contractors shall supply, install and terminate all impedance bonds, bonding cables and continuity bonds, including all bonding in the turnouts, required for proper functioning of track circuits. The Traction contractor(s) shall supply, install and terminate traction bonding cables, if required additionally, at appropriate intervals, which shall be co-ordinated with the Signalling Contractors, contractor to ensure the balanced & unobstructed flow of traction return current. All connections to the rail shall be suitably welded (thermo welding or pin brazing technology) to give resistance & corrosion free smooth contact. The rail welding material shall confirm to IRS: S103-2004 or the latest.
- 4) For connecting the traction transformer earthed neutral terminal to the running rails, Traction contractor(s) shall co-ordinate with Signalling Contractors.
- 5) The two Contractors shall interface regarding use of Buried Earth Conductor, if provided along the line, for earthing of outdoor signalling equipment.
- 6) The two Contractors shall interface to achieve an integrated Earthing & Bonding plan for the main line and depot area.

4.2 Insulated Rail Joint

- 4.2.1 For track circuits, the Signalling Contractors shall provide the Traction contractor(s) with the location of required insulated rail joints at Depot, and on the mainline.
- 4.2.2 Traction contractor(s) shall design the traction return system considering the locations of insulated joints.

4.3 Neutral Sections

- 4.3.1 The Traction contractor(s) shall provide the Signalling Contractors with the length & location of all traction neutral sections.
- 4.3.2 The Signalling Contractors shall design the Signal Locations such that no train or a part of a train stops within the neutral sections during normal operations.
- 4.3.3 The signalling contractor will ensure that track circuit (wherever provided) under the neutral section shall be a single continuous track circuit.

5. FUNCTIONAL INTERFACE

5.1 Protection Characteristics

- 5.1.1 The Traction contractor(s) shall provide the Signalling Contractors with the overhead line feeder circuit rating, the protection tripping setting, the overhead line conductor current carrying capacity, Transient & surge protection and the protection relay setting.
- 5.1.2 The Signalling Contractors shall ensure that the Train Control and Signalling System makes allowance for the settings as described in Paragraph 5.1.1 when planning for simultaneous start up of several trains. The Contractors shall ensure that there is no degradation with respect to the performance requirement as specified in the respective Specifications.

6. ELECTROMAGNETIC COMPATIBILITY

6.1 Joint EMC Management Plans and Testing Regime

- 6.1.1 The Traction and Signalling Contractors shall perform a joint study and develop the Electromagnetic Compatibility Management Plans using such data as the emission characteristics, susceptibility levels, filter characteristics, physical layout and construction of their equipment, taking into consideration variation in component characteristics with frequencies. The study shall demonstrate compatibility or highlight areas of potential problems with a view to implement remedial measures in time to achieve compatibility.
- 6.1.2 Traction and Signalling Contractors shall co-ordinate for any information concerning EMI/ EMC in the overhead line & other structures.
- 6.1.3 The Contractors shall jointly develop a test plan detailing how the electromagnetic compatibility of the OHE traction System and the Signalling & Train control System will be verified, taking into consideration the study conducted.

7. Operating Modes and Principles Document

The signalling contractor as a lead contractor shall prepare a comprehensive operating modes and principles document (OMPD). The rolling stock contractor, Platform Screen Door contractor and Telecommunication contractor as participating contractors will assist the signalling contractor in preparation of the document. The traction and tunnel ventilation contractors will also assist the signalling contractor in preparation of the document. JMRC will provide necessary inputs such as standard operating procedures etc. The document shall establish the principles related to system and interface design under normal, degraded and emergency modes of operation. For each operating principle the document shall describe the scenario, action to be taken by operator and system in a structured process flow chart.

END OF APPENDIX - C

APPENDIX D

INTERFACE BETWEEN

ROLLING STOCK

AND

JP/EW/1B/E2

APPENDIX D

INTERFACE OF JP/EW/1B/E2 (ROCS CONTRACTOR) FOR ROLLING STOCK

1. INTRODUCTION

1.1 Definitions and Scope

This specification covers the interface requirements for Rolling stock by Contractor=

1.2 Contractor's Responsibilities

This Specification outlines the interfacing requirements of the Contractors identified during the Technical Studies stage of the Project.

The requirements herein specified are by no means exhaustive and it remains the Contractors' responsibilities to develop and execute jointly an Interface Plan after the commencement of the works and throughout the execution of works, to ensure that:

- (1) all interfacing issues for Contractor are satisfactorily resolved;
- (2) supply, installation and testing of equipment and software are fully co-ordinated; and
- (3) that all equipment supplied under the Contractor are fully compatible with the present rolling stock, whilst meeting the requirements of the respective Specifications.
- (4) The size & type of equipment selected should be similar to already operating section & should allow smooth transition of operation from present section to new section, without any hindrance.

2.0 Interfaces

Interfaces for Rolling Stock by JP/EW/1B/E2 Contractor shall include the following but not limited to:-

Item No.	Subject	Details to be arranged from the existing JMRC rolling stock operating department*	JP/EW/1B/E2 Contractor's Responsibilities
1.	Size and Types of ROCS Contact wire.	--	JP/EW/1B/E2 Contractor shall provide information to Rolling Stock operating department of JMRC.
2.	Arrangement of the ROCS and	--	JP/EW/1B/E2 Contractor shall provide information to Rolling Stock

Item No.	Subject	Details to be arranged from the existing JMRC rolling stock operating department*	JP/EW/1B/E2 Contractor's Responsibilities
	sectioning		operating department of JMRC.
3.	Detailed drawings of pantograph and pantograph head.	Rolling Stock operating department shall provide information to JP/EW/1B/E2 Contractor	JP/EW/1B/E2 Contractor to incorporate into the design of the ROCS.
4.	Material of pantograph contact strip	Rolling Stock operating department shall provide information to JP/EW/1B/E2 Contractor	JP/EW/1B/E2 Contractor to incorporate into the design of the ROCS.
5.	Detailed masses, springing and damping & pressure of pantograph	Rolling Stock operating department shall provide information to JP/EW/1B/E2 Contractor	JP/EW/1B/E2 Contractor to incorporate into the design of the ROCS.
6.	Pantograph sway calculations	Rolling Stock operating department shall provide information to JP/EW/1B/E2 Contractor	JP/EW/1B/E2 Contractor to incorporate into the design of the ROCS.
7.	Details of harmonic contents of rolling stock power supply	Rolling Stock operating department shall provide information to JP/EW/1B/E2 Contractor	JP/EW/1B/E2 Contractor to incorporate into the design of the ROCS.
8.	Maximum traction return current	Rolling Stock operating department shall provide information to JP/EW/1B/E2 Contractor	JP/EW/1B/E2 Contractor to incorporate into the design of the ROCS.

*all the interface for the details required for the Rolling stock shall be done by ROCS contractor. All the design related requirement shall be provided by the JMRC's rolling stock operating department. The design details have to be shared with the rolling stock department before implementation of the same.

Additional Interfacing Requirement

- 1.0 Details regarding acceleration, deceleration, coasting and Braking distance of Rolling Stock has to be arranged by ROCS contractor.

JP/EW/1B/E2 Contractor shall also be responsible to fully coordinate with the Rolling Stock Contractor in this regard.

- 2.0 JMRC's Rolling Stock operating department and JP/EW/1B/E2 Contractors shall also interface for conducting Current Collection test.

END OF APPENDIX - D

APPENDIX E

INTERFACE BETWEEN

CIVIL

AND

JP/EW/1B/E2

APPENDIX E

INTERFACE BETWEEN JP/EW/1B/E2 AND CIVIL CONTRACTOR

1. Civil Contractor shall construct appropriate passages/trenches, ducts, cable shaft and also keep provision of crossing of various cables in the Station along the walls, central column, under the platform including all fire separation requirements in interface with Power Supply Contractor.
2. Civil Contractor shall interface with Power Supply Contractor and as per requirement, provide opening in diaphragm walls of Cut & Cover tunnel for passage of cables.
3. Civil Contractor shall make provision of hatches, gantry beam, Lifting hooks for lifting equipments and travelling hoist to meet the material movement.
4. Civil Contractor shall make provide all hooks for lifting of equipment in SSP, SP and SS.
5. **JP/EW/1B/E2 Contractor shall coordinate with Civil Contractor in order to ensure obligatory Static and Dynamic clearances between OCS/ Pantograph and structure as per standards IEC followed.**
6. Civil Contractor shall be responsible for exposing reinforcement bar of tunnel & station area as per the location indicated by JP/EW/1B/E2 Contractor to meet the earthing requirement.
7. Civil Contractor shall provide cuts in tunnel and Station for fixing OCS warning / Caution / indicator boards.
8. Civil Contractor shall ensure that entire tunnel roof is free from unwanted/ unwarranted material like plywood or any other material etc.
9. JP/EW/1B/E2 Contractor shall interface with Civil Contractors regarding requirement of Niche in tunnel wherever required as per ROCS design. JP/EW/1B/E2 Contractor shall also be responsible for measuring the required dimensions and clearances at critical locations during construction stage.
10. **All cable supports and cable hangers required for installation of all cables and conductors for ROCS in station area as well as in tunnel, is to be provided and erected by JP/EW/1B/E2 Contractor. JP/EW/1B/E2 contractor shall be required to interface with civil contractor for the routes and access.**

END OF APPENDIX E

APPENDIX F

INTERFACE BETWEEN

TRACK CONTRACTOR

AND

JP/EW/1B/E2

INTERFACES BETWEEN JP/EW/1B/E2 AND TRACK CONTRACTOR

1. Definitions and Scope
 - 1.1 This specification describes the interface requirements between Contract JP/EW/1B/E2 and Track contractor for all the underground corridors of Phase-III.
 - 1.2 This specification shall be read in conjunction with the relevant clauses of the General Specification. Both the JP/EW/1B/E2 Contractor and the Track Contractors shall be responsible for ensuring that all requirements of the General Specification pertaining to interfaces are properly satisfied.
 - 1.3 This Interface Specification outlines the interfacing requirement during the execution of the Works. However, the requirements herein specified are by no means exhaustive and it remains the responsibility of JP/EW/1B/E2 and Track contractor's responsibility to develop, update and execute jointly an Interface Management Plan after the commencement of the Works and throughout the execution of Works to ensure that:
 - (1) all interface issues between the Track contractor and JP/EW/1B/E2 Contractors are satisfactorily identified and resolved; and
 - (2) all the construction tolerances at the interface shall meet the requirements of the respective specifications.
- 2 The JP/EW/1B/E2 contractor's scope of works
 - 2.1 Where details of the JP/EW/1B/E2 Contractor's design are required to enable the Track Contractors to implement the interface works, the JP/EW/1B/E2 Contractor shall provide the Track contractor with the necessary information. The level of information provided shall be of sufficient detail to enable the Track Contractors to construct the interface works required.
 - 2.2 The JP/EW/1B/E2 Contractor shall take a lead in developing an Interface Management Plan in conjunction with the Track Contractor to cover all aspects of the implementation of the interface works stipulated in this Specification and all other interface works required to complete all works in the JP/EW/1B/E2 Contract, including but not limited to those listed in clause 4.
 - 2.3 The JP/EW/1B/E2 Contractor shall liaise with during the development of the Interface Management Plan for any proposals for amendments or additional works required for completion of Earthing & Bonding and ROCS work.
- 3 Track contractors' scope of works
 - 3.1 The information and the scope of works to be provided by the track Contractor include but not be limited to those outlined in clause 4 of this specification.
- 4 FUNCTIONAL INTERFACE
 - 4.1 Track contractor shall provide & mark Track Centre all along the station & tunnel for installation of ROCS even without laying of Track.

- 4.2 In respect of the location of impedance bonds that may be required by the Train Control and Signalling system, the Contractors shall agree on the final location of impedance bonds, cross bonds or any other rail connections related to traction current return;
- 4.3 The JP/EW/1B/E2 Contractor shall supply, install and terminate bonding cables at appropriate intervals for which he shall co-ordinate with the Track contractor for Thermosetting welding of cable to rails for providing return current continuity.
- 4.4 In regard to traction bonding cables between rails and cross-bonding cables, JP/EW/1B/E2 will co-ordinate with Track contractor.
- 4.5 The JP/EW/1B/E2 Contractor shall coordinate with track Contractor for providing continuity from plinth to plinth by cable of suitable size (which will be informed by JP/EW/1B/E2 Contractor). Providing plinth to plinth continuity shall be the responsibility of the track contractor.
- 4.6 For any specific requirement of passage of traction cables under the track bed, JP/EW/1B/E2 Contractor shall clearly indicate the requirements to Track contractor. JP/EW/1B/E2 Contractor shall provide the necessary HDPE pipe for the cable crossing under the track, Track contractor shall provide the passage for the pipe for cable crossing.
- 4.7 Track contractor shall provide the necessary track geometry drawings to JP/EW/1B/E2 Contractor for designing the Rigid OCS installation in the tunnel and station.
- 4.8 JP/EW/1B/E2 Contractor shall provide drawings showing size and location of non-metallic pipes required for track crossings for 25 kV traction and return current cables.
- 4.9 Track contractor shall provide drawings showing locations of rail expansion joints.

END OF APPENDIX – F

APPENDIX G

NOT USED

APPENDIX H

INTERFACE BETWEEN

E&M CONTRACTOR

AND

JP/EW/1B/E2

APPENDIX H**INTERFACE BETWEEN JP/EW/1B/E2 AND E&M/ECS CONTRACTOR**

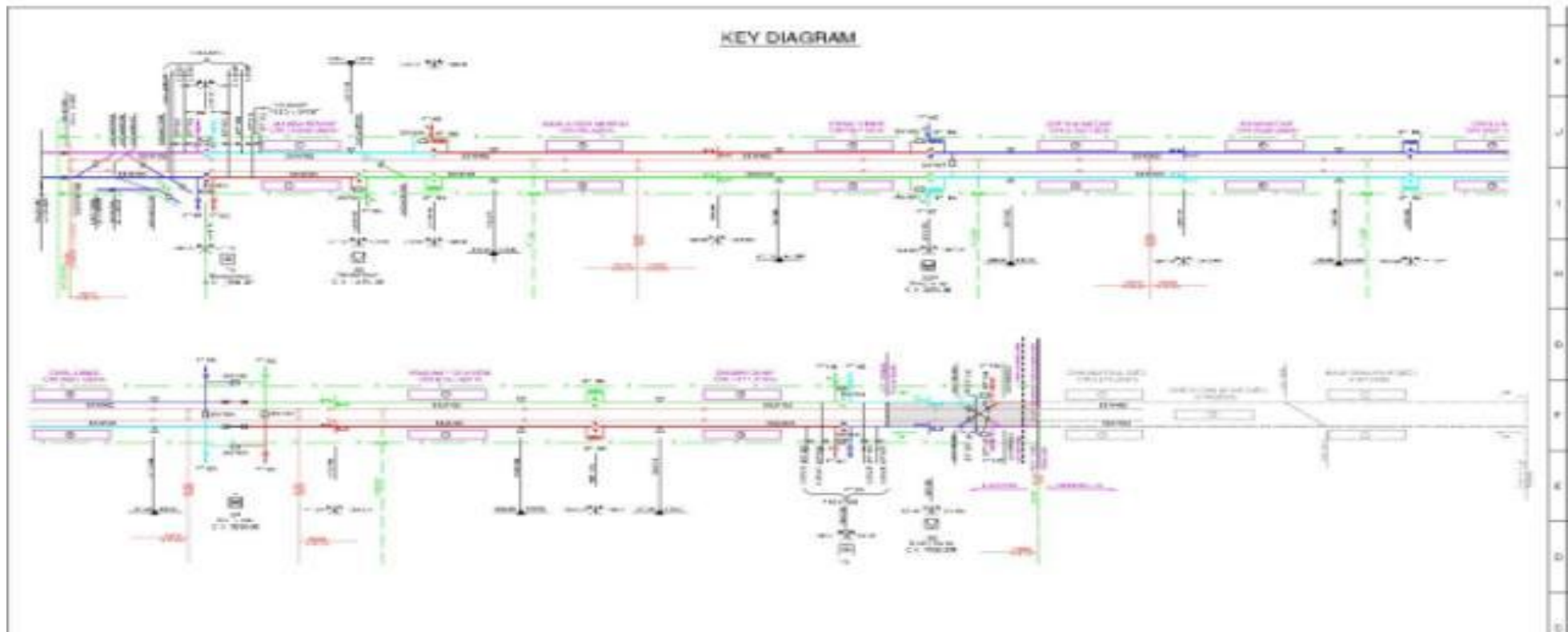
Item No.	Item Description	JP/EW/1B/E2	E&M contractor
1.	415 V AC supply for Switching post rooms	Provide load information and termination points and suitable MCB/ MCCB on Distribution Board. Interface to ensure provision of suitable allocation of MCB/ MCCB on DB of station E&M panel	To lay the cable and terminate at designated point on Distribution Board of Switching post
2.	Ventilation and lighting in SP rooms	Provide information of total Ventilation and lighting requirements in SP rooms	To install Ventilation and lighting in SP rooms
3.	Earthing of equipments in SP rooms	Provide information of total Earth risers and type, design of earthing required in SP rooms. Connection from Earth risers to panels/ equipments.	To provide Earthing as per design and Earth risers in SP rooms

END OF APPENDIX - H

APPENDIX I

DETAIL OF INTERFACE FOR RSS SUPPLY BY JP/EW/1B/E2 CONTRACTOR

The ROCS contractor has to interface for planning the EMI/EMC study details at the existing RSS of Jaipur Phase- 1A project. The 25 kV traction power supply will be extended from the existing RSS's. The power supply details (Schematic) are as under:-



The Transformer capacities provided in different Receiving Sub Stations (RSS) are as follows for reference:-

RSS Name	Traction transformer 66/25 kV or 220/25kV	Auxiliary transformer 66/33 kV or 220/33 kV
MANSROVER ,	21.5 MVA	30 / 45 MVA
SINDHI CAMP	21.5 MVA	30 / 45 MVA

APPENDIX - J

NUMBER OF PERSONNEL TO BE TRAINED

APPENDIX J - Number of personnel to be trained in each of the Lot**Table 1 - Man-Weeks of Employer's personnel's Offshore Training at Contractor's Works**

	Duty of trainee	Man-weeks
25 kV traction equipment	Operator	2
	Maintenance Staff	2
	ETI	1
OCS		
	Maintenance Staff	2
	ETI	1
	ETI	1

Table 2 - Man-Weeks of Contractor's Training Instructors for training Employer's operating personnel in India.

	Man-weeks
25 kV traction equipment	1
SS/SSP,	2
OHE/OCS	1

Table 3 - Man-Weeks of Contractor's Training Instructors for training Employer's maintenance personnel in India

	Man-weeks
25 kV traction equipment	2
SS/SSP	4
All types of Cables	4
EMI/EMC, bonding and earthing system requirements	1
Electrical safety and earthing	1
OCS	1

END OF APPENDIX - J

APPENDIX-K

The Opening of JMRC/Metro Railway for Public Carriage of Passenger Rules, 2002

CHPATER X

DESIGN AND INSPECTION OF EQUIPMENT FOR ELECTRIC TRACTION

37. Design of electric installations-

- 1) The design of all electric installations, namely transmission and distribution lines, sub-stations, switching stations, rigid overhead current collection system and regulated overhead equipment, etc, shall be according to approved standards laid down by the central govt. and the Indian Electricity Rules, 1956, or any other law for the time being in force and wherever any departure from accepted norms becomes necessary, approval of the central govt. shall be obtained.
- 2) Adequate protective arrangement shall be made to ensure that the public cannot come in contact with the electric equipment on line within the metro railway premises.
- 3) Suitable protective screens shall be provided where live conductors pass under or over bridges.
- 4) The structures supporting overhead equipment shall be designed in accordance with the relevant international and Indian standards. The wind pressure to be adopted shall be generally in accordance with IS 875-64 (latest revision). Inside metro corridor tunnel, complete overhead current collection system and its supporting system shall be as per relevant international / Indian standards and shall be capable of working safely under air piston effect during train operation.
- 5) When the distribution system involves overhead wires carried on steel structures including bridges and roofs and return circuit via running rails or earth, all such structures, masts and associated tracks shall be effectively earthed and bonded or other precautions taken to ensure that contact with the steel work of the structure, will not be dangerous to the public and the metro railway staff. In AC and DC traction, bonding and earthing shall be as per the approved code for bonding and earthing in respective areas. In case of elevated concrete structures continuous earth bonding shall be provided by earthing the reinforcement of structures and connecting the same to overhead electrical structures.
- 6) Earthing arrangements at power supply installations shall strictly conform to the Indian electricity rules, 1956 and accepted codes of practices for bonding and earthing for AC and DC traction. Adequate stray current control system shall be provided to under DC traction systems avoid corrosion to steel reinforcement and other metallic parts of the tunnels and nearby structures. All precautions

shall be taken to avoid electro-magnetic effect in the environment as per relevant standards.

- 7) The earthing system for DC traction shall conform to requirements of IS-3043 and EN-50122 part-I and the maximum rail potential during, Permanent condition shall not exceed 120 V for main lines and 60 V for depot area in accordance with EN-50122 part-I
- 8) No earth wire shall cross any track and where structures to be connected to an earth-wire are located on opposite side of a track separate wire runs shall be used for connecting the structures. In complicated areas, structures may be connected to individual earthing stations.
- 9) When overhead lines transmitting electric power (other than lines forming part of the railway traction equipment) have to be carried across metro railway track, the details of the equipment provided in connection with such lines shall be designed with the object of minimizing danger in the event of breakage and in accordance with Regulation for electrical crossings, 1997. These details shall be approved by the electrical inspector to the Govt. of India.

Note:- The chief electrical engineer of JMRC/Metro rail corporation functions as the electrical inspector to the Govt. of India for JMRC/Metro railways jobs.

- 10) Lightning arrestors of standard of approved types shall be provided wherever they are necessary.
- 11) All component parts of the equipment which carry live conductors shall be provided with devices approved by the electrical inspector to the Govt. of India to prevent unauthorized persons climbing them. Anti-climbing devices shall also be provided, wherever necessary, on structures carrying high tension equipment with in metro railway premises.
- 12) On both sides of the roads at road-under-bridges, height gauges of suitable design shall be provided to ensure that no part of any road vehicle or its load shall come in contact with the road under bridge girders.
- 13) Warning notices shall be erected in conspicuous position indicating the existence of live electrical equipment.

38 Display of caution boards and notices-

The following caution boards and notices of standard sizes written in English and Hindi shall be displayed at the various locations indicated below:

- a) Treatment for electric shock boards giving instructions for treatment of shock at all railway stations control rooms, car sheds, sub-stations, switching stations, offices of maintenance engineers of works, signal, overhead electrical equipment and cabs or moving vehicles, etc.
- b) General "caution notices" regarding danger of high voltage traction wires for public at various entrances to metro railway stations and for staff at prominent places;

- c) "1500V DC Caution" boards and "25 KV AC caution" boards as applicable shall be affixed on to the screen erected on foot over and road over bridges, sub-stations, and switching station and track cabins;
- d) Caution boards at such posts (for signal and telecommunication staff) where protective screening shall not be provided;
- e) "Caution-Unwired turn-out" boards ahead of all unwired turnouts or cross over taking off from wired tracks;
- f) "Warning" boards for neutral sections;
- g) Boards for "switching on" and "switching off" of power at neutral sections;
- h) Danger boards on height gauges for road-under-bridges;
- i) Restricted clearance boards at such identified locations;
- j) Power Block limit boards; and
- k) Stop boards at termination of over-head electrical equipment in the sections to be energized.

39. Protection of private property against inductive effects of AC traction –
Under 25KV AC traction, there is a heavy induction on all metallic structures and conductors in the vicinity of track. Inductive effects show themselves on any overhead conductor, such as metallic clothes lines, power lines and the like belonging to private parties running parallel and close to the electrified tracks. Wide publicity shall be given to the effects of the induction, so that special precautions may be taken by private parties concerned against the possibility of electric shocks from conductors running their premises.

40. Approval of energization of high tension lines –

- 1) Application shall be submitted at least a fortnight before energization of high tension lines to the Electrical Inspector of the Govt. for JMRC/Metro rail corporation for the following namely:-
 - a) Formal approval, if not already received to the design and layout of all high voltage equipment including traction sub-stations, transmission lines, 25KV/33 KV and 1500V DC feeders, switching stations, booster stations, etc.;
 - b) Approval for energization of high tension installations mentioned above including overhead equipment for AC/DC traction;
 - c) The application should be accompanied by documents as specified in AC/DC Traction Manual.
- 2) On receipt of an application under sub-rule (1), the electrical inspector shall scrutinize and inspect the design and installations in respect of the following, namely:
 - a) The layout and design for receiving sub-stations, traction sub-stations auxiliary sub-stations, 1500 V DC/25KV AC overhead equipment and other installations for compliance with the Indian electricity Act, 1910 (9 of 1910) and the rules

made thereunder and the relevant Indian standards or international standards; and

- b) Inspection of completed installations, either personally or by deputing his officers for compliance with the safety requirements.
- 3) After conducting the inspection under sub-rule (2), the electrical inspector shall convey his approval for the energization of 25kV/33 kV/1500 V DC feeder lines from receding sub-stations, energization of receiving sub-stations, traction sub-stations, auxiliary sub-stations, traction sub-stations to feeding posts, switching stations, booster transformer stations, track cabins and auxiliary transformer stains subject to such conditions as he may consider necessary.

41. Procedure for energization of traction installations –

- 1)
 - a) After obtaining the sanction of the electrical inspector to the Govt. of India for energization under rule 39, the sub-stations should be commissioned sufficiently in advance for the energization of overhead electrical equipment;
 - b) Before energization of the sub-stations, full communication facilities should be available and power supply authorities should be ready to give power supply;
 - c) On the date on which energization of track installations take place, necessary clearance certificate should be obtained from the electrical construction officers and others who had been hitherto working in the sub-station premises to the effect that their staff had been withdrawn and the sub-station could be energized;
 - d) After final measuring of the whole installation and check on the satisfactory operation of all equipment including protective relays, the traction sub-stations and other installations may be energized;
 - e) Energization of overhead electrical equipment and overhead current collection system shall be progressively undertaken starting with 33 kV/ 25 kV/1500 V DC feeders from the receiving sub-stations to the traction sub-stations, track cabins, bus bars of the feeding posts followed by one sub sector after another; and
 - f) Before running electric rolling stock, a confirmatory field test by the proper operation of the protective relays shall be conducted.
- 2) In addition to giving wide publicity through newspapers and other media, the station manager shall warn all passengers about the danger of 1500 V DC /25 kV AC overhead equipment/1500 V DC OCS equipment and not allow them to ride on top of rolling stock working on the section.
- 3) All relevant documents and certificates mentioned in, and notifications issued under the AC/DC traction manual, and the ordinance, along with the approval of electrical inspector for energization shall form a part of completed documents to the commissioner while making reference to the commissioner under sub-rule (2) of rule 3 for opening of the metro railway for public carriage of passenger.

- 4)
 - (a) The inspection of the entire section shall be carried out by means of over head equipment inspection car by the commissioner.
 - (b) An officer equivalent to senior administrative grade rank officer of electrical department nominated by the chief executive officer should accompany the commissioner throughout the inspection.
 - (c) The engineer-in charge of the section during the construction should also be present.
 - (d) During inspection, particular attention shall be paid to the safety and operational aspects of the train movements and to see that staff are in possession of statutory rule books, instruction books, registers, forms, etc and the transportation, electrical, permanent way and signal and telecommunication staff are fully acquainted with the duties to be carried out after electric traction is introduced.
- 5) Subject to inspection being satisfactory, an all concerned message may be issued by the commissioner, communicating his sanction for the introduction of commercial services under electric traction.
- 6) The signal and telecommunication requirements in electrified sections shall be in accordance with the provision of JMRC/Metro Signal Engineering manual.

Notes:- A catechism dealing with the requirement of signal and telecommunication installations for 1500 V DC and 25 KV 50 Hz AC electrified section are enclosed as Appendix A and B to these rules.

APPENDIX A

(See rule 41)

CATECHISM FOR SIGNALLING AND INTERLOCKING INSTALLATIONS SIGNALLING AND TRAIN CONTROL

Have the requirements and recommendations for signalling and train control systems vide Chapter Ix of these rules and appendix thereto pertaining to signalling and train control systems installed on the section being complied with?

SIGNAL

1. Do the signals comply with the requirements as metro railway General Rules, 2002.
2. Have all the signal posts been placed on the left side of the track of the approaching train to which they refer? If otherwise, for what reason?
3. Are all running signals controlling placed in such a position and at such a height above rail level so they can be clearly seen by the drivers in sufficient time and be readily distinguished by night or by day from subsidiary signals?
4. In case of slotted or controlled signals, can the signals be freely returned to danger by either of the controlling agencies?
5. Are signals not commissioned have their aspects covered and the cover displaying tow crossed white bars on a black background, the bars not being less than 30cms x 10 cms?

POINTS

1. Are the locking of facing points such that the points cannot be or become unlocked while a train is passing over them, i.e, electrically controlled by track circuits or alternative devices?
2. Are detectors (internal / external) fitted to all facing pints and do they efficiently detect with switches the signals controlling the movement of train over them?
3. Are switches adjusted to come tight against stock rails? Does the insertion of 5mm obstruction piece between the switch and stock rails 150mm from the toe of the switch prevent the points being locked and prevent the relevant signal being locked and prevent the relevant signal being taken 'OFF' the giving of which is preceded by the locking of the points?

STATION CONTROL ROOM

1. Are all signals, points and track circuits electrically /electronically repeated on the station control panel/work station as and where provided?
2. Is the station controller provided with necessary means the stopping of train at his station?

3. Have instructions for working been issued to all staff and included in Metro Railway working instructions and are they correct and efficient?

TESTS IN STATION CONTROL ROOM

It is essential that the interlocking of all signals with points must be so effected as to ensure the following conditions, which may be tested from the station control panel or work station.

1. Is it possible to take off conflicting signals at the same time?
2. Is it possible to take off a signal until:
 - a) All points on the running line including overlap are correctly set and the points locked where required?
 - b) All points, giving access to the running line from sidings are set against the running line?

OPERATION CONTROL CENTRE

Are all signals, points and track circuits electrically/ electronically repeated on the operation control or work station as and where provided?

CAB SIGNAL

1. Are the various modes of train control clearly distinguishable on the Driver's Man Machine Interface (MMI).
2. Under cab signaling system of working, is Automatic Train Protection System able to bring the train to a stop before an obstruction?

APPENDIX B

(See rule 41)

**A. ADDITIONAL CATECHISM FOR SIGNALLING AND
TELECOMMUNICATION**

Have the requirements and recommendations for signalling and telecommunicate in installation in accordance with the instructions issued for the installation of signalling and Telecommunication equipment in 25 kV 50Hz AC or other traction system as adopted on the section, been complied with?

If not, in what respect the arrangements provided fall short of them?

STATEMENT OF DEVIATION – SIGNALLING AND TELECOM SYSTEMS

	Exiting Parameters	Prescribed Parameters	Deviation / Infringement	Remarks	Approval sanction
Signal Points Track circuits Cables Electric Signalling EQPTS Batteries Earthing Mobile train radio Communications General safety					

END OF APPENDIX - K

DESIGN, DETAIL ENGINEERING, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID TRANSPORT SYSTEM PROJECT PHASE-1B

CONTRACT PACKAGE – JP/EW/1B/E2

EMPLOYER'S REQUIREMENTS

TECHNICAL SPECIFICATION

PART – 1: RIGID OHE

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CONTRACT PACKAGE –JP/EW/1B/E2

CHAPTER – 1

INTRODUCTION

1 INTRODUCTION

1.1 Scope and Purpose

This specification defines the objectives, guidelines and requirements for the contractor's Design, Supply, Installation, Testing and Commissioning of 25kV Rigid Overhead Contact System (ROCS), associated switching station (FP, SS, SSP and SP) with 25 kV associated cabling and SCADA System in the U/G corridors of the Chand Pole to Badi Chaupar

- 1.1.1 The works to be executed under the Contract include the design, supply, installation, validation / verification, testing, including integrated testing and commissioning, technical support and documentation for a complete System necessary to deliver the requirements of these Specifications.
- 1.1.2 Since the system of traction on Phase-I of Jaipur Metro consisting of elevated corridors and the underground corridors have been commissioned at 25 kV AC, it shall be the endeavour that the new system shall meet the quality standards and equipment rating of existing installations at underground locations.

1.2 Relevant Documents

- 1.2.1 This Specification should be read in conjunction with the General Conditions of Contract (GCC), the Special Conditions of Contract (SCC), the General Specification (GS), the Employer's Drawings and any other document forming part of the Contract.
- 1.2.2 In the event of a conflict between the GS and this Specification, this Specification shall prevail.
- 1.2.3 In the event of a conflict between this Specification and any other standards or specification quoted herein, the requirements of this Specification shall prevail.
- 1.2.4 The order of precedence, with item a) having the highest priority, is:
 - a) Technical Specification
 - b) International Standards referenced herein.
 - c) Other International Standards
 - d) General Specification
 - e) Indian Railway Standards
 - f) Indian Standards
 - g) Other National Standards
- 1.2.5 Notwithstanding the precedence specified in clauses 1.2.1, 1.2.3 and 1.2.4 the Contractor shall always immediately seek advice from the Engineering the event of conflicts between Specifications.

1.3 Design Service of the Works

- 1.3.1 The Contractor shall be responsible for the design service of the Works and shall satisfy himself that the tentative capacities, ratings and quantities of equipment as specified herein

meet the operational requirements for the underground portion of contracts of Phase-1B of Jaipur metro project.

- 1.3.2 The contract price shall deem to include any necessary additional equipment, equipment of higher capacities and higher ratings for the systems and sub-systems necessary for the complete, safe, reliable and operable power supply system for the underground portion of the works.
- 1.3.3 The proposed capacities, ratings and number of equipment as a result of the design development shall be demonstrated by a proper design and simulation study and subject to review by the Employer.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 2

OVERVIEW OF THE PROJECT

2 OVERVIEW OF THE PROJECT

2.1 General

This Chapter gives an overview of the Project and the information provided in this Chapter is for reference only.

2.2 Jaipur Metro Phase IB Project

2.2.1 The Jaipur Metro Phase-IB project network consists 02 station.

2.2.2 Trains are electric multiple unit (EMU). Modern rolling stock with stainless steel body and VVVF 3-phase drive with regenerative braking has been utilised. The cars are air-conditioned.

2.2.3 Signalling System as adopted for the existing JMRC Lines shall be implemented. The phase-1A project has been provided with Automatic Train Operation system (ATO).

2.2.4 Rolling stock maintenance Depot for Manasarovar

2.2.5 25kV single phase AC traction has been utilised with flexible Overhead Equipment (OHE) on elevated section and Rigid Overhead Contact System (ROCS) on underground sections.

2.2.6 NOT USED

2.2.7 'Closed' type Tunnel Ventilation System has been used in U/G stations. The station public areas are air-conditioned while the plant rooms are provided with supply/exhaust system. Tunnel ventilation is primarily achieved by the movement of vehicles inside the tunnel under normal working conditions. Tunnel Ventilation Fans installed at each end of the stations are used to provide supplementary ventilation at times of high temperatures, and under congested traffic or emergency conditions. Booster fans have also been used at appropriate locations for use under emergency conditions or in case of a tunnel fire, the tunnel ventilation system is used for smoke extraction by operating tunnel ventilation fans in push pull mode. During emergency fire condition within a station, the station air handling system is operated for smoke removal.

2.2.8 Jaipur Metro Phase-IA Project

Details of the existing Switching Stations :-

Traction power at 25 kV is fed to the operational Corridor from Traction Substations located in the premises of Receiving Substations (RSS) at Mansarovar and Sindhi Camp. The traction feed is further divided into several Substations, with the help of Switching Stations, whose locations are shown below:-

Sr. No.	Name of Switching Stations	Type of Switching Stations	Approx. Chainage
1	Mansarovar	FP	-00.778
2	Mansarovar	SS	-00.549

3	Shyam Nagar	SSP	02.037
4	Civil Lines	SP	05.235
5	Sindhi Camp	FP	07.720

2.2.9 Details of Phase-1B

The power supply to the proposed corridor will be extended from the Chandpole underground station. The 25 KV supply is feed at 2 locations in the present operational line, Mansarovar park & Sindhi camp.

2.2.10 Power Supply

2.2.10.1 The power supply for Existing Phase-I line is from

Receiving Sub station	Location	Incoming Voltage	Power Source
RSS-1	Mansarovar	132 kV	Mansarovar GSS (220 / 132 kV)
RSS-2	Sindhi Camp	132 kV	GIS Substation, PWD Bungalow at Station Road (near RSRTC Bus Stand)

2.3 Key Challenges

The traction systems for the Underground Portion shall be adequate, safe and reliable. The following are the Key Challenges presented to the Contractor.

- The specified level of reliability, availability, maintainability and safety requirements of the System shall be achieved and verified by the Contractor by analysis, simulation, testing and commissioning, and system demonstrations as required in this Specification.
- The space requirement given in the tentative layouts of Sectioning Rooms, etc. shall be critically reviewed by the Contractor to economise on space and also to provide a layout amenable to good maintenance and operation practices, to achieve an overall economic design.
- Various interfacing issues with other Contractors are required to be resolved to ensure timely completion of the Works. Whilst most of the interface issues have already been addressed, some of them are yet to be identified or finalised during the progress of the work. It is the Contractors responsibility to ensure that all interfacing

issues are clearly defined and agreements sought from all concerned Contractors in accordance with the GS and the interface requirements.

- d) The System Design shall meet the specified performance and operational requirements stipulated in this Technical Specification. The Contractor shall carry out a study to assess the work to be done to suppress the effect due to 25kV ac traction (EMI/EMC) on Civil Engineering RCC construction, power, telecom, control, ETS and signalling circuits etc. for safety of public, personnel and equipment. These studies shall form part of detailed system design.

Since passenger and personnel safety is involved in humid RCC tunnel environment for a high capacity metro system, the long time & short time induced voltage rise above earth potential shall be carefully computed based on reliable field data.

- e) 25kV AC & 415 V AC and control cables will require laying at different levels within Auxiliary Substations, Cable Galleries, Stations, Train Tunnels and under croft. Liaison with the Civil Contractor & other Electrical System Contractors shall be undertaken to ensure that workable solutions for cable installation are established in advance keeping in view the maintenance requirements.
- f) The cable feeders, overhead current collection system, other system components shall be designed to withstand the atmospheric pollution and ambient conditions furnished in GS (clause 1.12) relevant to the location where installed. However, the equipment installed in open at the ground level or inside buildings at ground level shall be designed for working in the tropical conditions existing in the area and under the maximum ambient temperature and relative humidity levels prevalent in the area.
- g) The entire Scope of Works shall generally meet design requirements of fire safety in accordance with NFPA-130 Standard for Fixed Guide-Way Transit System, 2010 edition, except where amended by this TS.
- h) The entire installation shall meet the protective provisions relating to electrical safety and immunity, including those required against induced EMF caused by 25 kV ac traction.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 3

SCOPE OF WORKS

3 SCOPE OF WORKS

3.1 General

- 3.1.1 This Specification establishes requirements for the Design, Supply, Installation, Testing and Commissioning of 25kV Rigid Overhead Contact System (ROCS)& SCADA, associated switching station (FP, SS, SSP and SP) with 25 kV associated cabling for **Section Chand Pole to Badi Chaupar**

3.2 Scope

The Contractor shall supply all equipment and materials necessary to meet the requirements of ROCS works, include but not be limited to the following: -

- a) 25 kV Rigid Overhead Contact System (ROCS) for the Underground Portion of under any of the lot as described above.
- b) 25 kV Switching posts (SS, SP, SSP and FP) using Gas Insulated Switchgears (GIS) type interrupters/ CBs as applicable.
- c) 25 kV AC cable from RSS/TSS to the feeding post at respective location as defined in the pricing document.
- d) Differential relay for the protection of 25kV cable between TSS/RSS and FP.
- e) Interrupters/ Circuit Breakers for stabling sidings, Y-siding, link line etc.
- f) 25 kV AC Cable works and cable support system including return current cabling in tunnel. In tunnels and station box structures, Contractor will provide & install the supports for cable hangers.
- g) 25 kV Neutral Section in the underground portion.
- h) Design, Supply, Installation, Testing & Commissioning of protection scheme and relays for 25kV Traction system at SP, SSP etc.
- i) Transition arrangement of 25 kV Rigid OCS to 25 kV flexible OHE in different ramp portions.
- j) Earthing system (based upon simulation study) including providing of METs, Copper cable, relevant connections to OCS & all other services (hydrant pipe, track, walkway, tunnel reinforcement etc).
- k) Centre Line marking (on co-ordinates provided by Civil/track contractor), supports location marking, drilling, Supply and fixing of anchor fasteners for OCS supports.
- l) Supplying and Fixing of Tunnel earth wire (Size of TEW will be based upon simulation study).
- m) Provision of thermosetting welds in track for connection of cables for return current continuity and for earthing of equipments.
- n) Simulation Study for EMI / EMC and calculation of voltage induced in different services e.g. Rail, 33 kv cable, Earth wire, S & T cables, Tunnel Earth wire, LCX, Coaxial cables, etc. Also, magnetic field produced in a Transverse Plan of the Track.
- o) All minor civil works or modifications required for installation of the equipment and restoring to final finishes.

- p) Transfer of Technology.
- q) Coordination with Contractors responsible for 25kV flexible OHE & other Systems.
- r) Integrated Testing during train trials.
- s) Validation (Auditing) of design & installation of ROCS through Independent Agency as per IEC and other relevant Standards as per clause 14.1.2 of TS.
- t) Facilitate Power block during trials upto ROD (manpower for the same should be deployed by the contractor).
- u) Protective provisions relating to electrical safety and earthing which include earthing of equipment, cables and non-current carrying metallic components of this Contract, etc.
- v) All protective measures to suppress EMI/EMC effects due to 25 kV AC traction
- w) Works Train for transportation of materials & equipment and for construction purposes.
- x) Supply of Spares
- y) Supply of Consumables during DLP
- z) Special tools, testing and diagnostic equipment and measuring instruments.
- aa) Training
- bb) Documentation. Supervision of Maintenance during DLP
- cc) Services
- dd) Furniture, shock treatment charts, first aid boxes and danger notice plates
- ee) Contractor's Design team shall supervise the installation 25kV Rigid Overhead Contact System (ROCS), switching station (FP, SS, SSP and SP) with 25kV associated cabling for the Underground Portion of Jaipur MRTS Phase-III Project.
- ff) Contractor will be required to provide SCADA system according to latest standards and specifications. The design of the SCADA should be prepared and submitted to Engineer in charge for approval. All the equipments, cables, connectors, links, connections, interface devices etc required for the successful operation of the underground SCADA system has to be provided by the ROCS contractor. The price of the SCADA system is included in the ASS works BOQ of this document.
- gg) To enable implementation of SCADA system for the Rigid OCS and Switching Posts ROCS contractor has make all necessary interface.. The SCADA system proposed may be compatible/integrated with the existing SCADA system of Jaipur 1A, all the details of existing system has to be arranged by the contractor (ROCS contractor to note that at present operating section of Jaipur phase-1A ABB SCADA system is provided). The entire local works and connectivity upto Operational control centre has to be maintained by ROCS contractor. Suitable OFC Communication cable/ link between all Rigid OCS, and TSS equipments shall be provided by JP/EW/1B/E2contractor.
- hh) In a general manner, all works, facilities and services and other components as required whether or not specified necessary to deliver the requirements of ROCS

works to ensure a perfect and complete execution under this scope and relevant code and standards and to this specifications.

- ii) Any other item of work as may be required to be carried out for completing the work under this Contract in all respects in accordance with the provisions of the Contract and/or to ensure the safety of installation during and after execution.

3.3 Services

The Services to be performed by the Contractor shall include, but not be limited to, the following:

- a) Design, supply, system quality management, installation, testing including integrated testing and commissioning of the complete system as brought out above.
- b) Presentations, reviews and audit support as specified in this Specification.
- c) Contractor shall install ROCS, even without laying of track with use of rail cum road vehicle having pollution norms minimum EURO-II. However, centre line of track shall be made available to ROCS Contractor by other designated Contractor (Civil/Track)
- d) Interface management as specified in this Specification.
- e) Design, identification of locations and installation for concrete foundations for trackside equipments, Neutral Section, SSP, SP and SS.
- f) System operations and maintenance support services.
- g) Training for Employer's training instructors, operations staff, maintenance staff and engineering staff.
- h) Decommissioning, removal and/or disposal of temporary works.
- i) Prototyping.
- j) Defects liability of Permanent Works after commissioning as stipulated in the General Conditions of Contract (GCC) and Special Conditions of Contract (SCC).
- k) Contractor shall be responsible for providing all assistance, manpower for giving 'Power Block', earthing ROCS during Power Block by providing & fixing discharge rod for facilitating train trails upto revenue operation.
- l) Assisting in obtaining statutory clearances (e.g. design clearance from Ministry of Railways and Sanction of Commissioner of Railway Safety) and submittal of information asked for by statutory bodies (e.g., Government of India, Ministry of Railways, Commissioner of Railway Safety, Ministry of Power, BSNL, PTCC, etc.) in particular format as directed by Employer.

3.4 Documentation

The documentation to be delivered by the Contractor shall include, but not be limited to, the following items: -

3.4.1 Design Stage

- a) Description of general design philosophy.

- b) System simulation reports based on simulation study and EMI/EMC effects.
- c) System reliability, availability, maintainability and safety evaluation reports.
- d) Fault level calculations and short-circuit current curves.
- g) Automatic fault identification and isolation arrangement.
- h) Feeding arrangements under various supply failure scenarios.
- i) Restrictions, if any, under receiving supply failures.
- j) Determination of equipment ratings.
- k) Determination of space requirement.
- l) Design and proving protection system and its calculations.
- m) Lightning protection measures.
- n) Latest type test reports for equipment selected.
- o) Detailed design drawings and reports.
- e) Detailed interface reports and interfacing design drawings.

3.4.2 Construction Stage

- a) Construction and Installation Plan.
- b) Factory Acceptance Test Plan for equipment, components and its integration.
- c) Quality Plans.
- d) Installation, operation and maintenance instruction of all equipment.
- e) Operation and Maintenance Manuals.
- f) Records and drawings of equipment installed.
- g) All other records of construction, including hidden parts.
- h) Site test report of equipment.
- i) As built drawings including interface drawings. and
- j) Other documentation as required, by the Employer.

3.5 Furniture and other statutory requirements

- 3.5.1 The Contractor shall provide requisite furniture duly approved by Engineer at the SSP, SP & SS Rooms etc.
- 3.5.2 The Contractor shall provide Single Line diagram, Earthing & Bonding Diagram, Fire Extinguishers, shock treatment charts, insulating mats as per IS15652: 2006 (superseding IS5424: 1969), fully equipped first-aid boxes, danger boards, warning boards, restricted clearance board, Protective Covers, etc. being statutory requirements in adequate number and shall be exhibited at required locations.

3.6 Key Dates and Access Dates

The Key Dates and Access Dates applicable to this Technical Specification are given in Chapter 21 of this Specification.

3.7 Items of Work Excluded from Contract

The following items of work associated with the System will be provided by other Contractors and are excluded from the Contract. However, the Contractor shall provide timely inputs such as necessary drawings, instructions, hardware and materials to the relevant other contractors as required. These items are detailed in Chapter 13 of this Specification.

- 3.7.1 In tunnels and station box structures, Contractor will provide & install the supports for cable hangers.
- 3.7.2 Other civil engineering works viz. building, access roads, surrounding walls, shutter doors will be provided by Civil Contractors for SSPs, SPs and SSs. JP/EW/1B/E2 and Civil Contractors shall interface suitably.
- 3.7.3 Earth mats and earthing electrodes in ASS and in tunnels will be supplied and installed by other Contractors. However, earthing connection to all ROCS equipment from earth met to be done by JP/EW/1B/E2 contractor.

3.8 Provision of Work Sites

The Contractor will be provided Work Site at suitable locations along the corridor for storage, setting up workshop, stabling of vehicles and setting up of offices during construction period. The plan for office building will be duly approved by the employer. The contractor will be required to provide at least one air-conditioned room in each of his site office for the employer's representative with necessary communication facility.

3.9 Optional Items

- 3.9.1 Not used

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 4

DESIGN AND PERFORMANCE REQUIREMENTS

4 DESIGN AND PERFORMANCE REQUIREMENTS

4.1 General

4.1.1 The design, supply, installation, testing and commissioning of the Rigid OCS system shall meet the design and performance requirements within the design environments specified in this TS.

4.2 Design Environment

4.2.1 Climate Conditions/Operating Environment stipulated in clause 1.12 of General Specification shall apply. Wherever the equipment is installed in open at the surface level or inside buildings at surface level, the same shall be designed for working in the tropical conditions existing here and the ambient temperature and humidity levels pertaining to Jaipur area.

4.2.2 Isoceraunic level: Average 30 thunderstorm days per year as per IS 2309:1989

4.2.3 Tunnel walls may be wet and seepage water will normally be present in the invert. The system design shall, therefore, take into consideration the effect of seepage and continue to operate in such wet and humid conditions.

4.3 Salient features of the Metro System

4.3.1 The salient features of the underground Corridor are as follows:

4.3.1.1 General

S.no.	Description	Unit	Standard Gauge (Line-1)
(i)	Gauge	mm	1435
(ii)	No. of tracks	Nos.	2
(iii)	Shortest radius of curve		
	on main lines	m	200
	on Depot lines	m	150
(iv)	Maximum gradient	%	4%
(v)	System of current collection In tunnel		25 kV AC Rigid Overhead Contact system
(vi)	Type of platforms		Island/Side
(vii)	Length of platforms	m	140 (approx)
(viii)	Design Speeds		

S.no.	Description	Unit	Standard Gauge (Line-1)
	Main Line	km/h	95
	Depot Access Line	km/h	95
	Depot Test Track	km/h	95
	Crossovers	km/h	40

4.3.1.2 Underground Section

Cross Section

- (i) Box tunnel - 4700 x 5200mm
- (ii) Diameter of bore tunnel - 5600mm (5700 ± 100mm)
(Construction tolerance ± 100mm)

Finished tunnel for single track after as-built tolerances shall be of minimum 5600 mm internal dia with the design axis of the tunnel. This means that at no point of circumference of as built tunnel, distance between designed axis of the tunnel and internal surface of tunnel shall be less than 2800 mm.

The tolerances for the design internal dia of minimum 5700 mm for single track tunnel shall be as under:

- a) The internal profile of lining shall not depart from its design position by more than 30mm. This means that the centre of the tunnel at any cross section may deviate from the designed centre upto 50 mm, provided the internal dia at that cross section is equal to 5700 mm.
- b) The internal profile of any ring of shield-driven tunnels shall not deviate from a true circle by more than 25 mm. That is, any diameter of the as-built ring shall not differ from the design internal diameter by more than 50mm. However, this tolerance shall not be permitted where tolerance at 4.3.1.2 (a) has been utilized.
- c) The plane of the leading face of each ring, including a taper ring, shall not depart at any point from the plane surface by more than 6 mm.
- d) Steps between abutting segments shall not be greater than 5mm.
- e) The roll of adjacent circle joint bolt holes shall not be greater than 5 mm; the maximum total bolt hole roll of any ring is 40 mm from the design position.
 - i) Depth of rail below ground level - 10 to 20 m approx.
 - ii) Overall length of station box - Approx. 280-290m
 - iii) Width of station box - Approx. 25-30m
 - iv) Width side platform - Approx. 5m
 - v) Width of island platform - Approx. 10 -15m

Note: Above parameters are to be ascertained and to be confirmed from Civil Contractors.

4.4 Basic Design Philosophy and Requirements

4.4.1 Proven Design

The Contractor shall develop the design based on this specification and on proven and reliable Engineering Practices. The design details shall be submitted with technical data and calculations to the Engineer for review.

The System, including all Sub-systems and Equipments shall be of proven design.

Sub-systems and Equipment proposed by the Contractor shall have been in use and have established their performance reliability on at least one Mass Rapid Transit System or Suburban Railway System in Revenue Service over a period of at least two years.

Where similar equipments or Sub-systems of a different rating are already proven in service, then the design shall be based on such equipments. In case these stipulations are not fulfilled, the Contractor shall furnish sufficient information to prove the basic soundness and reliability of the offered Sub-system and can be adopted only after the approval of the employer. The system will be permitted to be energized only after the technical audit by an independent renowned agency.

4.4.2 The design philosophy should meet the following criteria:

- a) Application of state-of-the-art Technology
- b) Service proven design
- c) Design life 30 years
- d) Minimum life cycle cost
- e) Low maintenance cost
- f) Use of interchangeable, modular components
- g) Extensive and prominent labelling of parts, cables and wires
- h) Use of unique serial numbers for traceability of components
- i) High reliability
- j) Low energy loss
- k) System safety
- l) Adequate redundancy in system
- m) Fire and smoke protection
- n) Use of fire retardant materials
- o) Environment friendly
- p) Adherence to operational performance requirements
- q) Maximum utilisation of indigenous materials and skills, subject to quality conformity.

4.4.3 Adequate margin shall be built into the design particularly to take care of the higher ambient temperatures, dusty conditions, and high seasonal humidity, etc. prevailing in Jaipur.

4.5 Design Management and Control

- 4.5.1 In order to ensure that the requirements of this Technical Specification are met, the Contractor shall establish and maintain documented procedures using, ISO 9001 to control and verify the design of the System and all its equipment. These procedures shall be subject to review by the Engineer.
- 4.5.2 The Contractor shall establish and maintain a systematic, documented, comprehensive, and verifiable system integration process throughout the execution of the Contract.
- 4.5.3 This process shall ensure that interfaces and interaction between System, infrastructure, sub-systems, software, and operating and maintenance requirements have been identified and engineered to function together as a system.

4.6 System Integration Process

- 4.6.1 The Contractor shall systematically identify and formally document all design, manufacturing and operational interfaces between equipment within the System, and between the System and external systems, facilities, operations and the environment likely to affect or be affected by the System.
- 4.6.2 A mechanism and assigned project responsibility for interface management and control shall be provided, such that every identified interface has a defined resolution process that can be monitored.
- 4.6.3 The Contractor shall define methods to confirm compatibility between System equipment and carrying out integration tests at different stages of the design and interface management process to demonstrate that all equipment functions perform properly, both individually and as part of the complete System.
- 4.6.4 The Contractor shall ensure that performance, availability, and safety requirements are addressed in the design process and that the reliability and maintainability of all equipment will enable the service performance to be met.
- 4.6.5 The system integration process shall be capable of audit by the Engineer

4.7 Interface Management Plan

- 4.7.1 The Contractor shall submit to the Engineer for review an Interface Management Plan (IMP) and Detail Interface Documents, in accordance with the General Specification, which defines how the Contractor will systematically identify and document technical interfaces.

4.8 Design Submission Requirements

- 4.8.1 The Contractor shall perform his designs for the Contract in accordance with the requirements of this TS and the GS. The Contractor shall submit to the Engineer for his review, relevant design information as identified under each stage. Such submissions shall incorporate the relevant Standards applicable.
- 4.8.2 The design submission requirements are detailed in the General Specification.

4.9 Traction Power Supply Performance Requirements

- The following data shall be used for all normal and emergency performance requirements of traction power supply system.
- 4.9.1 Rolling stock characteristics and train operation data

Traction power supply of shall be designed taking into consideration the rolling stock characteristics and train operation data given below Table 4.9-1 and Table 4.9-2

Table 4.9-1 Rolling stock characteristics and train operation data

Item	Metro Corridor
Maximum design speed	95 km/h
Maximum service speed	85 km/h
Schedule speed with 30 seconds station stop and 8% coasting excluding terminal station turn-round time	32 km/h
Acceleration 0-30 km/h for fully loaded train on tangent track	1 m/s ²
Service braking rate from 85 Km/h to standstill (fully loaded train on tangent track)	1.0 m/s/s
Emergency braking rate from 85-0 km/h	1.3 m/s/s
Expected adhesion but not limited to	18%
Train configuration	3MC+2DTC+1TC
Type of rolling stock	Modern stainless steel cars with VVVF 3 phase drive
Type of Braking	Electro-pneumatic service friction brake, Electric regenerative brake
Design headway between trains	90 Seconds
Maximum gradient	4%
Maximum current drawn by 6-car fully loaded train	To be ascertained from Rolling Stock Contractor

Table 4.9-2 Car weights and passenger capacities

Type of car	Tare weight	Total passenger carrying capacity @ 10 passengers per square metre	Total passenger weight @ 65 kg per passenger
Motor car	42.10 Tonnes	380	24.7 Tonnes
Trailer car	40.85 Tonnes	380	24.7 Tonnes

The tentative rolling stock characteristics are subject to confirmation from Rolling Stock Contractor.

Further details such as power drawn versus time and distance characteristics for level of services at design headway may be ascertained from the Rolling Stock Contractor.

4.9.2 Performance Requirements of Traction Power Supply System

Traction power supply system shall meet the requirements given below in Table 4.9-3 in respect of maximum and minimum voltages at any overhead current collection point.

Table 4.9-3 Voltage Requirements

Voltage	Metro Corridor
Nominal voltage	25 kV ac
Minimum Voltage	19 kV ac
Maximum voltage	27.5 kV ac

4.10 Performance Features Required

- 4.10.1 Contractor shall provide built-in diagnostics and remote monitoring functions for each microprocessor-based equipment and module of the systems such that the performance requirements can be demonstrated.
- 4.10.2 The reliability and maintainability processes and procedures shall be planned, integrated and developed in conjunction with the operating environment, and the design, development and production functions to permit the most effective and economical achievements of the systems and equipment design objective.
- 4.10.3 The systems shall meet or exceed the requirements for safety and reliability as specified in national or International Standards for such mass rapid transit system. The reliability of the systems designed, supplied and installed is the principal element for availability. It is essential that the System reliability is as high as reasonably practicable.
- 4.10.4 A high design standard incorporating redundancy if practicable, flexible system arrangement, together with good quality products, and adherence to strict construction standards, are required to ensure high reliability of systems installed for smooth operation of train services.

4.11 Not used

4.12 Availability

4.12.1 Service Availability Targets

- 4.12.1.1 System availability to ensure that the reliability of the Systems does not jeopardize the reliability of services of the MRTS.
- 4.12.1.2 The Systems shall be designed to ensure that failure of any major equipment, caused by an external accident or negligence of internal staff, will not lead to unavailability of the whole System, other than temporary outage of the failed equipment.
- 4.12.1.3 All elements of the systems shall be able to be maintained during out-of-traffic hours to avoid interrupting passenger train services.
- 4.12.1.4 Figure for service availability are specified in 'failures per annum' in each of the four classes of severity of failure. Both reliability and maintainability in terms of time to restore service or implement mitigation measures to work around the occurrence of a fault are to be considered. The service availability targets include failure of the System power supplies, but exclude grid supply failures affecting multiple primary substations.

4.13 Detailed Availability Requirements

- 4.13.1 As far as is reasonably practicable, failures of the overhead line, or support equipment shall not cause loss of traction supply to more than one line, nor to sections of route that do not pass over the section of line where the fault occurred. Provision shall be made, through section isolators and other means, to allow reconfiguration of the traction power supply to feed the overhead line in areas not directly affected by the fault.
- 4.13.2 The Contractor shall define maintenance and test procedures of various equipment to ensure adequate availability of the traction power supply.
- 4.13.3 Indoor components and cabling shall be so located as to prevent exposure to water and moisture. Adequate care shall be taken to ensure that derating of indoor equipment does not take place.

4.13.4 Means shall be adopted, in the design and installation of the System, to prevent equipment and component failures or overhead line structural collapse, as far as reasonably practicable. Mechanical joints of conductors, which may be susceptible to failure, shall, where practicable, not be located in close proximity to passenger platforms.

4.13.5 Proven Section insulators shall be designed so that their frequent adjustments are not required.

4.14 **Maintainability**

4.14.1 The Contractor shall undertake maintainability analysis to assess the preliminary maintainability targets of the systems.

4.14.2 The Contractor shall state the maintainability requirements, and demonstrate that System maintainability is sufficient to support the claimed System reliability and availability performance. The Contractor shall demonstrate that maintenance errors have been considered, and, as far as is practicable, the risk of maintenance-induced faults has been mitigated by the appropriate design.

4.14.3 The equipment to be supplied by the Contractor must be designed for minimum or no maintenance. Maintenance activity required must be capable of being performed with minimum or no impact on the train service.

4.14.4 Maintenance equipment and materials should not be stored at the trackside unless essential for efficient and safe operation. This is particularly important in restricted access areas such as tunnels.

4.14.5 Maintenance activities may be classified into two areas, routine preventative and corrective, both of which affect service availability. Other maintenance strategies such as condition monitoring may be incorporated.

4.14.6 Routine/preventive maintenance periods shall be limited to non-operational maintenance hours during the night or if essential during off peak periods.

4.14.7 To optimise speedy corrective maintenance, techniques employing automatic diagnostics test points, and rapid repair facilities shall be provided. In addition, especially the OCS System and the associated traction power cable network shall be so arranged that the corrective maintenance work can be easily carried out under accidental crippled operation.

4.15 **Safety**

4.15.1 **Safety Requirements**

- The installation design shall incorporate measures to avoid presenting safety hazards to people.
- The Systems design shall incorporate measures to provide for its safe management and operation.
- The Systems shall not give rise, or be subject to, dangerous interactions within the railway or with other systems. The design of the systems shall consider the safety and reliability of interface to the adjoining transit system such as surface corridor or Northern Railway. The design shall also consider potential interfaces with Road System.
- The installation shall meet the fire safety requirements generally as per NFPA130.

- The design of the earthing system shall conform to IEEE-80/2000, IS 3043: 1987 and EN 50122-1 with latest amendments.

4.15.2 **Safety Targets**

- The Contractor shall show that the Systems can be maintained safely. The Contractor shall prepare a Quantified Risk Assessment (QRA) to model the risk to (a) travelling public and (b) maintenance and operations staff. The QRA may be based on a comparison of System features and operating practices with other underground metro systems for which risk levels are known. The QRA shall address the risk of electrocution from the OHE/ OCS and other equipment as well as EMI effects of 25kV traction. For maintenance personnel key elements of the QRA shall include as a minimum an assessment of the risk of being struck by a train while working line-side, of falls during maintenance, of electrocution. Accidental charging of dead section due to problem with SCADA posing safety hazard shall also be addressed.
- The Contractor shall demonstrate that the Systems have been designed to minimize the risk due to operator and maintainer error, considering both the ergonomic aspects of the system design to reduce the likelihood of error, and protective measures adopted to mitigate the consequence of such error.
- The Contractor shall demonstrate that risk to passengers, members of public, including trespassers is low as reasonably practicable.

4.16 **System Requirements.**

4.16.1 **Design for horizon year 2031.**

The system shall be designed by Contractor to support the movement of ultimate maximum capacity transportation in the horizon year 2031. In the horizon year it is planned to run 6 Car (3MC+2DTC+1TC) EMU trains at 2.25 minute headway during peak periods in each direction and, therefore, System shall be designed for 2.5 headway.

4.17 **Conformity with Governing Specifications and other Statutory Requirements**

4.17.1 The work shall be carried out in accordance with the following governing specifications and other statutory rules:

- CEA Regulations 2010
- Indian Electricity Act 2003 with latest amendments.
- Central Safety regulations, 2010
- Regulations laid down by Chief Electrical Inspector to the government.
- Rules and Regulations prescribed by local authorities as applicable.
- Relevant, Indian Standards, IEC Standards, CENELEC, British Standards, 25kV AC traction Manual of Indian Railways (as applicable) and other National/ International standards as applicable. Appendix B of this Specification gives a list of relevant standards, which may be referred to. However, the list is not exhaustive.

4.17.2 The Contractor shall furnish information asked for by a statutory body (e.g., Government of India Ministry of Railways, Ministry of Power, BSNL, TRANSCOM/ DISCOM, Commissioner of Railway Safety, State Electrical Authorities BSNL etc.) in particular format as directed by

Engineer. Any documents, studies, test reports, compliances required for getting safety clearances from any authority shall be submitted by the contractor.

4.18 Electrical Sectioning of 25 kV OCS

4.18.1 OCS shall be divided into electrically isolated sections at selected locations by provision of interrupters at insulated overlaps and with section-insulators at the turnouts or air-gap overlaps. Sectioning shall be provided to permit isolation of OCS in small sections for maintenance, to isolate faulty OCS in case of fault/accident, and to permit evacuation of passengers from stations by bringing the train upto station. The sectioning shall be such that in case of fault, the faulty section can be isolated quickly and the trains in the healthy section on the same track can either be brought to a station or can be taken on the other track through emergency cross-over depending upon the operational requirement. Basic sectioning arrangement has been depicted in the tender drawings. If need sectioning arrangement may be modified by contractor to provide better sectioning scheme with the consent of Employer. However, Contractor shall take approval from Employer for the final sectioning arrangement.

4.18.2 The Contractor shall interface with respective DDCs, Design Build and Construct Contractors for accommodating 25 kV switchgear in the stations as well as for routing of cables and their connections at switchgear and at OCS.

4.19 EMI Study, Interface with other Contractors, Earthing and Bonding and Return Current Circuits

4.19.1 EMI Study

As a result of EMI and simulation Study the number and disposition of return current conductors, OPC, TEW & Earth wires, their sizes and interval between rail connections shall be established. The number and location of impedance bonds, S-Bond, -Bond shall be jointly finalized with S&T Contractor to ensure adherence to IEC Safety Standards of step and touch potentials and CCITT regulations in regard to S&T circuits.

The EMI/EMC study shall be carried out for the complete sections of phase-1A & 1B sections of the line. The already operational sections, depots & RSS's should also be considered for conducting the study. The limiting values concluded from study should be clearly brought out and stated in tubular form

4.19.2 Overhead Line Equipment Earthing System

The Contractor shall design a suitable and effective earthing system for the entire ROCS installation so that the Touch and step potentials are within safe limits.

4.19.3 Traction Bonding

The Contractor shall design bonding system in Metro Corridor. The bonding shall ensure safety of passenger, personnel, equipment, adjacent buildings, structures and reliable and safe performance of LT and HT power, control system, ETS, signal and telecom circuits and smooth passage of return current back to substation.

4.19.4 Traction Return

On the main line, both rails/one rail of the tracks shall be utilized as the traction return rails. Continuity & impedance bonds, S-Bond and -Bond shall be provided wherever required. Necessary interface with S&T Contractor shall be detailed out.

For bonding Thermosetting Welding to be provided with suitable size cable.

- 4.19.5 Based on the results of EMI study, a detailed interface plan for Civil, Electrical, Signal and Telecom works shall be prepared to ensure adequate safety of works.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 5

FUNCTIONAL REQUIREMENTS

5 FUNCTIONAL REQUIREMENTS

5.1 Functional Role

- 5.1.1 The installation shall deliver safe, adequate and reliable 25 kV AC traction power supply to the electric trains via overhead current collection system.
- 5.1.2 The Contractor shall prepare and submit specifications, which provide a clear description of the functional requirements of each of the system, sub-system and equipment proposed. This description shall indicate acceptable levels of performance, for system/ subsystem equipment within the stipulated environment. The Contractor shall identify by manufacturer model and parts number each system equipment, which plans to install.
- 5.1.3 The Contractor shall work out a detailed interlocking and protection scheme to prevent inadvertent operation of circuit breakers resulting in electrical accident by short circuiting of two sources of supply. The operating arrangement incorporating the system interlocking requirements shall be proposed by the Contractor for review by Engineer.
- 5.1.4 Unless specific authorization to the contrary is given in writing by the Employer, all design shall conform to the latest applicable standards.

5.2 Functional Interface with others

- 5.2.1 Functional Interface with other Contractors and Authorities.
This is addressed in Chapter 13 of this Specification.

5.3 Functional Performance of the System

This is addressed in Chapter 4 of this Specification.

5.4 Functional Safety

5.4.1 General

- 5.4.1.1 In accordance with clause 4.15 of this Specification, the overhead current collection system shall be designed and constructed to ensure safety to passengers, the Employer's staff and the general public.

5.4.2 Specific safety requirements

- 5.4.2.1 Safety Legislation and Regulations are included in clause 4.19 of this Specification. The System shall comply with all Enactments and Rules framed there under.
- 5.4.2.2 The System shall comply with all the relevant safety documentation of the Employer, including, but not limited to 'Project Safety Manual' and any update thereof provided by the Engineer

5.4.3 Risks on Functional Safety

- 5.4.3.1 The risks on functional safety System will include, but not be limited to, the following items:
 -
 - a) Malfunctioning of equipment due to EMI, such as picking up parasitic induced voltage.
 - b) Explosion or Fire at SP/SS Room.
 - c) Equipment safety;

- d) Damage to overhead conductors;
- e) Damage to overhead current collection system equipment;
- f) Damage to 25 kV traction feeder cables;
- g) Damage to return conductors or earth conductors;
- h) Electrical safety including safety clearance from exposed live conductors;
- i) Safety for passengers, the Employer's staff and public, including trespassers as far as is reasonably practicable; and

The Contractor shall minimise the above-mentioned risks to a level as low as reasonably practicable in the design and construction of System.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 6

DESIGN CRITERIA AND PERFORMANCE SPECIFICATION GENERAL

6 DESIGN CRITERIA AND PERFORMANCE SPECIFICATION - GENERAL

6.1 Brief Description of the System

6.1.1 25 kV AC Traction Overhead Current Collection System

6.1.1.1 The Contractor shall provide 25 kV AC rigid overhead conductor rails on main lines of underground Corridor including stabling lines at terminal stations as outlined in Chapter-10. Overhead conductor rail shall be of composite aluminium with easily insertable copper contact wire.

6.1.1.2 Control Panels

All the remote controlled switchgear of the entire power supply system shall be equipped with local/remote switch to enable local operation with indication to OCC.

6.1.2 Protective Relaying and Metering Scheme

The Protective Relaying Scheme shall be such as to ensure maximum discrimination resulting in highest reliability and stability of power supply as well as safety of equipment and personnel. Paralleling of 25 kV supply from adjacent Receiving Substation shall be prevented.

6.1.3 Earthing and Earth Conductors

Suitable design of earth system shall be developed for the SP & SS as per the stipulations of this Specification. The entire work of system earthing shall be the responsibility of the ROCS Contractor. The Contractor will also take up extension of these earths to cable galleries and train tunnels & Colour Code for equipment and cables.

The Contractor for review by Engineer shall propose an appropriate colour code scheme for equipment and cables of different voltage.

6.1.4 Drawings

The schematic and general concept drawings related to power supply and civil requirements are given in Employer's Drawings.

6.2 Not used

6.3 Not Used

6.4 Design of Earth System

6.4.1 System protective earthing for providing electrical safety on entire system including earthing of non current carrying metallic components, cable supports, etc shall be designed by respective contractor JP/EW/1B/E2. The earthing system shall conform to IS 3043:1987, EN 50122-1 and IEEE 80 with latest amendments.

The earth system shall in scope of this contract consist of: -

- a) Earthing Systems in Switching Posts.
- b) Earth Conductors to earth non-live metallic parts of overhead current collection system.
- c) The system of earth and return current conductors shall ensure a safe earthing system and return current conduction.

In view of the caution required for passenger and personnel safety in an underground metro system operated on 25kV AC traction using rails for return current, the design for step & touch potentials will need abundant care. This is further aggravated by damp tunnel environment. Accordingly the touch and step potential shall be designed based on allowable continuous touch and step optional being below as per EN 50122-1 and CCITT Directives.

- d) Earthing and, if required, isolation of long railings, metallic parts at stations and concrete reinforcements.

In underground Switching Posts, earth mat / earth electrodes shall be provided by Civil Contractors to the requirements of the JP/EW/1B/E2 Contractor.

The Contractor shall carry out entire design study of the earthing system on the basis of safety to public and maintenance personnel against touch and step potential and fire hazards and finalise the design, sizes and layout of main earth conductors in the tunnels, cable galleries etc.

Based on EMI study, suitable return conductor and TEW, OPC of requisite size shall run in the tunnel.

- 6.4.2 The maximum earth resistance of entire System shall meet the following requirements:

Table 6.4-1 Maximum Earth Resistance

Location	Earth resistance (ohms)	
	Each electrode	Total earth system
SP/SS	5	1.0
Other locations	10	To meet the requirements of IS 3043:1987, IEEE 80, EN50122-1

- 6.5 Not used

6.6 Short Circuit Capacity

The Contractor shall ensure that power supply system including cables installed shall be capable of withstanding the TRANSCOM/GENCO fault levels at the points of common coupling and down. The fault levels to be catered for generally are given in Table 6.6-1 below. Specific requirements (if they are different) are furnished in the equipment/sub-system specifications.

Table 6.6-1 Design Short Circuit Levels

S.No.	System Voltage (kV)	Breaking Capacity in MVA	Fault Current in kA	Fault Duration in Seconds
1.	25 AC	-	14	3
2.	0.415 AC	-	50 minimum	1

6.7 Insulation Coordination

6.7.1 The nominal voltages and corresponding maximum voltages shall be as follows

Nominal Voltage	Maximum Voltage
25kV	27.5kV

25 kV AC equipment shall have insulation levels according to Indian Railway AC Traction Manual and the European Standards EN 50124, Railway Applications – Insulation co-ordination.

6.8 Switchgear and panels

6.8.1 All indoor switchgear and panels shall be vermin proof, constructed from mild steel finished with anti-corrosion paint. The proposed colours shall be submitted for review by Engineer. Anti-condensation heaters shall be supplied wherever necessary.

6.9 Galvanisation of All Indoor/Outdoor Steel Works:

6.9.1 Steel structures and all Small Part Steel works (SPS) shall be hot dip galvanised.

6.9.2 The galvanisation shall be done only after cutting and drilling work is over. Galvanised bolts, nuts and spring washers shall be used for assembly work.

6.9.3 The coating of zinc shall be not less than 1000 gm/m² in accordance to ETI/OHE/13(4/84).

6.9.4 Galvanisation shall comply with the standards mentioned below:

IS-209/1992	Zinc Ingot-Specification
IS-800/1984	Code of practice for General Construction in steel.
IS-802 (PT-II),1978	Code of practice for use of Structural Steel in Overhead Transmission Line Towers-part II Fabrication , Galvanizing, Inspection and Packing.
IS-802 (Part-III),1978	Code of practice for use of Structural Steel in Overhead Transmission Line Towers-part 3 Testing.
IS-808/1989	Hot Rolled steel Beam, Column, Channel & Angle Section.
IS-813/1986	Scheme of Symbol for Welding.

IS-814/1991	Covered Electrodes For Manual Metal Arc Welding of Carbon & Carbon Manganeses steel-Specification.
IS-816/1969	Code of practice for use of Metal Arc Welding for General Constructions in Mild steel.
IS-1730/1989	Steel plates , sheets, Strips & Flats for Structural & General Engineering purposes- Dimensions.
IS-1732/1989	Steel Bars, Round & Square for Structural & General Engineering purposes- Dimensions.
IS-1852/1985	Specifications For Rolling and Cutting Tolerances For hot Rolled steel products.
IS-2062/1999	Steel For General Structural purpose- Specification.
IS-2629/1985	Recommended practice for hot dip Galvanizing of Iron and Steel.
IS-2633/1986	Method for Testing Uniformity of Coating on Zinc Coated articles.
IS-4759/1996	Hot dip Zinc Coatings on Structural Steel and Other Allied products- Specification.
IS-6745/1972	Determination of Mass of Zinc Coat-Ing on Zinc Coated Iron And Steel Articles.
IS-7215/1974	Tolerances For Fabrication of Steel Structures.
IS-13229/1991	Zinc For Galvanizing-Specification.
RDSO SPECIFICATIONS ETI/OHE/13(4/84)	RDSO Specification For Galvanization of steel Structures.

All latest standards and specifications with amendments are to be followed for galvanisation work

- 6.9.5 Wherever galvanising on ferrous components has been damaged in handling, the same shall be given two coats of zinc chromate primer and two coats of aluminium paints conforming to IS 2339.

6.10 Protection Scheme For Power Supply Equipment:

- 6.10.1 The Contractor shall define the philosophy and furnish a scheme of protection with fast discrimination and reliable operation based on latest state-of-the-art computerised logic protection scheme. The zones of protection shall overlap providing second and third tier back-up protections. The scheme of protection shall be fully co-ordinated with RSS CONTRACTOR.
- 6.10.2 Contractor shall submit detailed fault calculations, relay settings and fault co-ordinated curves showing proper protection, discrimination between all upstream and downstream equipment.

6.11 Modular Equipment and Components

- 6.11.1 To the extent possible all components shall be modular in construction to facilitate easy troubleshooting and replacement of components to minimize down time of the system.

6.12 Control and Power Cables

- 6.12.1 Detailed specifications of power and control cables are given in section 8.2. The run of various cables shall be designed so as to ensure minimum de-rating.
- 6.12.2 Equipment Earthing Terminals
- All equipment shall have at least two readily accessible separate earth terminals, which shall be identified by symbol of earth mark adjacent to the terminals.

- 6.13 Not Used.

6.14 Electrical Safety and Earthing

6.14.1 General

- 6.14.1.1 The scope of work includes Design, Supply, Installation, Testing and Commissioning of protective measures/equipment relating to electrical safety and earthing based on protective measures against electromagnetic induction due to 25kV ac traction.
- 6.14.1.2 Following Specifications shall be followed in addition to the National Codes of practices on earthing, and the Employer's safety documentation. The track bonding shall also conform to these specifications:
- EN 50122-1-Railway applications: Fixed Installation
- Part 1: Protective provision relating to electrical safety and earthing.
- IEEE 80 and IS 3043 with latest amendment.
- In all cases of safety and protective measures those against electric shock shall have highest priority.

6.14.1.3 Design criteria and performance specification

6.14.1.4 General Requirements

The Contractor shall design the entire system of earthing, bonding, and connections of return current circuit, means of measuring of track voltages, determination and calculation

of safe touch and step potentials. The design shall also include the construction details and methods to be followed by other underground Contractors, so that their entire work is rendered safe for both the protection aspects of electrical safety. The Contractor shall interface with other Contractors in this regard.

6.14.1.5 Laying of tracks

The Contractor shall inter-face with track laying Contractor, Civil contractors, for track laying work and with S&T Contractor for provision of Impedance Bonds, S Bond, Bond and E&M Contractors.

6.15 Electromagnetic Compatibility (EMC) Requirements

6.15.1 General

6.15.1.1 The requirements stated below shall be read in conjunction with the EMC Requirements in the General Specification. The limits should be as per the latest applicable ICNIRP standard. The EMC report should clearly indicate the values of exposure of magnetic fields to the general passenger and workers at stations platforms and working areas. Magnetic shielding plan along with the modifications in design and equipments if any required to limit the exposure of magnetic fields within the safe limits has to be provided by ROCS contractor.

6.15.1.2 An EMC Control Plan shall be submitted for review by Engineer

6.15.1.3 The EMC Control Plan shall include measures to reduce conducted, induced, and radiated emissions, especially the levels of harmonic, to acceptable values as specified by the relevant international standards.

6.15.1.4 The plan shall analyse EMI/EMC impacts on the trackside equipment as well as the general environment. Particular attention should also be paid to additional requirements in grounding, bonding, shielding, filtering, and cabling arrangements.

6.15.1.5 The Contractor is required to conduct type tests as well as full EMC tests. Tests to be conducted shall include but not limited to the following standards:

a) Overall compliance:

EN50121-1, EN50121-2, EN50121-5 and EN50123

b) Specific standards:

i) Immunity

Electrostatic discharge IEC 61000-4-2

Radio frequency fields IEC 61000-4-3

Power frequency magnetic field IEC 61000-4-8

Pulse magnetic field IEC 61000-4-9

Damped oscillatory magnetic field IEC 61000-4-10

ii) Emission:

Radiated emission EN50121-5

Conducted emission EN50121-4

IEC61000-2-6/

IEC61000-3-2/

IEC61000-3-3/

IEC61000-3-4

Examples of EMC tests and their respective test levels extracted from selected international standards are given in Table 6.15-1 of this Specification. However, this table is by no means exhaustive and the Contractor shall refer to the respective standards for further information.

All tests shall be conducted at severity levels specified by EN50121 and/or the Engineer, whichever are more stringent.

6.15.2 Intra-System EMC

The Contractor shall ensure that all intra-system EMI are taken care of through proper design and other special measures. All major sub-systems shall be tested for emissions and immunities in accordance with the appropriate international standards for equipment operating in railway or similar industrial environment. Examples of these international standards are given in, but not limited to Table 6.15-2 of this Specification. Where testing is not applicable due to factors such as size of sub-system or availability of test facilities, letter of no objection shall first be obtained from the Engineer for waiver of such tests.

6.15.3 Inter-System EMC

The Contractor shall ensure that all OCS equipment is designed and constructed in accordance with the latest issues or versions of internationally recognized EMC standards, including but not limited to EN50082, EN50121, EN50123, EN50155, IEC60571 and IEC61000 or equivalents, to ensure proper functioning. Consideration shall be given to the EMC of the complete Jaipur MRTS.

6.15.4 Safety-Related System Interference

Special attention shall be given to the interference with safety-related operations. Special tests shall be designed to ensure that the emissions whether conducted, induced, or radiated conform to the specific requirements of the safety-related systems. Adequate safety margins between the immunity levels of these safety-related systems and the emission levels of other electrical and electronic equipment shall be adopted. Measures shall be taken to reduce the levels of the unwanted emissions. These measures shall include but not limited to the following actions:

- a) Proper use of filters to minimise harmonic generation.
- b) Proper use of power line filters to reduce conducted emissions.
- c) Proper use of shielded cables to reduce radiated emission.
- d) Proper use of magnetic shielding to minimise magnetic coupling from transformers.
- e) Proper use of surge arrester (see EN50123-5).
- f) Proper use of 25kV return conductors to maximize protection.

The Contractor shall also provide computations on the expected conducted and radiated emissions from the power supply systems due to electrical fault, load fluctuations, and/or system imbalance. Their effects on the safety-related equipment, especially the probabilities of leading to an unsafe operation shall be determined. An appropriate

technical construction file suitable for safety audit shall be developed to demonstrate EMC compliance.

6.15.5 Non-Safety-Related Systems Interference

- 6.15.5.1 Contractor shall take measures to ensure that EMC is achieved between power supply system and all other equipment as specified by the latest version of the relevant International Standards or by the Engineer.
- 6.15.5.2 All radiated emissions, either via the power cables, rectifiers, transformers or any other system components, shall be minimised such that they conform to the appropriate international standards. Special reference shall be made to the compliance of EN50121-5, EN50123, and IEC61000-2.
- 6.15.5.3 All power cables shall be properly shielded where applicable, not only to reduce radiated emissions from the cables, but also to reduce the possibility of the cable picking up unwanted RF noise. Reference shall be made to IEC61000-4-6 and IEC61000-4-16.
- 6.15.5.4 The Contractor shall ensure that all conducted emissions, including but not limited to harmonics, shall not interfere with telephone, communications, supervisory and control, automatic fare collection, train protection and control, and other MRTS equipment either via the rectifier transformer to the primary 33kV system or via the rectifier to the DC traction power system. Reference shall be made to EN50121-5, EN50123, IEC61000-2.
- 6.15.5.5 The Contractor shall also co-ordinate with other contractors whose equipment are connected to the power supply system and are likely to inject unwanted emissions into the power supply system to reduce such emissions. Reference shall be made to EN50121-2, EN50121-4, EN50121-5, IEC61000-3 and IEC 61000-4-7.

6.15.6 Environment EMC

The Contractor shall ensure that radiated emissions from the power supply cable are maintained at an internationally acceptable level. The Contractor shall also ensure that the power cables are protected from RF radiations from All India Radio (AIR), Doordarshan, Mahanagar Telephone Nigam Limited (MTNL), Videsh Sanchar Nigam Limited (VSNL) and others.

6.15.7 Installation and Mitigation Guidelines

IEC61000-5 series of guidelines shall be observed wherever applicable.

6.15.8 Earthing

- 6.15.8.1 An earthing system shall be designed to ensure personnel safety and protection of installations against damage. It shall also serve as a common voltage reference and to contribute to the mitigation of disturbances.
- 6.15.8.2 To achieve the primary goal of assuring personnel safety and damage control, a low impedance path shall be made available to the large current generated due to lightning or power system fault. The potential differences (touch and step voltages) between any two points shall be as low as possible. Safety considerations also require the chassis or enclosure to be earthed to minimise shock hazards to passengers and Employer's staff.
- 6.15.8.3 To achieve the secondary goal of providing protection for sensitive and interconnected electronic and electrical systems, earthing shall be designed to minimise the noise voltage generated by currents from two or more circuits flowing through a common earth

impedance and to avoid creating earth loops susceptible to magnetic fields and differences in earth potential.

6.15.8.4 Earthing shall also be designed to accomplish the following minimum requirements:

- a) Protect personnel and equipment from electrical hazards, including lighting, where practical.
- b) Reduce potential to system neutrals.
- c) Reduce or eliminate the effects of electrostatic interference and electromagnetic interference arising from within the MRTS.
- d) Provide a single-point earthing method for all equipment enclosures, cabinets, drawers, assemblies and sub-assemblies.

6.15.9 Bonding

6.15.9.1 Bonding all exposed metallic parts of all equipment, civil structures and connecting them to the earthing network is a way for meeting safety requirements and to minimise noise voltages due to potential differences.

6.15.9.2 Direct bonding shall be used wherever practical. Where indirect bonding via bonding strap is used to connect two isolated items, the bond shall satisfy the following minimum requirements and prevailing international standards, for example, IEC61000-5-2.

- a) Proper bonding procedure, including appropriate surface treatment before and after the bonding process, is adopted.
- b) Proper use of bond material to minimise electrolytic corrosion.

6.15.10 Cabling

6.15.10.1 The cables used shall be adequately protected against external interference. Additional protective measures, including but not limited to the use of metallic conduit, armour, ferrite choke, EMI filters shall be used to reduce such external interference wherever required. Covered conduit is preferred.

6.15.10.2 A cable routing plan shall be designed to minimise likelihood of coupling between parallel cables. The Contractor shall refer to guidelines recommended by IEC61000-5-2 wherever possible.

Table 6.15-1 Immunity levels at various power ports

Enclosure port

<u>Test</u>	<u>Severity level</u>
RF field	800-1000 MHz, 20 V/m, 80%AM 1kHz
RF field - pulse modulated	900 MHz, 20 V/m, 50% duty cycle, PRF 200 Hz
Power frequency magnetic field	50 Hz, 100 A/m
Electrostatic discharge	6 kV contact, 8 kV air
RF common mode	0.15-80 MHz, 20 V, 80%AM at 1kHz source impedance 150 ohms
Fast transients	2 kV, 5/50 Tr/Th nanoseconds, PRF 5 kHz

Port for process, measurement and control lines, and long bus and control lines

<u>Test</u>	<u>Severity level</u>
RF common mode	0.15-80 MHz, 20 V, 80%AM at 1kHz source impedance 150 ohms
Fast transients	4 kV, 5/50 Tr/Th nanoseconds, PRF 5 kHz
Transients common/diff modes	1.2/50 Tr/Th μ sec, 2 kV (c), 1 kV (d)
Power frequency	150 V rms
Power frequency common mode	650 V rms

DC input and DC output power ports

<u>Test</u>	<u>Severity level</u>
RF common mode	0.15-80 MHz, 20 V, 80%AM at 1KHz source impedance 150 ohms
Fast transients	4 kV, 5/50 Tr/Th nanoseconds, PRF 5 kHz
Transients common/diff modes	1.2/50 Tr/Th μ sec, 2 kV (c), 1 kV (d)

AC input and AC output ports

<u>Test</u>	<u>Severity level</u>
RF common mode	0.15-80 MHz, 20 V, 80%AM at 1kHz source impedance 150 ohms
Fast transients	4 kV, 5/50 Tr/Th nanoseconds, PRF 5 kHz
Transients common/diff modes	1.2/50 Tr/Th μ sec, 2 kV (c), 1 kV (d)

Earth port

<u>Test</u>	<u>Severity level</u>
RF common mode	0.15-80 MHz, 20 V, 80%AM at 1kHz source impedance 150 ohms

Table 6.15-2 Typical International Standards on EMC

BS EN 50082-1	Electromagnetic compatibility _ Generic immunity standard Part 1: Residential, commercial and light industry.
Pr EN 50082-2	Electromagnetic compatibility _ Generic immunity standard Part 2: Industrial environment.
DD ENV 50121-1	Railway applications _ Electromagnetic compatibility Part 1: General

DD ENV 50121-2	Railway applications _ Electromagnetic compatibility Part 2: Emission of the whole railway system to the outside world.
DD ENV 50121-3-1	Railway applications _ Electromagnetic compatibility Part 3-1: Rolling Stock _ Train and complete vehicle _ limits for emission and immunity.
DD ENV 50121-3-2	Railway applications _ Electromagnetic compatibility Part 3-2: Rolling stock _ Emission and immunity of apparatus.
DD ENV 50121-4	Railway applications _ Electromagnetic compatibility Part 4: Emission and immunity of the signalling and telecommunications apparatus.
DD ENV 50121-5	Railway applications _ Electromagnetic compatibility Part 5: Emission and immunity of railway fixed power supply installations.
EN 50155	Railway applications - Electronic equipment used on rolling stock
IEC 571-1	Electronic equipment used on rail vehicles Part 1: General requirements and tests for electronic equipment
IEC 571-2	Electronic equipment used on rail vehicles Part 2 : Standardisation of certain mechanical and electrical quantities - Principles of test devices
IEC 571-3	Electronic equipment used on rail vehicles Part 3 : components, programmable electronic equipment and electronic reliability
IEC 61000-1-1	Electromagnetic compatibility Part 1: General Section 1: Application and interpretation of fundamental definitions and terms
IEC 61000-2-1	Electromagnetic compatibility Part 2: Environment Section 1: Electromagnetic environment for low-frequency conducted disturbances and signalling in public power supply systems
IEC 61000-2-2	Electromagnetic compatibility Part 2 : Environment Section 2 : Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems
IEC 61000-2-3	Electromagnetic compatibility Part 1 : Environment Section 3 : Description of the environment - radiated and non-work-frequency-related conducted phenomena
IEC 61000-2-4	Electromagnetic compatibility Part 2: Environment Section 4 : Compatibility levels industrial plants for low frequency conducted disturbance
IEC 61000-2-5	Electromagnetic compatibility Part 2 : Environment Section 5 : Classification of electromagnetic environments
IEC 61000-2-6	Electromagnetic compatibility Part 2 : Environment Section 6 : Assessment of the emission levels in the power supply of industrial plants as regards low-frequency conducted disturbances

IEC 61000-2-7	Electromagnetic compatibility Part 2: environment Section 7 : Low frequency magnetic fields in various environment
IEC 61000-2-9	Electromagnetic Compatibility Part 2: environment Section 9 Description of HEMP environment – radiated disturbance
IEC 61000-2-10	Electromagnetic Compatibility Part 2 –10 environment – description of HEMP environment – conducted disturbance
IEC 61000-3-2	Electromagnetic compatibility Part 3 : Limits Section 2 : Limits for harmonic current emissions
IEC 61000-3-3	Electromagnetic compatibility Part 3: Limits Section 2 : Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current - 16A
IEC 61000-3-5	Electromagnetic compatibility Part 3: Limits Section 5 : Limitation of voltage fluctuations and flicker in low-voltage power supply systems for equipment with rated current greater than 16A
IEC 61000-3-6	Electromagnetic compatibility Part 3: Limits Section 6 : Limitation of emission of harmonic currents for equipment connected to medium and high voltage power supply systems
IEC 61000-3-7	Electromagnetic compatibility Part 3: Limits Section 7 : assessment of emission limits for fluctuating loads in MV and HV power systems
IEC 61000-3-8	Electromagnetic compatibility Part 3: Limits Section 8 signalling on low voltage installations – emission levels, frequency bands and electromagnetic disturbance levels
IEC 61000-4-1	Electromagnetic Compatibility Part 4: Testing and measuring techniques Section 1 : Overview of immunity tests
IEC 61000-4-2	Electromagnetic compatibility Part 4: Testing and measuring techniques Section 2 : Electrostatic discharge immunity test
IEC 61000-4-3	Electromagnetic compatibility Part 4:- Testing and measuring techniques Section 3 : Radiated radio frequency electromagnetic field - immunity test
IEC 61000-4-4	Electromagnetic compatibility Part 4: Testing and measuring techniques Section 4 : Electrical fast transient/burst immunity test
IEC 61000-4-5	Electromagnetic compatibility Part 4: Testing and measuring techniques Section 5 : Surge immunity test
IEC 61000-4-6	Electromagnetic compatibility Part 4 : Testing and measuring techniques Section 6 : <i>Immunity to</i> conducted disturbances, induced by radio frequency fields
IEC 61000-4-7	Electromagnetic compatibility Part 4: Testing and measuring techniques Section 7 : General guide on harmonics and inter harmonics measurements and instrumentation, for power supply systems and equipment connected thereto

IEC 61000-4-8	Electromagnetic compatibility Part 4: Testing and measuring techniques Section 8 : Power frequency magnetic fields immunity test
IEC 61000-4-9	Electromagnetic compatibility Part 4 : Testing and measuring techniques Section 9 : Pulse magnetic field immunity test
IEC 61000-4-10	Electromagnetic compatibility Part 4 : Testing and measuring techniques Section 10 : Damped oscillatory magnetic field immunity test
IEC 61000-4-11	Electromagnetic compatibility Part 4: Testing and measuring techniques Section 11 : Voltage dips, short interruptions and voltage variations immunity test
IEC 61000-4-12	Electromagnetic compatibility Part 4 : Testing and measuring techniques Section 12 : Oscillatory waves immunity test
IEC 61000-4-15	Electromagnetic compatibility Part 4: Testing and measuring techniques Section 15 flicker meter – functional and design specification
IEC 61000-4-16	Electromagnetic compatibility Part 4-16: Testing and measuring techniques – test for immunity to conducted, common mode disturbances in the frequency range 0Hz to 150kHz
IEC 61000-4-24	Electromagnetic compatibility Part 4 : Testing and measuring techniques Section 24 Test methods for protective devices for HEMP conducted disturbance
IEC 61000-5-1	Electromagnetic compatibility Part 5: Installation and mitigation guidelines Section 1 : General considerations
IEC 61000-5-2	Electromagnetic compatibility Part 5 : Installation and mitigation guidelines Section 2 : Earth and cabling
IEC 61000-5-5	Electromagnetic compatibility Part 5 : Installation and mitigation guidelines Section 5 Specification of protective devices for HEMP conducted disturbance

6.16 Contractor responsibilities:

Contractor's responsibilities shall include but not be limited to:

- a) Provision and maintenance in good condition sufficient tools, mechanical equipment and apparatus necessary to complete the work within the agreed schedule.
- b) Transporting and storage in safe and satisfactory condition all materials brought to their depot.
- c) Provision of temporary 415 V, 3-phase AC power for construction and testing
- d) Provision of temporary water supply

6.17 Works excluded from the scope of the Contract:

- 6.17.1 Civil Engineering Works pertaining to cable galleries, underground switching/sectioning posts are excluded from this Contract as the same form a part of the Civil Engineering Contracts. The optimum space requirements shall be furnished to the designated Civil Contractors, however, in order to have minimum impact on the existing Civil Engineering design, efforts shall be made to accommodate the above installations in the room sizes already firmed up switching rooms. Access for replacement of equipment and for personnel shall be ensured through interfacing with the designated Civil Contractors.
- 6.17.2 All Civil Engineering construction works including building E&M services at underground switching/sectioning posts rooms, and cable galleries connecting SP and SS to train tunnel are excluded. These shall form part of Civil & E&M Contract. Earth mat at underground traction switching posts shall also be done by designated Civil Contractors to the design requirement of the Contractor.

6.18 Compliance with Directives:

All works shall comply with directives and requirements mentioned below:

- 6.18.1 Compliance with electromagnetic compatibility as per requirements of this Specification.
- 6.18.2 Development and implementation of a Quality Management Plan. This is detailed out in Chapter 14 of this Specification
- 6.18.3 Preparation and finalization of schematic general arrangement, detailed construction drawings through to "As-Built drawings". This is detailed out in chapter 20 of this Specification.
- 6.18.4 Training and transfer of technology needs shall be complied with as indicated in Chapter - 19 of this Specification
- 6.18.5 Interface co-ordination shall be maintained with other Contractors and agencies as detailed out in Chapter 13 of this Specification.
- 6.18.6 Spare parts, special tools and test equipment shall comply as indicated in chapter 18 of this Specification.
- 6.18.7 Packing, shipping and delivery shall comply with stipulations of Chapter 15 of this Specification.
- 6.18.8 The scope of work shall cover all optional items as stipulated in this Contract.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 7

DESIGN CRITERIA AND PERFORMANCE SPECIFICATION FOR SWITCHING STATIONS

7 DESIGN CRITERIA AND PERFORMANCE SPECIFICATION – SWITCHING STATIONS

7.1 Design Criteria and Performance Specification: Traction Supply Equipment.

7.1.1 The Traction Supply Equipment includes:

- Circuit Breakers.
- Interrupters
- Motorised Isolators
- Instrument transformers.
- Other items such as connectors, cables, etc.

7.1.2 Governing specification of 25 kV AC traction equipment are summarised as under.

Table – Governing Specifications.

Sl. No.	Equipment	Governing Specifications
1	25 kV Circuit Breaker	EN 50152, EN 50124-1, IEC-62771
2	25 kV Interrupters	IEC 60694, EN 50152, EN 50124-1, IEC-62271
3	25 kV Gas Insulated Switchgear (GIS)	IEC 60298, IEC 60694& IEC 60129, IEC-62271
4	Earthing of Substation	As per IEEE 80 with latest amendments.
5	110 Volt tubular lead-acid, stationary compact, maintenance free batteries of adequate capacity for 10 hours discharged duration	IEC 622
6	110 Volt dc Battery Charger for the above batteries.	IEC 146
7	Cable specifications	Please see chapter 8

7.1.3 27.5 kV Switchgear (Circuit Breakers, Interrupters).

The incoming 27.5 kV switchgear shall be GIS Type (Indoor).

The switchgear shall be designed to work under indoor conditions as specified. Broad parameters are furnished in Annexure A.

Small part steel work shall be either of stainless steel or hot dip galvanized.

7.1.3.1 Earthing

All non live metal parts shall be connected to the earth be corrosion protected and labeled in conformity with the IEC standard 617-2.

7.1.3.2 Paint Work

Painting should be suitable for corrosive atmosphere, and to comply with IEC 60 721-2 & 5

7.1.3.3 Interrupters & Motorised Isolator shall be GIS Type.

All Interrupters & Motorised Isolator shall follow the same electrical and mechanical characteristics and must be in accordance with EN 50152, EN 50124-1, and IEC 56 with latest modifications.

7.1.4 25 kV Isolators

Each Isolator shall be GIS type and shall be proven design.

- Electric operation where required and manual operating capability
- Locking and interlocking devices
- Open / Closed auxiliary contacts

All isolators shall follow the same electrical and mechanical characteristics and must be in accordance with IEC standards.

25kV GIS shall be suitable to accommodate number of Copper 240 Sq mm cables (as per approved design)in each panel.

7.1.4.1 Not used**7.1.4.2 Operating Mechanism**

The operating mechanism for CB shall be motor operated spring type and shall be able to withstand 10,000 operations without any maintenance except periodic grease applications.

7.1.5 The broad parameters of these equipment have been indicated at Annexure 'A'.**Annexure 'A'****25 KV GAS INSULATED SWITCHGEAR (GIS)**

Standards	Unit	IEC 60298, IEC 60694& IEC 60129,IEC 62271
Bus bar		Copper
Service Voltage		25kV
Maximum Service Voltage		27.5kV
Rated Voltage		52kV
Frequency		50 Hz \pm 5 %
Rated AC Withstand Voltage		95 kV

Standards	Unit	IEC 60298, IEC 60694& IEC 60129, IEC 62271
Rated lightning-peak withstand voltage		200 kV
Continuous current rating		
For line CBs and OHE feeder CBs as per scheme provided		2000 A
For other CBs (link CBs, CBs of SPs) as per scheme provided		1200 A at 45° C 1250 A at 40° C
Rated peak current		40 kA
Short time current rating		16 kA for 3 sec
Overload current rating		3200A for 5 minutes 2400A for 10 minutes
Degree of protection of Gas Compartment		IP 64
Degree of protection for drive cabinet		IP 3X
Degree of protection for low voltage cabinet		IP 3X
No. of switching cycles at rated service current		10000 Cycles
Type of Circuit Breaker		Vacuum
Auxiliary voltage for closing coil, tripping coil, spring charge motor		110 V DC
Metal enclosure Bus bar Chamber Cubicle		Stainless Steel Sheet metal/Powder coated
Loss of Gas		< 1% per annum. Gas Charging equipment to be supplied
Rated short circuit current switching cycles		100 cycles at 16 kA
Sequence on short circuit		CO-15 sec-CO
Maximum closing time	ms	100
Maximum opening time	ms	70

Standards	Unit	IEC 60298, IEC 60694& IEC 60129,IEC 62271
No of Pole		1

Note:-

- One set of SF6 Gas Evacuation, Refilling kit as per latest specification should be provided. Number of cylinders depending upon the quantity of complete evacuation of SF6 gas from GIS should also be provided in spares. Specification and other details of the SF6 gas charging-discharging kit should be selected in confirmation to the GIS equipment manufacturer. Approval from the engineer should be taken before procurement of the same.
- Clear visual indications of isolator and earthing switch.
- Each Switching Station Post shall have Marshalling box which shall be provided by the JP/EW/1B/E2 contractor to act as interface for SCADA system. The Marshalling Box shall provide all the necessary input signal connections, including those from analog meters, from field equipment and the output signal connections to the field equipment for SCADA. In addition, the Marshalling Box shall provide for the necessary connection from/to the RTU's. The Marshalling box shall provide facilities for interconnection between the signals to/from RTU and signals from/to the field units.
- The connection between the Marshalling box terminals and the field equipment terminals, Marshalling box terminals and the RTU and interconnection between the terminal blocks of the Marshalling Box via copper cables, shall be made by the JP/EW/1B/E2 Contractor. The JP/EW/1B/E2 Contractor shall tag the either end/ of the cable with proper notification.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 8

DESIGN CRITERIA AND PERFORMANCE SPECIFICATION CABLING AND CONTROL SYSTEM

8 DESIGN CRITERIA AND PERFORMANCE SPECIFICATION –SWITCHGEAR, CABLING, PROTECTION & CONTROL SYSTEM.

8.1 Scope of Works

8.1.1 The scope of work under this chapter includes, complete design, supply, delivery at site, installation, testing and commissioning of, but not limited to, following:

Specifications for following equipment are covered in this Chapter

- i) 25 kV ac traction switchgear
- ii) Complete ac and dc Control source and systems.
- iii) Single core 25 kV cable, Return current cable to feed the traction power to OCS inside the tunnel as per design requirements.

8.2 Cabling System

8.2.1 General

8.2.1.1 The cabling system includes supply, laying, jointing and terminations of 25 kV ac traction and return current and 415 V auxiliary supply cables, Control cables, earth bus return current conductors etc. Types and sizes of cables are given below in Table 8.2-1

Voltage		Duty	Core material and size (sq mm)	Number of cores	Brief description	Remarks
Nominal (kV)	Max.(kV)					
25 ac For laying underground tunnel	52.5 ac	Traction power	Copper 240	Single core	Halogen free FRLS outer sheath XLPE insulated	For extending power from TSS to Feeding Post and for jumpering and other uses inside the tunnel and cable galleries.
25 ac return current	1.1 / 3.3 as required	Traction power	Copper 240	Single core	Halogen free FRLS outer sheath XLPE insulated	For bonding in tunnels and other uses inside the tunnel and cable galleries.
0.415 ac	1.1 ac	Power	Copper, sizes as required	4	Halogen free FRLS outer and inner sheath, Armoured, XLPE insulated	Auxiliary supply from U/G SP and SS

Voltage		Duty	Core material and size (sq mm)	Number of cores	Brief description	Remarks
Nominal (kV)	Max.(kV)					
0.240 ac	1.1 ac	Power	Copper, sizes as required	2	Halogen free FRLS outer and inner sheath, Armoured, XLPE insulated	Auxiliary supply to equipment in U/G sections
0.240ac	0.65 ac	Control	Copper, sizes as required	As per the requirement	Halogen free FRLS outer and inner sheath, Armoured Screened XLPE insulated	For Control and monitoring use

8.2.1.2 Not used

8.2.1.3 The contractor shall use a colour code scheme for different voltage grade cables after the receipt of letter of no objection from Engineer.

8.2.1.4 a) The cabling system shall meet the requirements of

Standards / specification given below and other relevant specifications:

IS- 7098 part- I, II, III, 8130, 5831, 3975, 1255, 1554, 5216, 10810(Pt-41), 10810(Pt-58), 209, 10418, 10462(Pt I), 10810(Pt-61), 10810(Pt-62)

BS 6121, 5468

IEC 38, 228, 540, 287, 332, 60502, 548, 811, 821, 60840

b) The cable design and installation shall also generally comply with local codes, regulations and standards viz.,

Central Electricity Authority Regulations (CEA)2010 as amended from time to time.

Regulations laid down by the electrical Inspector.

Regulations of the Electricity supply Authority, i.e. DISCOM/ TRANSCO etc.

Fire safety Regulations of the National Building code.

NFPA 130 2010 on Fixed Guide way Transit Systems.

NFPA 70E on Recommended Practice for Electrical Equipment Maintenance.

c) XLPE insulation, flame retardant, low-smoke, halogen-free (LSOH) shall meet the following requirements:

The flame propagating criteria of IEEE Standard 383 with a minimum test short circuit time of five (5) minutes.

IEC 332 Part 1 and IEC 332 Part 3 tests on single and bunched cables under fire conditions (category C).

Limiting Oxygen Index of at least 30 to ASTM D 2863.

A temperature index (TI) of 260°C to ASTM D 2863.

All insulation shall be moisture and heat resistant, with temperature ratings appropriate to the application conditions and in no case lower than 90°C

Compounds of additives to the cable over sheath for anti-termite resistance shall comply with Internationally acceptable Regulations.

Environmental designed life span of cables shall not be less than 30 years.

Test of gases evolved during combustion of electric cables by measuring the pH and conductivity in accordance with IEC 754 part 2.

Measurement of smoke density of electric cables in accordance with IEC 61034. Smoke Density maximum 30 % as per ASTM D 2843.

Cables constructed with FRLS properties should have Smoke Density maximum 50 % as per ASTM D 2843.

- d) The above requirements shall be met without compromising mechanical and electrical properties of the cables both during and after installation and other requirements of the specification.

The Contractor shall submit a certified test report for low-smoke halogen-free and anti-termite materials to be used in the manufacture of cables. These tests shall be in accordance with international standards / specifications.

The Contractor shall submit a certified test report each for flame-retardant tests on cables and for physical properties of materials to be used.

- e) The entire work of cable laying of power, traction, control, etc. shall ensure that EMI as a result of 25 kV ac single phase traction does not deteriorate the performance of installation nor cause danger to equipment and personnel. Details have been given in Chapter 6.

8.2.1.4.3 **25 KV TRACTION CABLES**

- 25kV cable connections at all locations of FP, SSP, SP & SS Interrupters and Isolating Switches.

8.2.1.4.3.1 Cable Characteristics

25 kV cable shall be dry-insulated, radial-field, based on proven technology.

8.2.1.4.3.1.1 25 kV cables construction

The cable shall be insulated with chemically cross-linked polyethylene, with semi-conducting screen over a copper conducting core, and insulating envelope and (a) polyvinyl chloride protective sheath-for the cables to be laid outside the tunnel (b) low smoke zero halogen fire retarding protective sheath-for the cables to be used inside the tunnel.

- Operating voltage: 27.5 kV,
- Specified voltage: 52 kV (according to IEC 840),

- Conductors: copper with 240 mm² for all applications. No. of cables in parallel shall be proposed during detail design stage for approval of Engineer.
- The short circuit rating of conductor and screen should be 14 KA for 3 seconds

8.2.1.4.3.1.2 Characteristics

- **Conducting Core**
The conducting core shall be made of bare annealed copper, according to class 2 per publication IEC 60228.
- **Core Screen**
The screen placed over the core shall consist of extruded covering of semi-conducting material.
- **Insulating Envelope**
The insulating envelope shall consist of extruded solid dielectric, made of chemically cross-linked polyethylene (Triple extrusion process). Its nominal thickness and tolerances shall comply with the requirements set forth in standard IEC 60502-2.
- **Insulating Envelope Screen**
The screen placed over the insulating envelope shall consist of a non-metallic semi-conducting part, associated to a metallic part.

The non-metallic part, consisting of a semi-conducting material, will be easily separable from the insulant in order to facilitate cleaning of the latter.

This semi-conducting material will constitute a mat to protect the insulant from expansion strains.

The metallic part applied over the semi-conducting part will consist of stranded wire with copper tape.

Suitable Armouring should be provided for mechanical protection.
- **Outer Protective Sheath**
Anti-corrosion outer protective sheath shall be provided. The nominal thickness of this sheath shall be determined according to the requirements set forth in standard IEC 60502-1

The protective sheath will carry the indications listed below, in letters and digits:-
 - designation of ownership,
 - nature and cross-sectional area of conductors,
 - specified cable voltage,
 - phase numbering,
 - manufacturer's name.

8.2.1.4.3.1.3 Connecting Junctions

Connecting junctions shall reconstitute perfectly all elements of the 25kV cables, so as to obtain electrical and mechanical characteristics at least equal to those of the cable.

The Contractor will submit to the Engineer, for approval, a detailed description of the technique foreseen for execution of connections in MV lines.

However, maintenance and repair being able to be carried out only during a short period of time, at night, due consideration shall be given to connection processes having the following characteristics, quality being otherwise equal:

- Quickness of execution,
- Possibility of replacement without having to disturb the cable,
- Small bulk.

RETURN CURRENT CABLES

- Each feeder will consist of two nos. phase cable (25 kV) and two nos. Return Cable (3.3kV).
- The 3.3kV cable shall be 1.9/3.3 kV grade, single core, 240 sq. mm stranded copper conductor XLPE insulated copper wired screen, tape armouring, FRLS/ FRLSOH sheathed cables. It shall conform to IEC 60502-1 latest for construction and for testing. The nominal thickness of insulation for 3.3kV cables shall not be less than 2.0 mm. As per IEC 60502-1. Construction details as per 25kV cables should be followed as per specification. Fault level for copper wire screen should be considered minimum 1 KA for 3 Seconds based on their detailed design.

8.2.1.4.4 **415V AC Power Cable**

8.2.1.4.4.1 General

The Contractor shall design, manufacture, supply, install, test and commission 415V, single core, circular, compacted stranded copper conductor, cross-linked polyethylene insulated thermosetting compound over sheath power cable and accessories.

The power cables shall be designed and constructed in accordance with the most up-to-date experience for a system of this voltage level and shall incorporate the latest improvements of design and manufacture for the type of cable required was currently employed in the industry.

8.2.1.4.4.2 System Earthing

The low voltage system on which the cables are used shall have its neutral earthed at the main LV switchboard.

8.2.1.4.4.3 Rating

The cable shall be rated in accordance with the following ratings:

- a) Rated voltage : 1.1kV (as per IS 7098 part-1)
- b) Rated frequency : 50Hz
- c) The numbers of cables installed for each circuit shall be based on the rating of equipment and taking into consideration of the following:

Installation method

- (i) Horizontally touching one another.
- (ii) In cast-in pipes

8.2.1.4.4.4 Cable Construction

The conductor shall be of Class 2 annealed circular, sector compacted, stranded, plain copper type and complying with Clause 4.2 of IEC 228.

8.2.1.4.4.5 Insulation

The insulation shall be of cross-linked polyethylene (XLPE) type and complying with the relevant test requirements specified in IS7098. The insulation shall have a high degree of cross-linking, free from contaminants and voids, good heat resistant and shall be treated by the extrusion process.

The XLPE insulation shall be suitable for use on power cables in wet and dry conditions at temperatures not exceeding 90°C for normal operation and 130°C for emergency overload condition.

The nominal thickness of the XLPE insulation shall be determined by the test method specified in IS. The average thickness of insulation shall not be less than the nominal thickness.

8.2.1.4.4.6 Over sheath

The over sheath shall be of a layer of extruded thermosetting compound that meets the requirement stipulated in Clause 8.1.2.4 c). It shall be extruded over the insulated core. The sheath shall also be compatible with the operating temperature of the cable. The over sheath shall incorporate and approved anti-termite mixture. The anti-termite mixture shall not be soluble in water.

8.2.1.4.5 **CONTROL CABLE**

8.2.1.4.5.1 The Contractor shall design, manufacture, supply, install, test and commission all control cables as specified.

8.2.1.4.5.2 All cables shall be provided with identification labels at both ends. The Contractor shall install the cables in accordance with relevant Indian/International Standards. The cables shall be installed on cable trays, in ducts or clipped to ceiling and wall. All spare control cables inclusive of pilot cables shall be properly labelled and terminated onto terminal blocks of the equipment.

8.2.1.4.5.3 Conductor

The conductor shall be circular stranded or compact stranded conductor composed of annealed copper wires complying with IEC 228.

8.2.1.4.5.4 Insulation

The conductor shall be insulated with extruded XLPE complying with IS 7098 part-1. Suitable separator tape or tapes may be applied over the conductor.

8.2.1.4.5.5 Core Identification

The cores shall be identified by various coloring/numbering systems with the acceptance of the Engineer.

8.2.1.4.5.6 Stranding of Multi-core Cables

The required number of cores shall be stranded with jute or other suitable materials fillers in round shape. A low smoke and halogen free tape shall be applied.

8.2.1.4.5.7 Inner Sheath

Extruded black low-smoke, halogen-free and anti-termite compound sheathing complying with Clause 8.2.1.4 c) shall be provided.

8.2.1.4.5.8 Bedding

The bedding shall be wrapped with low smoke, halogen free tape material.

8.2.1.4.5.9 Armouring

Two steel tapes shall be applied helical in the same direction over the tape bedding. The outer tape shall be approximately centered over the spaces between the convolutions of the inner stall tape.

Outer Sheath

Extruded black low-smoke, halogen-free and anti-termite compound sheath complying with Clause 8.2.1.4 c) shall be provide. The anti –termite mixture shall be of an approved make and shall not be soluble in water.

8.2.1.5 **Cables Routes and Installations**

The route plan, spacing of cables and method of laying shall ensure their safety, ease of inspection and renewal and minimum de-rating of power cables. The cables from RSS (TSS) to Feeding post shall be laid in the underground cable trench and sufficient space shall be provided in the trench to accommodate the cable for the ASS, pilot wire and for Signalling etc. The contractor need to interface will all the concerned system wide contractor for the same. Permanent route and straight through joint markers shall be provided on the route. Details to be submitted for review and approval by the Engineer.

8.2.1.6 General

All cable ends shall be provided with high strength, silicone rubber type identification labels and all control cable terminals shall be provided with non-metallic, non-flammable and durable sleeve type identification ferrules.

The identification labels shall be provided at eye level from the substation floor and shaft base and at each position where cables change direction. For cases where groups of cables are routed, cable identification labels shall be provided at not exceeding 10m interval.

The cable identification labels shall remain legible and not suffer degradation from weathering throughout the specified life of the equipment. All cable identification labels shall be subject to review by the Engineer.

All cables in the tunnels shall be tightened with tie clamps spread over an equal distance. The material of cable clamps and cable ties shall be subject to the review by the Engineer.

8.2.1.7 The underground cable gallery will be separated from other rooms by 3 hours fire-rated walls. All penetrations through these walls shall be sealed with fire-rated materials with waterproof properties. Details of proposed type of material to be submitted for review by

Engineer. The entire design jointly prepared with Civil Contractor shall be subjected to the review by the Engineer.

- 8.2.1.8 The Contractor shall be fully responsible for all civil works (such as drilling on cable basement walls, floor openings or wall openings) deemed necessary for the installation of the complete cabling works in the substations. The Contractor shall ensure that the floor openings, wall openings, cable openings, trunking and conduits used for his cabling works shall be sealed with water proof fire retardant material of the same rating as the fire compartment wall or floor. The ceiling compound shall be non-toxic (not harmful) and the chemical be chemically inert when in contact with cables and the associated equipments.
- 8.2.1.9 The cable hangers in sub-stations shall be supplied and installed by the Contractor. This will require close interface with the Civil Contractors. For tunnels, cable galleries and stations, all hangers, inserts, nuts and bolts and accessories will be supplied by the Contractor in accordance with interface specifications with Contractors.

8.2.1.10 Cable terminations

The cable lugs shall be compression type. Cable connector shall be of silver plated or tinned plated copper. The bolts and nuts shall be zinc plated or of stainless steel. Heat shrinkable sleeve shall be provided over the exposed conductor below the cable lug. Lock washers shall be installed under each bolt head and under each nut. The cable lug or cable connector shall have two 360 indentations. Cable lugs and connectors shall have 2-hole or 4-hole tongues.

JOINTS AND TERMINATIONS OF 25kV/ 3.3KV CABLES

Joints and termination for cables (FRLS / FRLSOH) shall be carried out as per best engineering practices by qualified persons only. The location of joints should be marked with details of location in the as built drawings.

The terminations for 25 KV cables (AIS/GIS) should be provided with adequate safety and clearance in tunnel and equipments. All supporting structures shall be provided with proper safety margin in design. For 25kV terminations in tunnels the terminations, cables and its accessories should be adequately supported considering the safe clearances from Rolling Stock.

8.2.2 **LT Cables**

8.2.2.1 LT cables include 415 V, 3 phase ac, 240V ac and 110V dc auxiliary supply cables, control cables.

8.2.2.2 Auxiliary supply from the panel to various equipment shall be through copper cable of required size.

8.2.3 **Control Cables**

8.2.3.1 Multicore control cables used in substations shall be un-armoured. Those laid in cable gallery, cable ducts, cable trenches or in train tunnel shall be armoured unless they are provided with protective conduit for mechanical and fire safety requirements.

8.2.3.2 The above drawings have been included in Civil contract packages for reference of Civil Engineering contractors who will provide adequate space for run of various cables in stations, tunnels and where applicable as per the requirement given by the Contractor.

8.2.3.3 Other drawings forming part of Civil contracts, viz. Tunnel plan drawings, tunnel cross section drawings, alignment plan drawings, BCC / Administration building drawings, station plan and cross section drawings are given in the Employer's Drawings.

8.3 **Switchgear, Remote Control and Protection**

8.3.1 **25 kV Switchgear**

8.3.1.1 General

8.3.1.2 The characteristics and specification of 25 kV Switchgears have been furnished in Chapter 7.

8.4 **Control Module**

In general, control module shall include but not limited to the following:

8.4.1 The interlocking of power supply system shall not be limited to the requirement specified herein. The Contractor shall also comply with the interlocking requirements elsewhere in this specification. The Contractor shall ensure that inadvertent operation which will result in human injury or equipment damage is prohibited by the interlocking scheme. In general, the interlocking shall be achieved through redundant means such as:

- a) Programme logic
- b) Electrical circuits
- c) Mechanical key/ Pad lock etc.

8.4.2 The Contractor shall submit detailed proposal for the interlocking facilities for the review by the Engineer

8.5 Not used

8.6 **Protection Relay Module**

8.6.1 General requirement

Each PCU shall be integrated with a protection relay module within which standard protective relay features are incorporated. The protection system to be designed for busbars, feeders and other equipment shall comply with IEC 255 or BS 142. The

application, performance and testing of protection relay modules shall be in accordance with the appropriate IEC standards.

All protection relay modules shall comply in accordance with the following IEC test requirements:

- a) Dielectric test voltage (IEC 255-5) 2.0kV, 50Hz, 1min
- b) Impulse test voltage (IEC 255-5) 5kV, 1.2/50ms, 0.5J
- c) High frequency disturbance test (IEC 255-22-1 Class III)
 - i) Common mode 2.5kV, 1MHz, 2s
 - ii) Differential mode 1.0kV, 1MHz, 2s
- d) Electrostatic discharge test (IEC 255-22-2 and IEC 61000-2 Class IV)
 - i) Air discharge 15kV
 - ii) Contact discharge 8kV
- e) Fast transient (IEC 255-22-4 Class IV)
 - i) Power supply inputs 4kV
 - ii) Other inputs 2kV
- f) Magnetic field (IEC 61000-4-8) 400A/m
- g) Electromagnetic field test (IEC 61000-3 Class III) 10V/m 150kHz to 1000MHz

The protective relay modules shall be microprocessor based numerical type with continuous monitoring and self-diagnostic features to identify faulty modules or components. The protective scheme shall be so designed that the system remains stable during switching operation and other disturbances.

In the event of a system fault, the protection module shall be able to record values of a minimum latest five cycles with time stamping such as phase currents and earth fault current. The fault data shall be captured and displayed at the PCU's digital display and at the remote OCC. The system should remain disabled until manual reset/ acknowledgement is done at the local or at the remote OCC. The local manual reset shall be capable of being reset without the necessity of opening the front cover.

The DC trip supply for the circuit breaker shall continuously be monitored by the individual protection relay module within the PCU.

In cases where two or more phase elements are included in one protection module, identification of each element shall be provided.

8.6.2 Types of Protection Relay Modules

The protection relay modules shall include all the protection requirements. The protection requirements shall comply with the latest IEC standards. The protection schema shall include as required for Traction power supply circuits, relaying out of following types:

8.6.2.1 Protections - common type for all circuits:

- a) Over current Protection

Over current with high set instantaneous tripping module shall operate with selectable characteristic such as definite time or normal inverse, very inverse, extremely inverse

and long-time of the four inverse time (IDMT) type characteristics as specified in IEC 255 and BS 142. The current and time setting shall be variable continuously over the range.

b) Busbar Protection

If the detailed system analysis requires provision of busbar differential protection at a substation, the same shall be provided having one zone per busbar section with overlapped protective zones. The details of this protection scheme, wherever applicable, shall be subject to review by the Employer's Representative.

The protection shall include a bus supervisory scheme for alarm monitoring at the OCC. In the event of an operation of the busbar protection, the pertinent fault data shall be displayed at the PCU and at OCC.

The busbar protection scheme shall be such that any secondary component failure shall not cause the operation of the busbar protection.

c) Trip Circuit Supervision (TCS)

Trip circuit supervision protection shall be provided to continuously supervise the integrity of each circuit breaker tripping circuit with the circuit breaker in the open or close position, and shall initiate an alarm in the event of the following fault conditions:

- i) Loss of control supply.
- ii) An open circuit in trip circuit
- iii) A fail-to-trip condition after closing of a trip contact

Such trip circuit supervisory protection signals shall be interfaced with the respective PCUs for the supervisory operations. The alarm shall be time-delayed to prevent it operating during momentary dips in the DC supply voltage, or when the circuit breaker is opening.

d) Hand Reset Lockout Protection

Hand reset lockout protection in each switchgear bay shall be provided to prevent re-closing of breaker following operation of certain protection relay circuits, e.g. differential or pilot wire, earth (ground) fault and second level over temperature of transformer or line test lock out of CB. Such hand reset lockout protection shall also be interfaced with the PCUs for the necessary functions.

8.6.2.2 Protection – for OCS and traction power circuit, and CBs at TSS:

- 25 kV feeder protection including OHE protection
- Line pilot wire Differential protection for 25KV feeders

25 kV OCS protection the principal and feature of the protection shall be as described below:

a) **Bus bar**

The protection shall consist of :

F 50: Instantaneous over current protection

F 51: Time delayed over current protection

F50 N: Instantaneous earth fault protection (homopolar)

F51 N: Time delayed earth fault protection (homopolar)

Each portion of OCS fed by a circuit breaker is called "sector".

Each sector is sub-sectioned into elementary sections (catenary section between two breaking apparatus).

The sectors of same direction are put in parallel at the level of the paralleling station through interrupters.

The entire fault on:

the catenary network, together with the switchgear directly connected thereto,

the rolling stock (upstream the circuit breakers),

the paralleling stations (bus-bars, switchgear,),

are detected and protected by the circuit breakers of the feeder station according to the following sequence:

a fault is detected by the two protection devices (minimum Z and Over current) of the same direction through the paralleling,

the related two circuit breakers are switched off,

the fault localisation system is put into service (operation is described later),

the paralleling interrupters open due to the lack of power on the two tracks after a temporisation of about 500 ms,

The re-closing order is given to circuit breaker within about 7 seconds,

If the fault remains (10% of the cases):

- the circuit breaker of the faulty sector trips and this is blocked open for 12 mn,
- the fault locator determines the faulty elementary section
- the circuit breaker for the healthy sector switches on.

If the fault is transient (90% of the cases):

the 2 circuits breakers re-close, the paralleling interrupters close following the energising of the two sectors, after a temporisation of approximately 1 mn.

b) Minimum impedance protection

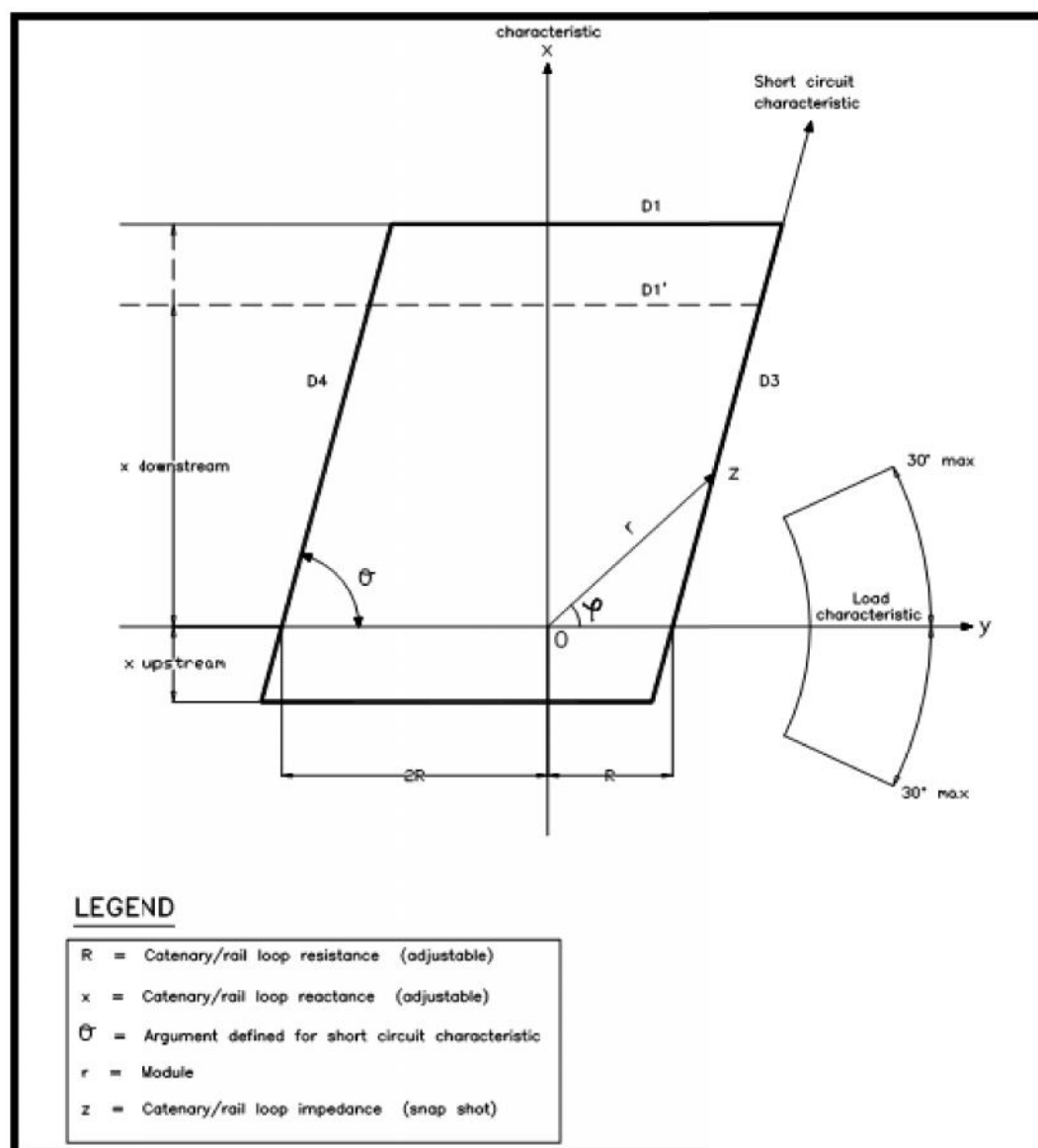
This module is a single-phase impedance measuring (in R-X co-ordinates) relay, which operates when the impedance value falls below a selected adjustment threshold.

The minimum impedance module defines the quadrilateral characteristic by fixing the straight lines D1, D2, D3 and D4.

The possibilities of adjusting the various elements of the parallelogram enable it to be adapted to various network conditions.

This protection is directional and selective; it makes a distinction between a high load and a distant fault of small intensity.

The minimum impedance protection is self-supervised and an internal fault in the protection entails the tripping of the associated circuit-breaker.



c) Over current protection

An over-current protection is designed to detect faults occurring very close to the feeder station.

This protection causes the tripping of the circuit breaker when the current reaches a value exceeding the highest load on the network.

Two stages of operation are foreseen:

an instant one,

a time-delayed one.

The tripping curves shall be of two types:

constant over time,

if necessary, dependent over time, following an inverse, highly inverse or extremely inverse characteristic.

Selectivity of protections

Selectivity calculation shall be based on the second-stage time-outs of over-current protections.

As a rule, for a 25 kV fault, it shall be admitted that the time-out must be minimum but not nil to avoid tripping on a transient current or a load transfer.

Therefore, HV protections shall be calculated with a longer timing, which remains below the power supplier line protection set values.

d) Other protections

These protections shall mainly concerned with the monitoring of the state and operation of:

- SF6 gas pressures of HV and 25 kV circuit breakers if any,
- non availability of auxiliary supply (d.c.).

Two stages are involved:

- the first one is an alarm,
- the second one causes tripping (except for the SF6 gas pressure which entails blocking) of the equipment concerned.

e) Protection back up

Protections have a direct action on the tripping gear of circuit breakers for which information must flow to OCC.

In case a protection is inoperative, a tripping order shall be sent to the higher-level circuit breaker via the local supervision after time delay (except for the power supplier HV circuit breakers).

f) Protection scheme for emergency traction feed from other line – at the interchange stations or at other location as specified shall be possible. The protection scheme shall cover such emergency feed arrangement satisfactorily.

8.7 Not Used

8.8 Fault-Diagnostic Facilities

8.8.1 Full built-in tests (BIT) shall be incorporated in PCU system. The BIT shall test all hardware, software and interfaces of the systems. The BIT shall enable the operator/maintenance personnel to carry out trouble-shooting and maintenance of the system effectively.

8.8.2 Critical faults are defined as faults that will cause stoppage or major degradation of system performance. The protection and control system shall be designed to achieve a minimum of 99.99% fault detection capability of all critical faults using BIT. For critical faults not covered by BIT, the Contractor shall provide a list of these faults and explain how they can be readily detected by other means.

8.8.3 The scope of the BIT diagnostics shall include but not limited to the following:

a) Power-up test

This test shall be executed during system start-up. Every part of the system shall be tested to indicate the readiness of the system as a whole. It shall be activated at system cold start or upon operator request.

b) Background test

This BIT shall run continuously with background test during system operation. The purpose of this procedure is to alert the operator if a fault is found. In the running, the BIT shall update the status on the BIT-Page on the display, and it shall be intelligent enough to help the operator to perform off-line BIT effectively. This test shall at least cover line replaceable unit.

c) Off-line test

This BIT shall be activated when in-depth troubleshooting is required to diagnose the failure. This BIT shall be able to locate a faulty shop replaceable unit (SRU) card and allow the maintenance and troubleshooting to be carried out.

8.9 Testing Facility

Two notebook computers based on the latest generation hardware using high-speed processor with sufficient memory, colour display and licensed software shall be provided with all programme utilities and necessary interconnected cables required for testing, commissioning, simulating, programming and parameterisation of protection control system. The model and make of the computer (i.e. hardware and software) shall be subject to review by the Employer's Representative. These two notebook computers shall be connected to the PCU interface port to perform the following functions as a minimum:

- a) Configuration and parameterisation protection control system
- b) Load, read out of configuration data
- c) Control, interlocking, inter-tripping logic re-programming
- d) Relay simulation test
- e) Simulation of the control system
- f) Read out and display of protection control system diagnostic messages.

8.10 Not Used.

8.11 Not Used.

8.12 **AC/DC Control source system.**

8.12.1 **General**

8.12.1.1 AC/DC Control source system shall include maintenance free Tubular type Lead-Acid battery banks, battery chargers, AC/DC distribution boards and all other accessories.

8.12.1.2 Not Used

8.12.1.3 Stationary type battery shall be provided. The batteries shall be automatically float charged to maintain the optimum charge during normal operation while feeding the switchgear steady state control current requirements.

The control voltage range for all equipment shall be 70-140 V DC except for DC motors where the operating voltage range shall be 100-140 V DC

8.12.1.4 The total ampere-hour capacity of the battery bank shall be designed to provide, in the event of AC power or charger failure.

- a) Entire load requirement for the protection, indication control and monitoring of the entire equipment for a continuous duration of 4 hours for traction switching posts:
- b) Within the above-mentioned four hour period it shall be possible to perform the following operations successfully:
 - i) Each 25kV Circuit Breaker at least five tripping and five closings operations
 - ii) Each 25 kV interrupters.
 - iii) The batteries terminal voltage shall not be less than 90 V DC after the tripping for each of the 66 kV/33kV/25kV AC switchgear in the switch room at the end of the four hours period.
- c) The batteries shall be design to have the capacity to close 2 ac circuit breakers simultaneously. The basis of the ampere-hour capacity of the battery bank and other design calculations shall be submitted for review by the Engineer for each location. The Contractor shall be required to verify the performance by actual site tests.

8.12.2 **Battery specification**

This specification covers the methods of Design, Manufacture, assembly of components, testing at manufacturer's works, packing, supply and delivery to site, Tubular type lead-acid stationary batteries in Mono-block Poly Propylene container and associated accessories.

8.12.2.1 Applicable Standards (Latest revision)

BIS - 13369-1992

IS-1885: Electrical vocabulary, secondary cells and batteries

IS-1069: Water for storage batteries

IS-266: Sulphuric acid for storage batteries

IS-8320: General requirements for methods of tests for lead-acidStorage batteries.

IS-1146: Specification for rubber and plastics container for leadAcid storage batteries

IS-6071: Synthetic separator for lead acid batteries

8.12.2.2 Terminology

TYPE

The battery shall be Lead Acid Tubular type in Monoblock Poly Propylene container. The cells of the batteries shall be similar in type and shape. It requires regular topping and maintenance during life time of the battery. The batteries should preferably be of 12 volts.

ACCEPTANCE TEST

Tests carried out on samples selected from a lot for the purpose of verifying the acceptability of the lot

LOT

All batteries of the same type, design and rating manufactured by the same factory during the same period using same process and materials offered for inspection at a time shall constitute a lot.

ELECTROLYTE

Aqueous solution of Sulphuric acid for ionic conduction and electrochemical reaction during passage of current through a cell.

TERMINAL AND POSTS

A post of a cell or battery to which an internal electrical circuit is connected.

8.12.2.3 Design and Constructional features of Battery (Materials & Construction)

The cells of the batteries shall be similar in type and shape. The nomenclature shall be 12T100P, 12T130P etc.

Overall dimensions masses and capacity of 12V units.

Voltage V.	Capacity @ C10 rate Ah	Maximum Overall Dimension			Weight (Kg.) approx	
		Length	Width	Height	With Acid	Without Acid
12	100Ah	500mm	187mm	421mm	56.90 kg/ 29.80 kg	
12	130Ah	500mm	187mm	421mm	66.90 kg/ 40.60 kg	

These dimensions are subject to revision after receiving details from manufacturers. Dimension may be interchange.

Terminal Post and Connectors:

Positive and negative posts shall be clearly and unambiguously identifiable.

Positive Plates:

The plates shall be of first class material and workmanship and shall be free from blow-holes, cracks and other imperfections. The tubular positive plates shall consist of a suitable bar with spines cast of suitably alloyed lead to give adequate mechanical strength and minimum electrical resistance.

The tubular spines shall be cast of an alloy of Pb and Antimony with Antimony content not greater than 3% by weight. The casting shall be done using proper controlled procedure preferably using high pressure casting machine with an operating pressure not less than 90-100 Bars. Low antimony alloy (not greater than 3%) will ensure low water loss and a guaranteed topping up frequency of not more than once in 12-18 months. High pressure cast spines will ensure a long life and trouble-free operation. Porous, acid resistant and oxidation resistant tubes shall be inserted one over each spine. After insertion, the tube shall be adequately filled and packed with active material (preferable through a rotary shaking machine) before their lower ends are closed by common plastic bar. The construction and material of tube shall be such as to reduce the loss of active material and shall be able to withstand normal internal stresses developed during service.

Dimension of positive plates

	130 Ah	100 Ah
Height of positive plates -	244 mm	262 mm
Thickness of positive plates -	8.25 mm	8.25 mm
Area of positive plates -	336 sqcm	361 sqcm
No. of positive plates -	03	02

These dimensions are subject to revision after receiving details from manufacturers.

Negative Plates:

The negative plates shall be of flat pasted type and should be made of lead-calcium alloy. The pasting shall be done on an automated machine for better control of process parameters. It should have adequate mechanical strength and would be so designed that active material is maintained in intimate contact with the grid under normal working conditions throughout the life of the battery.

Dimension of negative plates

	130 Ah	100 Ah
Height of negative plates -	232 mm	259 mm
Thickness of negative plates -	4.57mm + 3.2 mm	3.2 mm
No. of negative plates -	02 Inter + 2 End	03
Area of negative plates -	329 sqcm	360 sqcm

These dimensions are subject to revision after receiving details from manufacturers.

Separators:

The separators shall be micro-porous polyethylene (PE) type to avoid direct as well as side shorts. Providing explosion vents and type of vent and filling plugs are explosion proof

Microporous ceramic made. It should be acid resistant, chemically inert and should have excellent oxidation resistance and high degree of porosity to ensure minimum internal resistance. Average volume porosity should be more than 45%. It should not exhibit any tendency to swell or shrink at temperature encountered during operation. Micro-porous separators shall conform to latest IS: 6071.

Containers:

Containers shall preferably be made of Poly Propylene giving outstanding chemical resistance, rigidity and toughness with very high insulating qualities which eliminate the need for separate cell insulators. Thickness of container is 03 mm. and material of container is PPCP. It shall have adequate mechanical strength, cracking etc. during the life span of battery when operating under expected temperature range and due to action of static and dynamic loads and the action of electrolyte. The containers shall conform to latest edition of IS-1146.

Cell Lids

It should be moulded from opaque Mono block Poly Propylene and sealed to the container. The cell lids shall be made of suitable polypropylene material for heat sealing. The material shall confirm to IS-1146

Micro-porous Ceramic Vent Plugs

The vent plugs should be specially designed incorporating a micro-porous ceramic filter which effectively returns all acid spray to the cell, but allow free exit of oxygen and hydrogen which is generated at the end of boost charging. On removal, the plugs shall permit drawing of the electrolyte sample for servicing and of checking of the electrolyte level. The vent plug should preferably is flame retardant type to prevent any fire hazard in the battery room.

Connectors and fasteners: (Flexible)

Connectors shall be made of copper and completely insulated with rubber/plastics. Connectors should be adequately designed to carry maximum duty cycle as specified and shall offer minimum resistance. Connectors shall be adequately designed to withstand various stresses due to temperature changes, attack of acid and dynamic forces that could occur during the operation of the battery .Fasteners should be made of copper, brass, stainless steel or any to prevent corrosion.

Electrolyte:

The electrolyte shall be battery grade sulphuric acid conforming to latest edition of relevant IS 266. The strength of the electrolyte in the cell during operation shall conform to the governing IS specification for the cell. Required quantity of electrolyte for the initial filling with 10% extra quantity shall be supplied in no-returnable non-degradable acid resistant strong plastic containers. IS-1069-1964.

Water:

Water used in preparation of electrolyte and also to bring the level of electrolyte to the correct position during the course of operation or testing shall conform to the latest edition of IS-1069.

Terminal Post:

Positive and negative terminal posts of the cells shall be clearly and unmistakably identifiable. Terminal posts shall be designed to accommodate external bolted connections conveniently and positively. All metal parts of the terminals shall be of lead coated type. Bolts, heads and nuts, except seal nuts, shall be hexagonal and shall be lead coated. Terminal posts shall be adequately fixed to prevent its turning or twisting when the connectors are being fixed or removed. The junction between terminal posts and cover and between the cover and container shall be adequately sealed to prevent any seepage of the electrolyte. All terminals shall be provided with insulated covers.

Ampere –Hour Rating:

The rating assigned to; the cell or battery shall be the capacity expressed in ampere hours (after correction to 27 degree C) stated by the manufacturer to be obtainable when the cell or battery is discharge at the 10 hr. rate to the end voltage of 1.80 volts per cell.

Capacity in AH at various duration of discharge and corresponding ECV

(Ah output) 130 Ah (Ah out put) 100 Ah

1 hour ECV. 1.75	61.5	47.5
3 hour ECV. 1.80	88	68
5 hour ECV. 1.80	102.5	79
10 hour ECV. 1.80	123	95
Maximum momentary current	240 Amp	185 Amp
For 1 min till 1.60 ECV		
Number of charging discharging	1200 cycles	1200cycles
Cycle at 80% Depth of discharge		
Expected life of battery under	8-10 years	8-10 years
Normal operation & maintenance Condition		

8.12.2.4 Service Condition

The battery is required to work at ambient temperatures up to 45 degree C.

8.12.2.5 General Requirements for Tests

Specific Gravity of Electrolyte:

The specific gravity of fully charged cells shall be adjusted to 1.240 +/- 0.005at 27°C.and at full charge 1.245+/- 0.005

Temperature Correction:

The capacity of the cell shall be corrected to 27°C using the proper temperature correction factor pertaining to the type of the cell and the rate of discharge. The temperature correction should be made using factors supplied by the manufacturer but shall generally conform to some national or international standard for the similar type of cell.

Variation of capacity with temperature

Discharge Rate	Factor for variation in capacity
	Per °C R
C10	0.43
C9	0.45
C8	0.47
C7	0.50
C6	0.54
C5	0.58
C4	0.62
C3	0.68
C2	0.76
C1	0.90

Note:- Capacity temperature correction is not a true linear relationship.

8.12.2.6 Tests:**Test for Capacity:**

The cell shall be tested for its rated capacity output. The fundamental requirement shall be a discharge for 10 hours whilst discharge at other rates, as decided mutually between the manufacturer and purchaser, May also be performed.

A fully charged cell shall be allowed to stand idle for a period of 12- 24 hours before performing this test. The cell shall be discharged at a constant current of $I_{10} = C/10$ where C is the rated 10 hour discharge capacity of the subject cell till the voltage of the cell reaches 1.80 volts per cell. In case of more than one cell being tested at a time (in most of the cases), the discharge to be discontinued at a time when the voltage of the group has reached $1.80 \times n$ volts where n is the number of cells in the group.

The capacity of the cell thus established shall have to be corrected for temperature variation during the test if the temperature is different from 27deg. C. The temperature correction shall be as per the relevant IS for the type of the cell in question.

The battery should be very robust construction and provide 1200 – 1500cycles of charge and discharge at 10 hour rate of discharge to 1.75 vpc with a service life of 8-10 years. Battery should also be quickly recharged at higher at higher current (within 06 hours) up to 2.75 VPC without affecting the performance. The ampere hour and watt hour efficiency should be more than 80%.

It should withstand high ambient temperatures up to 35°C constantly and 40°C intermittently without losing much of its service life.

The capacity output, at the first discharge, corrected to 27°C shall not be less than 85% of the rated capacity of the cell. The cell shall reach 100% of its rated capacity within 5 charge-discharge cycles.

Test for Charging Efficiency:

Since the cells are expected to operate at various state of charge (SOC), the charging efficiencies at various depth of discharge needs to be measured and standardized for this application. Typically, charge efficiencies at 80%, and 10% SOC are to be notified.

Charge Efficiency at 80% SOC:

A fully charged cell shall be discharged at a constant current of I10 for 2 hours.

The voltage at the end of 2 hours (V1) to be very meticulously noted. The cell, then, shall be charged at a constant current of I10 for 2 hours and after a rest period of 2-4 hours shall again be discharged at a constant current of I10. The time taken to reach the voltage V1 is to be noted during this discharge.

The ratio of these two times would be designated as the charge efficiency of the cell. The time of discharge shall change to 9 hours for 90% SOC. The rest procedure being similar to the one explained.

The cell appropriate for this application should have the following charging efficiencies:

80% SOC 80%

10% SOC 90%

Retention of Charge

The charge retention of a cell is the capability of the cell to retain its capacity during the period of no charge, i.e. when not connected to the system, during transportation or storage. A fully charged cell shall be discharged for capacity appreciation. The capacity output shall be noted as C1. After recharge the cell shall lie in open circuit condition for a period of 28 days. During this period, the temperature of the cell shall be kept close to 27° C as much as practically possible. After completion of 28 days of idle standing, a second capacity discharge is to be performed. The capacity, corrected to 27° C thus obtained, shall not be lower than 95% of the earlier actual capacity C1.

Water loss:

The cell/ battery after being fully charged shall be kept on a float charge of 2.4volts per cell at a temperature of 40 deg. C for 21 days at a stretch. The loss of water due to evaporation and self discharge shall not be more than 0.65 grams per Ah.

The battery shall reach an equilibrium state of charge within 72 hours of such charging. This shall be indicated by the float current after 72 hours of constant float. The float current shall not be more than 3 mA per Ah.

Battery Racks:

The battery racks shall be constructed from good quality of high strength good quality mild steel sections. These battery racks shall be painted by the bidder with two coats of acid/ alkali resistant paint of approved make. When steel stands are used, they should be painted with acid resistant grade. The racks shall be of Single tier/ two tier construction depending on the final layout based on space availability.

Marking:

Each cell shall be marked to meet the requirements of relevant Indian standards. In addition, each cell shall be legibly numbered serially to identify the cell during manufacture,

testing, installation and operation of battery to identify after having assembled into battery bank in battery racks. Following marking however, shall be provided

- a) Manufacturer's type and trade name
- b) Electrolyte level (min & max)
- c) Type of container and standard AH capacity as per IS
- d) Polarity marking as per relevant IS

A set of loose stickers shall be provided to mark the cells position in the assembled battery bank at site so that a cell removed for maintenance can be put back in original position.

8.12.2.7 Other information

- a) Battery system shall not be earthed. Battery connections shall be as short as possible using flat bus bolted to the terminals and shall be coated with clean electrolyte resistance Vaseline grease. All necessary inter-cell/unit connectors including insulated inter-row and inter-tier connectors provided shall be electrolyte resistant.
- b) A minimum 600mm space around the batteries shall be provided for ease of access and maintenance. The batteries shall be provided with a continuous voltage monitoring signal to be displayed at the local battery charger panel and at remote OCC. In addition an alarm 'battery voltage level low' shall be activated at the battery channel charger panel and at OCC if battery voltage falls below the pre-set level.
- c) Contractor may offer, for review by Employer's Representative, other types of batteries based on technical merit and whole life cycle cost.

8.12.3 Battery Charger

8.12.3.1 The Contractor shall provide automatic constant voltage and current limiting type of chargers for each 110V DC battery system suitable for float, rapid and boost charging of batteries and simultaneously supply continuous DC loads. The charger shall be compatible with the equipment requirement and shall perform according to specified requirements.

8.12.3.2 Two battery chargers shall be provided for each battery set, one being standby.

8.12.3.3 The charger shall operate from 3 phase 415V, 50 Hz. Supply

8.12.3.4 The charger shall be protected against low battery voltage, short circuit at the output by employing current limiting feature and reverse battery voltage.

8.12.3.5 The battery charger and its main components shall comply with relevant Indian standards.

8.12.4. Battery Discharging Kit

Automatic Battery Discharge kit

Discharge capacities :

Battery Voltage	Max. current
12V	50A
24V	110A
48V	110A
110V	110A
220V	55A
480V	55A

With Cable Set GA-00550
Transport Case GD-00054
With Standard accessories

8.12.5. CB Timing Kit

Electronic Time Interval Meter,
Channel : Maximum Eight in PIR mode.
Control of Breaker : Through 300V / 30 A SSRs Trip and close the connected CB
Output : 4 line 20 character backlit LCD, RS 232 C port for downloading data to PC
Printer : Inbuilt, thermal printer
Paper : Thermal, 55 mm wide roll
Test Lead : Set of 15m, wear resistant Test Cables
Range : 999 milliseconds maximum
Resolution : 1 millisecond
Measuring Accuracy : Value +/- 0.05% +/- 1 digit
Power : 230V AC +/- 15%, 50 Hz +/- 10%, 25 VA
with 15 meter test leads and downloading and analysis software

8.12.6. Power Analyser

General information :

The power analyser should provide complete solution, which includes the following components:

- a. Power quality analyzer and recorder.
- b. Device shall be suited for portable application.
- c. On-board recording of all channels waveforms continuously for at least 7 Days at fix sampling rate of [512] per cycle for voltage and [512] current
- d. Power Quality analysis software

Measurements : The device shall measure and report at least the following parameters:

A. Voltage:

Phase to neutral and phase to phase, for all three phases and neutral to ground. • Phase angles for each voltage relative to each other. • Cycle by cycle values • Average for 200 milliseconds as per IEC 61000-4-30 • Aggregation as per IEC 61000-4-30 • Flickers shall be measured and displayed in accordance to IEC 61000-4-15 (PLT, PST). • Fast flickering shall be measured and displayed for shorter periods. The minimum is • displaying short voltage flicker of 2 second and 1 minute.

B. Current:

Phase to neutral and phase to phase, for all three phases and neutral to ground. • Phase angles for each current relative to voltages. • Cycle by cycle values • Average for 200 milliseconds as per IEC 61000-4-30 • Aggregation as per IEC 61000-4-30 •

C. Power

Watts – total and per phase • VARs – total and per phase • VA – total and per phase • True Power Factor – total and per phase • Displacement Power Factor – total and per phase • Cycle by cycle values • Average for 200 milliseconds as per IEC 61000-4-30 • Aggregation as per IEC 61000-4-30 •

D. Frequency as per IEC 61000-4-30

- E. Energy Watt-hr received and delivered• VA-hr received and delivered• VAR-hr received and delivered• Power demand shall be calculated using a sliding window comprised of a configurable• amount of 1 second sub-intervals. The meters shall be supplied with preset to 15 minute intervals.

Recording

I. Parameters and Duration

- a. The device shall be capable of record all raw data (e.g. waveform) of its input channels continuously, using its native sampling rate (current: [512], Voltage: [512] samples per cycle) and accuracy, for a period of minimum 7 Days. The raw data (waveforms) shall be recorded.
- b. The recording shall be done automatically without the need to set triggers and/or thresholds

II. Storage

- a. The recorded data shall be kept on board on flash memory of 256 MB.
- b. The records in the device shall not be lost even if all voltage sources disappear for 7 Days.

III. Display

- a. The supplied software shall be able to retrieve every cycle of the network, according to user request, in any resolution and time period.
- b. The resolution shall be from 7 Days to one sample (i.e., 16 microseconds for 512 samples per cycle at 50 Hz network). The time period can be from 1 millisecond to few Days.
- c. There shall be no limit between the time period and resolution (e.g., it shall be possible to display data from 7 Days with 1 millisecond resolution). If the display doesn't have sufficient resolution, the software shall display the minimum, maximum and average for each displayable pixel.
- d. The supplied software shall be able to display all the electrical parameters that the device can measure, to any period and resolution from 1 cycle to few years.

Communication

- a. The device shall have the following ports: [01] Integral fast Ethernet ports with built-in router. One (1) integral PoE in (power Over Ethernet) port• RS-422/485, both 2- and 4-wire (optional)• RS-232•
- b. The device shall have integral web server, which allows monitoring all real-time information using standard Internet Explorer 7 or higher. The web server shall provide access to all device features, such as real-time monitoring, power quality status, remote control and full device configuration. The device will communicate to the designated tablet PC
- c. Communication protocols: OPC• DNP3• Modbus – RTU• Modbus – TCP•
- d. The device shall have integral OPC, Modbus RTU, Modbus-TCP and DNP 3. Server for seamless integration with SCADA systems. The OPC server shall not require any additional hardware or software.

Display and reports

- a. The software shall be able to display all parameters in tabular view and graphical trends.
- b. It shall be possible to display trend graph of all RMS parameters.

- c. It shall be possible to display trend graph of all harmonics (THD and individual).
- d. It shall be possible to display trend graph of all waveforms.
- e. It shall be possible to display trend graph of frequency.
- f. It shall be possible to display power quality events on timeline graph.
- g. Items B to F shall be able to be displayed on the same graph with same Y axis and multiple Y-axis.
- h. Items B to F shall be able to be displayed as cycle by cycle or per IEC 6100-4-30 Class A calculation method.
- i. It shall be possible to display Items B to F aggregations according to IEC 6100-4-30 Class A
- j. It shall be possible to display all information from all devices on the same graph.
- k. The trends shall be for any period from 1/10th of a cycle to few years.
- l. The maximum time to display one graph, or to perform zoom in or out operations, shall not be more than 30 seconds on an average computer.
- m. It shall be possible to change line colours and as well as line types for any trend.
- n. All graphs shall allow exporting the data in CSV format and the graphs themselves in Windows compatible graphic format.
- o. The software shall be able to generate periodic and on-demand reports, both pre-defined and customized. Separate report for Transient and Event should be generated.
- p. The reports shall include as a minimum summary report of all RMS values and Harmonics (Min / Max / Avg), energy consumption report and EN50160 report.
- q. The software shall be able to display events and alarms information from the device, including list of all active alarms and indication when an alarm is activated.
- r. The software shall be able to display all power quality events, as per EN 50160 and/or user defined events (both level and parameter), in a tabular view. It shall be possible to filter and sort the data based on at list the following: time, event's type, event's duration, event's depth and event's severity (a calculated value for every event based on its type, duration and depth).

8.12.3 AC and DC distribution boards

AC and DC distribution boards and its accessories shall be provided with sufficient spare circuits. The equipment offered shall be in conformity with the relevant Indian Standards.

8.12.4 Miscellaneous works to be done by Contractor.

8.12.5.1 Contractor shall be responsible for minor civil engineering works incidental upon breaking and making good on account of installations to be provided.

8.12.5.2 Design and installation of rigid and strong cable trays, cable brackets, hangers, clamps and all fixing in TSS to ensure easy installation, proper laying, each of inspection and replacement of cables.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 9

NOT USED

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 10

DESIGN CRITERIA AND PERFORMANCE SPECIFICATION RIGID OVERHEAD CONTACT SYSTEM

10. DESIGN CRITERIA AND PERFORMANCE SPECIFICATION - RIGID OVERHEAD CONTACT SYSTEM (OCS)

10.1 General Requirements

10.1.1 Scope of Work

This specification covers complete design, supply, installation, testing and commissioning of 25 kV ac rigid overhead contact system (OCS) including switching Stations (SSP, SP, SS and FP) with 25kV associated cabling, earth conductor, return conductors, drilling and fixing of anchor fasteners for OCS supports, earthing and bonding as per EMI/EMC Study in the tunnels and stations on underground section. The transition from rigid overhead conductor system to the flexible overhead catenary system in the ramp portion of the elevated section of main line shall be designed for smooth current collection and to ensure that there is no traction jerk or sparking and undue wear of contact surfaces.

10.1.2 Route Particulars

The alignment follows cut and cover & Bore tunnel sections. The two tracks are in separate tunnels except at stations.

10.1.3 Sectioning

The conceptual schematic electrical sectioning diagram is depicted in schematic power supply diagram given in the volume-5, Tender Drawings. The provision of Neutral Section, Sub Sectioning and Paralleling Posts (SSP), Sectioning and Paralleling Posts (SP), Sub-Sectioning (SS), isolating arrangement, 25 kV cable connections, and jumpers shall be provided in accordance with the sectioning arrangement.

10.1.3.1 OCS Sub-Sectioning Arrangement inside the Tunnel

Inside the tunnel at departure ends of Metro stations, OCS Sub-Sectioning (SS) shall be provided. The OCS Sub-Sectioning arrangement shall be with an insulated Air gap across which a Jumper shall be provided.

At SSP, SP, FP and SS circuit breakers/ interrupters (GIS) shall be used for sectioning.

10.1.3.2 Sectioning and Paralleling Posts (SPs).

The Contractor shall design the Neutral Section of ROCS type. The Contractor shall Interface and Co-ordinate with RS contractor to finalise the location of STOP/START Board at Neutral Section. The Design & layout and feeding arrangement shall be furnished by Contractor for Engineer's approval.

10.1.3.3 Not used

10.1.3.4 Earth mats Design and calculation should be submitted to Employer and Contractor shall interface with E&M, DDC and Civil Contractor.

10.1.3.5 Not used.

10.1.3.6 Not used.

10.1.3.7 The performance specifications of traction switching equipment 25 kV, viz. load switches/interrupters and motorised isolators; are given in Chapter 7 of this specification.

10.1.3.8 Not used

10.1.3.9 For locating the sectioning devices, viz. interrupters and isolators in the underground stations, the Contractor shall interface with designated Civil Contractors for necessary room space complete with access for personnel and provision for replacement of equipment.

10.1.3.10 Not used.

10.1.3.11 To enable train to stop ahead of the insulated overlaps when power block is taken behind the section, necessary interface shall be ensured with Signalling Contractor.

10.1.4 Traction Power Supply for (Line-Standard Gauge)

At the 25kV rigid OCS will be directly connected to the existing 25kV rigid OCS 25 kV through Jumpers or Cables. The OCS and the connected feeders & Jumpers shall be designed to carry the full current of peak time traffic of horizon year under normal feed conditions as well as with one OCS sub- sector being out of commission. The current carrying capacity of OCS shall exceed 800 Amps with worn out contact wire.

The OCS and the connected feeders & Jumpers shall be designed to carry the full current of peak time traffic of horizon year under normal feed conditions as well as with one OCS sub- sector being out of commission. The current carrying capacity of OCS shall exceed 800 Amps with worn out contact wire.

25kV feed from RSS through suitable arrangement of Circuit breakers (GIS type with minimum rating of 2000 A) with all necessary OCS protections and interlocks shall be provided.

10.1.5 Earthing and Bonding

Suitable earthing and bonding arrangement in accordance to EN 50122-1 and CENELEC Standard shall be provided in the underground sections and tunnels for conduction of return current and safety against hazardous touch and step potentials under normal and the fault conditions. For reference, the Indian Railway ac Traction Manual may be referred to in addition to the practice of bonding and earthing adopted on Line No. 2.

10.1.6 Interface with other Contractors

For providing rigid OCS, the Contractor shall interface with other Contractors. Any problems for the installation of rigid OCS due to lack of co-ordination with related other Contractor shall be corrected at the Contractor's expenses.

10.2 Definitions

Composite aluminium Rigid Overhead Contact system:

The overhead conducting composite aluminium rail with copper contact wire including support fittings and insulators for distribution of electric power to the train.

Expansion joint: Mechanical joint for absorbing expansion of rigid contact wire due to temperature changes.

Air section: Electrical sectioning of OCS for separating feeding network.

- Anchor: Anti-creep equipment in the middle of a contact wire length so as to prevent the rigid contact wire from unidirectional creeping.
- End approach: The Sloping end portion of Rigid Conductor rail so as to maintain smooth pantograph passage
- Jumper wire for rigid conductor system:
Jumper conducting annealed copper wire for electrical continuity at expansion joints and crossovers. It also includes flexible insulated conductor from cable termination to rigid rail
- Feeder cables: 25 kV Feeding cables from 25 kV switchgear to rigid conductor rail for supplying traction power.
- Feeder cables system: Feeder cables, their supports, associated terminals and connectors
- Return current circuit: Running track rails and conductors forming part of traction return current circuit.
- Supporting fixture: Adjustable supporting fitting for conductor rail so as to maintain the geometry of height and stagger of contact wire with respect to the track.
- Support Insulator: Insulator for supporting rigid conductor rail.
- Water Proofing Cover: Insulated cover for conductor rail to prevent corrosion from leakage water in tunnel.

10.3 Rigid Overhead Contact System

10.3.1 Design Parameters

10.3.1.1 Type of overhead contact system

The Rigid Overhead Contact system shall include 25kV ac overhead rigid conductor rail with contact wire, associated jumpers, support structures and ancillary equipment.

10.3.1.2 Clearances - Minimum Electrical and Mechanical Clearance

The minimum electrical and mechanical clearances shown in Table 10.3.1.2 shall not be infringed under the worst operating conditions of the overhead line equipment, the rolling stock and pantograph.

Table 10.3.1.2 - Minimum Electrical and Mechanical Clearance (mm)

Item	Normal inside Tunnel
25kV Live metal to earth	
Static	270
Dynamic (passing)	170
25kV Live Metal to Vehicles	
-Static	290
- Dynamic (passing)	190
Phase Difference (47.6kV)	
Static	530
Dynamic (passing)	350
Gap at Insulated Overlap or air- gap on rigid OCS between conductors of different electrical sections	400
Gap at Uninsulated Overlap or expansion joint on rigid OCS	200

The minimum clearances inside the tunnel for 25 kV traction are those specified in IEC 60913 with latest amendments.

The values shown in the Table above shall be used as a minimum. In the event of additional space being available, the space shall be used to enhance the electrical clearances above the stated values, before consideration is given to increase the system height.

The Contractor shall interface with designated civil Contractors to verify bored tunnel, box tunnel and station box cross-sections and also in respect of moving dimensions.

10.3.1.3 Mechanical Clearance

Mechanical clearance to any point from the OCS with power off shall be adequate to provide for manoeuvring of working tools while carrying out maintenance work on the OCS. During detailed designing, the contractor shall ensure that the minimum clearance between pantograph and insulator is 100mm.

10.3.1.4 Rolling stock

The locked down height of the pantograph is 4048 mm, the minimum OCS height is 4318 mm.

10.3.1.5 Supporting structure

10.3.1.5.1 Safety of supporting structure

Supporting steel structure for overhead contact system shall have a safety factor not less than 3 times yield point strength of steel against dynamic operational loads. Grouting shall be designed with a factor of safety as 4 and shall be load tested individually.

10.3.1.5.2 Anchor plug and anchor bolt/ Chemical fasteners of supporting fixture.

Anchor bolt shall be installed for the supporting fixtures of rigid conductor rail at intervals finalised on basis of detailed design. The type of bolts shall be similar to existing Line No. 2 or chemical fasteners of adequate design. The supporting fixtures shall have facility of adjustment so as to install the rigid OCS at the designed height with the requisite stagger of the conductor rail. Yielding point strength of the fixtures and fitments shall have adequate factor of safety, considering worst loading/torsion conditions and dynamic loading on account of pantograph thrust and movement. The Contractor shall furnish the supporting design details.

10.3.1.5.3 Supporting steel fixture

The supporting steel fixtures shall be provided at suitable intervals based on design consideration. The interval between successive fixtures shall not permit undue sag and vibrations. The contractor shall furnish the supporting data of similar systems, which may have been provided by him on other metro systems with 25kV ac rigid conductor OCS. The steel work shall be hot dip galvanized and the nuts, bolts and washers shall be G.I/stainless steel of suitable grade for moist and polluted tunnel atmosphere.

10.3.1.5.4 Support Insulator

Type of OCS support insulator to be provided shall be a proven one.

The electrical and mechanical properties of support insulator for the 25 kV ac rigid conductor shall be in accordance with the recommendations of IEC 383 / 1109. The minimum creepage distance of the insulator shall be 1100 mm, wet power frequency withstand voltage shall be 110 kV and dry lightning impulse withstand voltage shall be 250 kV in accordance with the recommendations of IEC 60913.

The mechanical design should be proven to take the fluxul stress to support the design train headway of 90 seconds.

Supporting insulator fixture shall permit free sliding of Rigid conductor to allow for expansion on account of temperature changes.

10.3.1.5.5 Preventing loosening of nuts and bolts

Adequate measures shall be taken for preventing all bolts and nuts from becoming loose, through use of lock nuts/ spring washers.

10.3.1.6 Expansion Joint

10.3.1.6.1 Typical arrangement and Interval between expansion joints.

Expansion joints shall be provided at suitable intervals but the maximum interval may be allowed up to 500m depending upon the site condition.

10.3.1.6.2 Parallel contact wires at expansion joint

Parallel contact wires shall be of adequate length to provide for suitable expansion joint assembly with provision for adequate number of flexible continuity jumpers. Separation distance between two OCS sections at expansion joint shall not be less than 200mm to ensure smooth passage of pantograph. No expansion joint shall be provided in the station area. Suitable gradient will be provided to ensure smooth change over. The expansion joint may be erected at site or prefabricated from the manufacturing works.

10.3.1.7 Sectioning equipment

10.3.1.7.1 Air-gap section

The structure of air-gap section shall be same as that of an expansion joint. At insulated air-gaps, separation distance between two OCS sections at the overlap shall not be less than 400 mm, with two OCS sections aligned such that pantograph passes satisfactorily. No air-gap section shall be provided in the station platform area. Air-gap sections shall be provided at the crossovers to segregate two sections. In case air-gaps are not found practicable, only in exceptional circumstances the section insulators may be permitted.

10.3.1.8 Jumper wire for rigid conductor

Jumper wires for rigid conductor shall be of stranded annealed copper with adequate current carrying capacity. Connection of jumper wire to rigid conductor rail shall be through suitable bimetallic terminals each having at least two fixing bolts. Bolts shall not conduct any current. Jumper wire shall be flexible to allow creeping of rigid conductor. The design shall ensure that the jumper loops remain at least 75 mm above the contact plane.

10.3.1.9 Anchors

Anchors shall be provided for prevention of unidirectional creeping of rigid conductor rail.

10.3.1.9.1 Location of anchoring

Anchoring shall be provided in the middle of one conductor run length between two expansion joints.

10.3.1.9.2 Anchoring Insulators and Hardware

The design shall be such that the Insulator and hardware used at anchoring location shall be least affected by passing pantographs. Materials for anchors shall be corrosion resistant such as hot dip galvanized or of stainless steel. Suitable bimetallic fitment shall be integral with the hardware to prevent electrolytic corrosion to aluminium.

10.3.1.10 Rigid conductor rail and contact wire

Conductor rail shall be of Aluminium alloy section with wearing copper contact wire. Sections of transportable lengths will be joined together to form lengths up to 500m between expansion joints. The contractor shall furnish the merits of the conductor rail system offered indicating the life, speed potential of installation, strength and conductivity of joints, maintainability and the supporting details including performance of similar rigid conductor systems if provided by him on any other metros system. In regard of the wearing copper contact wire size, RDSO requirements or EN should be followed (as per approval). *Contact Wire shall be Round Bottom, 150 sq mm area and shall comply with latest RDSO standard ETI/OHE/76 (6/97) or EN 50149 specifications. Contact wire shall be made from Continuous Cast Copper (CCC) rod of minimum 23 mm diameter as per RDSO Specification. Also, Contact wire shall be hard Drawn Grooved Copper contact Wire complying to RDSO standard ETI/OHE/76 (6/97).*

10.3.1.11 Standard length of conductor rail system

Standard length of conductor rail offered shall not be generally less than 10 metres. However, the length offered shall be supported by the data of various metro systems using similar/same size rigid conductor OCS and the site condition.

10.3.1.12 Protection cover for rigid conductor rail

Protection cover with Warning Boards of material and design to be approved by the Employer for rigid conductor rail shall be provided at station area, below the ventilation ducts and where there is a possibility of maintenance personnel inadvertently coming close to the rail. In case of continuous provision of protection covers, Warning Boards shall be provided on the protection cover at 5m intervals. The waterproof cover shall be provided on the conductor rail where water leakage will occur in the tunnel. The material should be Fire Retardant Low Smoke, Zero-Halogen (FRLSOH).

10.3.1.13 Height of rigid conductor rail and contact wire

Minimum Height of the contact wire plane shall not be less than 4318 mm from the safety distance criterion as per EN-50122-1 and keeping safety clearance and electrical clearance as per IEC 60913.

10.3.1.14 Stagger of rigid conductor and contact wire

Stagger of rigid conductor contact wire shall be limited to ± 200 mm, nominal, from rail centre on tangent track and on the curves, however, the value of stagger shall be finalised based on pantograph profile obtained from the rolling stock Contractor. Stagger of rigid conductor and contact wire (200mm) shall be achieved over a suitable length to avoid grooving on the pantograph current collection strips.

10.3.1.15 The design of OCS shall permit a displacement of track by ± 50 mm horizontally without need for changing any component.

10.3.1.16 Permissible gradient of contact wire

Gradient of contact wire shall be not more than 1/1000 on main tracks and not more than 2/1000 on stabling line tracks at terminal stations. Deviation from these limiting values shall only be with specific permission of the Engineer. The junction with level contact surface shall be joined by a transition gradient half that adopted for the main gradient.

10.3.1.17 Cross Over

The separation of contact wire at centre of the turn out shall be not less than 250 mm and not more than 300mm from the track, which it serves at any point after the take off.

10.3.1.18 Transition from Rigid to Flexible Catenary System

The transition from Rigid overhead conductor system in the tunnels to flexible overhead catenary system in the ramp portion shall be so designed that passage of the trains (electrical multiple units) is as smooth as possible without resulting in any pantograph jerk, sparking and wear of components. The X-sectional area of copper (current carrying capacity) to remain the same throughout the installation. The design should be a proven one.

10.3.1.19 Indicators Boards

- a) OCS section indicator Boards shall be provided at approach to each electrical section of OCS, which shall be visible to Train Operators (Drivers) from an adequate distance. .
- b) Number plates shall be provided at support locations, the numbering scheme to be adopted shall be submitted for review of Engineer.
- c) Warning indicator Board shall be provided at approach to termination of contact wire.
- d) "Warning: 25kV ac" Boards shall be provided at locations and intervals as per rule of opening metro railways and as decided upon by the Employer. These boards shall be prominently displayed at the platform at frequent intervals.

10.4 Contractor's Design Responsibility

10.4.1 Design Environment

This is furnished in clause 1.12 of GS and clause 4.2 of this Specification.

10.4.2 Traction Power Supply Performance Requirement

These are addressed in clause 4.9 of this Specification.

10.4.3 Detailed Design of the OCS

10.4.3.1 Based on the survey of entire route, the Contractor shall offer the most suitable OCS profile including OCS sectioning and work out in detail the OCS construction plan including return current longitudinal (continuity) and transverse (equalizer) bonding plan.

10.4.3.2 The above application designs shall be based on standard arrangement Design principles and specially for:

- a) OCS supports and spans, adequate common parallel run at expansion joint.
- b) Arrangement of jumper connections at expansion joints and at feeder connections.
- c) As far as possible section insulators shall not be used on the main line. The X-overs, turnout etc shall be designed through over laps. In case if it is inevitable to use section insulator in any section, the approval for the same shall have to be obtained from JMRC.
- d) Transition arrangement with flexible OHE to be such that area of X-section remains the same throughout this section.

- e) The insulator and OCS fittings must be able to take the fluxul stresses to accommodate train headway of 90 seconds.

10.4.3.3 The components and fittings shall be of type and metallurgy, which are rust and corrosion proof. Steel components shall be hot dip galvanised. Nuts, bolts and spring washers shall be suitable grade stainless steel.

The fittings, jumpers etc shall need minimum maintenance and to the extent possible shall be of 'fit and forget' type.

Insulators suitable for humid and urban polluted atmosphere of Jaipur shall be used. The insulator shall be oil resistant and the surface finish should be such that least amount of dust is able to accumulate on the insulator surface.

The design shall be coordinated fully with the requirements of the signalling and train control system, final track work, tunnel work and any specified design requirements that those systems or facilities may dictate for the operation and management of the services.

10.4.4 Submittals

10.4.4.1 Basic Design

Based on the basic designs worked out and route survey, the Contractor shall prepare and submit a detailed OCS final design, together with hardware applications design appropriate for the whole Project. The design of the support and anchor assemblies shall ensure adequate clearance from the pantographs under dynamic conditions.

The submittal shall include a tabulated allocation of all parts for the OCS.

The Contractor shall select a full range of proven OCS components, and shall demonstrate by means of engineering calculations that all elements of the selected system are capable of meeting the Design Criteria, Safety, and Operational requirements as stated in these Specifications. When computer programs are proposed for use, the Contractor shall submit typical hand calculations, together with comparable computer data input and output, for verification of the program, together with a description of the software.

10.4.4.2 Drawings for review

Construction drawings shall be prepared and verified at site. The site verified plans shall be submitted to the Employer for review. These shall include but not be limited to:

- a) General Traction Power supply diagram.
- b) Schematic sectioning Diagrams.
- c) OCS construction Plans.

These shall include chainage of all support anchors and air gaps, height over rail level and other general particulars. On- site verification of the plans shall be carried out and based on final construction plan. OCS layout shall be finalized for construction.

- d) OCS layout plan:

Based on the finalised construction plan, OCS layout plan shall be developed and submitted for review by Engineer.

The OCS layout plan incorporating following information shall be submitted:

- The alignment of the conductor.

- Chainage of each support structure location.
 - Exact chainage of all expansion joints, anchors and air gaps.
 - Direction and value of stagger at each location.
 - Clearance of live conductors to fixed structures with respect to reference chainage.
 - Alignment and layout of feeders.
 - Jumper connections to switches and feeder tails.
 - List of infringements, if any.
 - Numbering of each support structure with respect to reference chainage
 - Location and serial number of isolator switches.
 - Final Sectioning diagram drawn to a convenient scale showing identification number of section insulators and elementary sections.
 - Transition Element drawing (from Rigid OCS to Flexible OHE).
 - General arrangement of OCS at SSP, SP and SS.
- e) OCS profile drawings
- In case the height of contact wire is changed, an OCS profile drawing showing the actual height of the contact wire at each location and the gradient adopted until normal height of contact wire is achieved.
- f) Return current and Earthing and Bonding plan
- Return current circuit Earthing and bonding plan in interface with Track construction Contractor, Signalling and Train Control Contractor.

10.4.4.2.1 Proceed to construction

Based on finalized plans field construction work may proceed.

10.5 Construction Requirement

10.5.1 Track route and layout inspection and preparation of installation work

As preparatory work prior to installation, the location and position of supporting fittings, rigid conductor rail and anchoring shall be verified and marked at site. Height of the tunnel from top of rail at various locations shall be confirmed.

10.5.2 Installation of supporting structure

10.5.2.1 Supporting structure

Supporting anchor bolts shall be supplied and installed by the Contractor.

10.5.2.2 Supporting Insulator and accessories

Supporting insulator and accessories for rigid conductor rail shall be mounted on supporting structure to enable adjustment of the conductor to required stagger as per the final design drawings.

10.5.3 Installation of rigid conductor and contact wire.

10.5.3.1 Transporting material

Care shall be taken that no breakage, dent, crack or bending of any component takes place during transportation. Adequate care shall be taken to prevent any damage due to rust by applying rust prevention paint. Painting schedule to be submitted for review by Engineer.

Materials delivered at work site shall be laid up neatly at nominated locations so that interference does not occur from other works going on nearby.

10.5.3.2 Installation of rigid conductor rail and contact wire

Due care shall be taken while handling the rigid conductor rail that no twisting or bending or development of any crack takes place. Temporarily supporting the rail with one end cantilevering should be prohibited.

While installing the rigid conductor rail, safe practices shall be adopted.

The erection of conductor rail shall be commenced from the anchor structure and continued on to the expansion joint.

Before installation of the end approach of expansion joint, adjustment of final length shall be in accordance with the measured temperature in the tunnel.

On curved track, the conductor rail lengths appropriately bent to requisite curvature taking into account track conditions and deviations of contact wire shall be provided.

On turnouts the level of the crossover contact wire shall be raised so that it does not come in contact with train pantographs running on the main track, and for the trains negotiating the turnout, the passage and current collection by pantograph is smooth.

Adequate tensile force shall be maintained in the contact wire.

The contractor shall interface with Tunnel and Station Civil Contractor and shall be responsible for Centre line Marking of Track (even without its laying) on the roof of the tunnel.

The Contractor shall submit the OCS installation plan to Employer for approval.

10.5.3.3 Jointing the rail

If the rail lengths are bolted together, the bolting process shall be of proven design with use of proven components.

10.6 Installation of Feeding System

10.6.1 Design requirement of traction power cables

25 kV feeder cables shall conform to the specifications of these cables given in clause 8.2. The number of cables constituting a feeder shall take in account the whole current requirement of a single source of feed.

The feeder cables and the jumper cables shall be sized to provide for environmental derating corresponding to the laying method and maximum overload and short-circuit currents.

The cable terminations shall be suitably designed for adequate insulation, mechanical strength, low resistance and against fraying of strands, developing cracks or getting loosened with vibrations, wear and tear.

The interrupters and isolators meant for sectioning shall be located in the station area in a room close to the sections required to reduce length of cables.

Connection of feeder cables to OCS conductor rail shall be through flexible jumper and terminal connectors and shall be of bolt fixing type. Details shall be submitted for review of Engineer.

The feeder cable jumpers shall be flexible to accommodate rigid conductor rail movement due to temperature variations.

Due care should be taken to lay and connect the cables to switchgear and to OCS to ensure that the current carrying capacity of the system is not de-rated. All connectors shall be robust and of proven types.

10.6.2 Return conductor and earth conductors

10.6.2.1 Return Conductor.

Return conductor shall be aluminium conductor conforming to Bureau of Indian Standards, specification IS: 398 (Part I)-Latest Revision.

conductor of adequate size to be finalised by EMC simulation study. The Conductor shall conform to Indian Railway's RDSO specification

10.6.2.2 Earth Conductor

Earth Conductors shall be made of flexible Aluminium conductors of adequate size to be finalised by EMC simulation study. The Earth Conductor shall conform to Indian Railway's RDSO specification for IS: 398.

Suitable bimetallic connectors to be provided between any copper and aluminium connections in earthing system.

10.7 Submittals of Designs and drawings for review

The designs and drawings for the cable runs, connection and jumpering arrangement of the 25 kV feeder cables to the OCS and Earthing and return current conductors shall be submitted to Engineer for review. The drawings shall include but not be limited to the following:

- a) General arrangement drawings for each type of joint and connection
- b) Individual Site location drawings over the entire route.
- c) Bonding and Earthing plans over the entire route.

10.8 Cable Installation Requirements

10.8.1 General

As preparation work prior to cable installation, the location and position of cable supporting fittings shall be ascertained and actually at site in coordination with other civil works so as to avoid any error in installation.

Provision of adequate clearance for running cables across tracks and at location of jumpers to OCS should be ensured through interface with Civil Contractors who may have to provide niches to obtain such extra clearance.

10.8.2 Cable laying

10.8.2.1 Cable protection

At any location where any damage or rubbing to cables or touching with walls is expected, fibre glass or equivalent cable protection cover shall be provided.

10.8.2.2 Bending of cables

Bending of cable shall be executed gradually and bending radius of the cable shall be not less than allowable bending radius of cable. Bending of cables shall not be executed repeatedly. Special precaution shall be taken for bending at cable ends where shrinkable sleeves and petticoats are fitted.

10.9 Final Adjustment and Measurement of OCS

After the equipment has been finally adjusted, the equipment shall be subject to final measurements jointly with the Employer. The checks shall include but not be limited to:

- a) Support location member, its height above rails level and stagger, gradients in OCS.
- b) Contact wire height at mid span between successive support members.
- c) Anchors, expansion joints and air gap separations.
- d) Clearance checks to ensure pantograph passing clearances, both electrical and mechanical clearance Pantograph test to ensure smooth shock free passage especially at section insulators at air gaps, at turnouts, crossovers and change of height of the contact system.
- e) Fittings or jumpers and cable connection to
 - Overhead conductor rail
 - Return current circuit connected to running rails

10.10 Site Testing and Inspection

In accordance with Chapter 14 of this Specification and the GS a detailed protocol for inspection and testing of complete OCS shall be prepared and the tests and complete methodology for testing shall be submitted for review by the Engineer.

10.10.1 Installation checks and tests

- a) Visual inspection of overhead contact system installation, random check of components; electrical and mechanical clearances, air gaps and general alignment.
- b) Continuity test of each joint in traction and return current circuit.
- c) Insulation resistance of 25 kV ac overhead contact system shall be as per international standards.
- d) Physical examination of rail bonds.
- e) Checking of construction gauge
- f) Return current continuity test, testing of joints.
- g) Earth resistance test.

10.10.2 Partial Acceptance Tests

10.10.2.1 Not used

10.10.2.2 Tests

After physical verification and measurements, tests as indicated below but not limited to these, shall be carried out.

10.10.2.2.1 Circuit continuity, loop resistance test

The purpose of this test is to obtain the OCS section. These test checks both the OCS and the rail return system for electrical continuity. The test entails short-circuiting a discrete section of the OCS by connecting the OCS to the rails at one end and applying a variable ac voltage at the other end. The length of section under test should be approximately 1.0 - 2.0 km (i.e. in the station to station zones). An ac source with variac to provide requisite testing current.

10.10.2.2.2 High voltage ac test.

Meggering of OCS sections at 2.5 kV and record results.

10.10.2.2.3 Pantograph tests will be performed using a self-powered transit vehicle in order to identify any locations where arcing may occur.

10.10.2.2.4 The Contractor shall be responsible for all adjustments required as a result of these tests.

10.10.3 System Acceptance Tests

10.10.3.1 Energisation

10.10.3.1.1 Successive Energisation

Each electrical section shall be energised successively at 25kV ac from for one minute with adjacent sections isolated and connected to traction earth. Finally entire section shall be energized for at least 24 hrs.

10.10.3.1.2 Short circuit tests shall be carried out as per a detailed test protocol, which shall be submitted for review by Engineer.

10.10.4 Integrated Testing and Commissioning

10.10.4.1 All the items of supply and required for completion of the work in all respects, testing and commissioning of the overhead equipment system as well as associated work for facilitating trial run of the rolling stock and Integrated Testing and Commissioning shall form part of the work covered by the contract whether specifically stated or not.

During train trial contractor shall be responsible for providing and fixing discharge rods during power block permission/Cancellation before ROD.

10.10.4.2 High speed tests shall be carried out by means of running the trains initially at slow speed, then increasing the speed in stages up to full speed permitted for the section. On successful completion of the high speed tests, the OCS shall be declared fit for pre-revenue system tests.

10.10.4.3 The Contractor shall be required to operate and maintain the OCS until Taking Over by the Employer.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 11

I/O list for underground switching station breakers

9

S.no	Description	Type of signal		
		DI	DO	AI
1	CB close command		1	
2	CB open command		1	
3	CB close status	1		
4	CB open Status	1		
5	Isolator Close Command		1	
6	Isolator open Command		1	
7	Isolator open status	1		
8	Isolator Close status	1		
9	Earth switch close status	1		
10	Earth switch open status	1		
11	Control supply fail alarm	1		
12	L/R Mode in local	1		
13	SCADA permissive for local control		1	
14	Spring discharged	1		
15	CB stuck	1		
16	Current			1
17	Voltage			1
18	SF6 gas pressure low alarm Stage-I	1		
19	SF6 gas pressure low trip stage-II	1		
20	Lock out relay operated	1		
21	Lock out relay reset		1	
22	PT MCB trip	1		

23	Trip circuit unhealthy	1		
24	Under voltage tripping of Paralling interrupters		1	

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CHAPTER – 12

NOT USED

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 13

PHYSICAL INTERFACE

13 PHYSICAL INTERFACE

13.1 GENERAL

- 13.1.1 The Contractor shall interface with relevant authorities and other contractors to ensure the effective and compatible coordination of all aspects of design, installation, testing and commissioning of Works.

13.2 CONTRACTOR'S RESPONSIBILITY

- 13.2.1 The Contractor shall ensure that all the interface items as listed in, but not limited to, clause 13.3 of this Specification shall be included in the Interface Management Plan.
- 13.2.2 Other items not mentioned in the interface items but are relevant to the design, installation, testing and commissioning of the Permanent Works, shall also be included in the Interface Management Plan.

13.3 PHYSICAL INTERFACE DETAILS

The list of relevant contractors/ DDC's is as under:

- 1) Civil Contractor
- 2) S&T Contractor
- 3) Power Supply (RSS), SCADA & Elevated line Traction Contractor
- 4) Track Contractor
- 5) Rolling Stock Contractor
- 6) DDCs
- 7) E&M Contractor
- 8) VAC Contractor
- 9) Any other associated with the work

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 14

TESTING, COMMISSIONING AND VERIFICATION

14 TESTING, COMMISSIONING AND VERIFICATION

14.1 General

- 14.1.1 Tests shall be performed in accordance with Chapter 9 of GS.
- 14.1.2 For Validation of design of 25KV Rigid OCS, Contractor shall arrange auditing of design of 25kV ROCS, as per IEC and other relevant Standards from reputed Independent Agency (Auditor), who have already undertaken the similar job in past for other Metro system. The auditor shall submit separate reports for validation of design, drawings and installation of ROCS. Two stage reports should be submitted, one for Installation validation & auditing after installation of ROCS, other for design validation & auditing. Final validation report should cover installation & design of 25 KV ROCS, the reports should clearly certify that design/installation has been done according to applicable standards and international safe practices. The contractor shall submit the reports for review of Engineer.
- 14.1.3 The Contractor shall develop a full test plan and submit for review by Engineer. The tests mentioned herein are indicative and minimum requirement.
- 14.1.4 Test Certificates

Five sets of all principal test records and test certificates duly endorsed by the Contractor's Professional Engineer are to be submitted for the review by the Engineer in accordance with the specifications of this contract. These test records and certificates shall be supplied for all tests, whether or not the Engineer has witnessed them. The information given on such test certificates shall be sufficient to identify the materials or equipment to which the certificate refers.
- 14.1.5 Factory Acceptance Tests
 - 14.1.5.1 FAT shall comprise Sample Tests, Routine Tests, and any additional tests required by the Engineer. FAT plan as per GS should be submitted for approval of Engineer.
 - 14.1.5.2 The testing shall be conducted such as to simulate the working conditions as closely as possible.
 - 14.1.5.3 Upon the request of the Engineer, type tests, Life, Endurance and destruction tests shall be carried on components and assemblies to verify the design loading.
 - 14.1.5.4 All the tests shall be conducted both on the assembly and on the members/ components of each product in accordance with design specifications and applicable Standards.

Contractor shall certify the matching of all components of ROCS.

14.2 Contractors Responsibilities for On-site Testing

- 14.2.1 The Contractor shall be responsible to carry out all tests as required by the Engineer. During the course of erection, the Engineer shall have full access for inspecting the progress of work and checking the accuracy as may be required. On completion of erection and prior to commissioning, all equipment shall be tested to the acceptance by the Engineer in accordance with an agreed Inspection and test plan to demonstrate that it is entirely suitable for commercial operation. Any additional/special tests as directed by Engineer should be done by contractor.

- 14.2.2 Contractor shall arrange temporary power supply (DG set) in addition to general lighting during drilling, anchoring, fixing of Brackets). Permanent lighting in the tunnel & station will be provided by E&M contractor or other.

The Contractor shall be responsible for providing temporary electricity supply, all instruments, gauges, test equipment, tools, accessories, personnel, services and any other facilities required for the execution of all tests and inspection. Wherever necessary, the Contractor shall provide two or more sets of testing equipment, tools, etc. to expedite testing. All test equipment shall be accompanied with the appropriate calibration certificate from an approved testing authority before submission to the Engineer. Tests shall not proceed until no objection is received from Engineer.

- 14.2.3 Test equipment, tools, etc. necessary for subsequent preventive and corrective maintenance are to be provided to the Engineer as specified herein and shall be available to assist the tests. The use of these test equipment, tools etc shall be subject to review by the Engineer.

- 14.2.4 The Contractor shall also employ a qualified and competent Professional Engineer (P.E) for the supervision of the entire work covered by this contract and the appointed professional engineer shall be fully responsible for the proper installation, testing and commissioning of all the equipment. The appointed P.E. shall produce all certificates of supervision of work for all works covered under this contract. Contractor's Design team shall supervise the installation of ROCS and certify that installation is as per approved design.

- 14.2.5 Energisation shall be carried out in stages, and shall include, traction sectioning and paralleling posts, and OCS on the mainline. Energisation of the OCS shall be carried out progressively in stages. For the energisation of certain OCS sections, turn-on of power may require putting up of temporary works e.g. cable diversion, additional earthing provision, etc. to ensure the safety of workers working in the adjacent non-energised area. Such work inclusive of sectional testing of traction power shall be deemed to be included in the contract.

- 14.2.6 The Contractor shall be responsible for surveillance and security of the power supply systems including padlocking or otherwise maintaining control of the substation, padlocking of Switchgear and circuit breaker units, distribution switchboards, power panels, etc. throughout all energisation stages of the installation. The Contractor shall interface with the other Contractors to assure no downstream cables or other electrical equipment is energised before it has been tested and before other involved Contractors facilities are ready and secured. The Contractor's responsibility for surveillance and security of the system shall remain in force for each part of the system until such a time that the Employer takes over the System.

14.3 Re-Testing

- 14.3.1 When defects are detected in the equipment accessories, etc during the commissioning tests, the Contractor shall ensure that adequate spares are kept on site. The Contractor shall, on receipt of no objection from the Engineer make use of spares intended for preventive and corrective maintenance to rectify defects detected during the tests. No objection will generally be given to make use of the spares provided the Contractor undertakes to replenish the spares at the earliest possible date. The Contractor shall submit details of all tests prior to testing and all tests shall be carried out in the presence of the Engineer and to his complete satisfaction.

- 14.3.2 Should the plant or any portion thereof fail to give the performance required, then any further tests that may be considered necessary by the Engineer shall be carried out in a similar manner by the Contractor.
- 14.3.3 If any item fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site, the Engineer may reject the item or defective component thereof, whichever is considered necessary and after adjustment or modification as directed by the Engineer, the Contractor is to submit the item for further inspection and/or test. In the event of the defect on any item being of such a nature that the requirements of this Specification cannot be fulfilled by adjustment or modification, such item is to be replaced by the Contractor at his own expense, for the acceptance by the Engineer.

14.4 Installation Tests

14.4.1 Installation Tests

- 14.4.1.1 An inspection and visual verification of ratings and connections of equipment, instrument transformers and auxiliary circuits, installation tests shall be carried out.
- 14.4.1.2 After installation of equipment, visual inspection and operational tests on un-energized equipment shall be carried out to check the following:
- a) Cleanliness;
 - b) Workmanship;
 - c) Confirmation of items conforming to ratings specified;
 - d) Water and dust proofing;
 - e) Levelling, mounting and positioning;
 - f) Joints and connections tightness;
 - g) Cables – dressing, bending radii, jointing and finish at terminals;
 - h) Clearances and dimensions in conformity with drawings;
 - i) Earthing, bonding, and continuous earth conductors
 - j) Functioning of, interrupters, isolating and earthing switches and their interlocks;
- 14.4.1.3 Earth resistance measurements – individually and of the subsystem and system as required.
- 14.4.1.4 Insulation Resistance
- The insulation resistance of 25 kV cables shall be tested in accordance with manufacturer's instructions. All LV circuits and traction return cables shall be tested with a 500 V insulation tester. All sections of OCS shall be tested using a 2.5 kV insulation tester.
- 14.4.1.5 Continuity Test and Contact Resistance
- Continuity of all circuits shall be verified. Contact resistance of all high current joints and bolted contacts, shall be measured with a Ductor set. Earth system joints shall also be measured.
- 14.4.1.6 Testing of GIS equipment as per relevant IEC:
- Gas Leakage Test

- Contact resistance Test
- Mechanical & Electrical Operational Test
- High Pot Test of Bus Bar Chamber
- A vertical & horizontal alignment

14.4.1.6.1 Secondary and primary injection tests

Tests shall be carried out at a minimum of three settings if multiple settings are available. Test results of operation boundaries and operating times shall be recorded.

14.4.1.7 Batteries and Chargers.

Discharge tests and charging tests shall be carried out to verify the capacity of the batteries and all functions available on the charger

The operation of the boost charge facility and the effect of the voltage dropping diodes shall also be demonstrated.

14.4.1.8 Control, Indication and Alarm Functions

Insulation resistance and continuity of all cores of cables shall be identified and tested.

The correct functioning of all control, indication and alarm devices shall be verified.

14.4.1.9 Switchgear

14.4.1.9.1 All switchgear, including circuit breakers, interrupters isolating and earthing switches, shall be operated to prove that the operating gear, tripping devices, protective gear and mechanical interlocking are satisfactory.

14.4.1.9.2 SF6 gas leakage test shall be performed where applicable.

14.5 Partial Acceptance Tests

14.5.1 These tests form part of on-site and System Acceptance Tests as part testing of the equipment and system.

14.5.1.1 Functional Tests and Interlock Tests

All control and protection functions and electrical/mechanical interlocks shall be tested.

14.5.1.2 Primary Injection Tests

The Contractor shall carry out primary injection tests on each protective system, to prove the auxiliary circuit connections, the relay fault setting values, the correct metering indications and the stability limits.

14.5.1.3 AC/DC Pressure Tests

14.5.1.3.1 The insulation resistance of all circuits shall be measured before and after the dc pressure test using a 5kV insulation tester. The minimum phase-to-phase and phase-to-earth insulation resistance shall be 100 mega ohms.

Pressure tests shall be carried out on completed cable lengths of high voltage cables in accordance with IEC 60502.

14.6 System Acceptance Tests

14.6.1 Energisation

- 14.6.1.1 The Contractor shall prepare operation safety rules and procedures for the review of the Engineer before Energisation.
- 14.6.1.2 The Contractor shall carry out all necessary checks to ensure safe Energisation.
- 14.6.1.3 All power equipment shall be subject to inspection by inspectors from the Electrical Inspectorate of Employer before Energisation. The Contractor shall ensure all Employer's requirements are met.
- 14.6.1.4 Contractor shall be responsible for reliable operation of Traction Power equipment. As per requirement of Employer Contractor shall disconnect and subsequent reconnect the jumper of OCS or operate Circuit Breaker/Interrupter.

14.6.2 Tests

SAT shall include but not be limited to: -

- 14.6.2.1 Short Circuit Tests on OCS
- 14.6.2.2 Short Circuit Tests on the 25 kV OCS shall be carried out to prove correct operation of protection equipment and to ensure that the dynamic strength requirements of overhead equipment are met.
- 14.6.2.3 Short Circuit Tests shall be carried out on every overhead equipment line feeder.

14.7 Integrated Testing and Commissioning

- 14.7.1 Integrated Testing and Commissioning refers to those tests undertaken in order to demonstrate that the various components of the MRTS operate satisfactorily between one another and meet all specified requirements for design, operability, safety, and integration with other works and systems. These tests shall be entirely within the requirements of one or more of the project contracts or they shall involve a multiplicity of contract procedure.
- 14.7.2 Those systems that can be tested without depending on the running of trains, will have their integration tests scheduled to commence as early as possible. It is preferable that any interface problems associated with these "trainless" system tests be identified and resolved prior to the commencement of test running.
- 14.7.3 The following is an indicative listing of those Integrated Testing and Commissioning functions that necessarily be integrated with others to demonstrate that the equipment and controls installed therein meet the Contract Specifications and demonstrate a safe-to-operate condition. This listing is not exhaustive and shall be updated by the appropriate contractor, or by the Engineer, to demonstrate functionality, completeness and safety of the installed works.
 - a) Power system functional tests.
 - b) EMI/EMC tests.
 - c) Short circuit tests on OCS.
 - d) Rolling stock regenerative braking tests.
 - e) Measurement of step & touch potential to validate the result obtained by Simulator study.
 - f) Current Collection Test

14.7.3.1 On-load Tests and Directional Tests

14.7.3.2 Once sufficient load current is established, voltages and currents into protection and metering equipment shall be verified to ensure correct operation of protection relays and accuracy of meter readings at local and remote locations.

14.8 Service Trials

14.8.1 The Contractor shall provide special and general attendance during the Service Trials period such that the persons who carried out the On-Site Testing and Commissioning are available on Site to solve any problem arising from the Service Trials.

14.9 Performance Verification

14.9.1 The Contractor shall carry out all Performance Tests to verify that the performance of the System meets the Employer's Requirements after the substantial completion of the Works.

14.9.2 One of the Performance Tests which shall be carried out by the Contractor in conjunction with Other Contractors or relevant parties (e.g. DOT) is the measurement of EMI levels at locations to be specified by the Engineer. Such measurements shall be carried out prior to energisation of the Traction Power System, and then during Service Trials and commercial operation of the train services to ensure that the EMI levels comply with the requirements of this Specification.

14.9.3 Should the performance of the System deviate from the Technical Specification, the Contractor shall make every effort to rectify the deviation in the shortest possible time, and to the satisfaction of the Engineer.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 15

PACKAGING, SHIPPING AND DELIVERY

15 PACKAGING, SHIPPING AND DELIVERY

15.1 General

15.1.1 All the stipulations laid down in the GS shall apply.

15.2 Packaging and Shipping

15.2.1 All equipment Goods and materials shall be properly inspected to ensure that there are no defects before shipment. An inspection tag bearing the words "INSPECTION PASSED" giving reference number to the inspection date and details to permit verification of inspection details shall be attached to those items inspected satisfactorily.

15.2.2 The four adjacent sides of each package shall be marked with permanent paint with the following information:

- a) CONSIGNEE
- b) COMMODITY
- c) CONTRACT No
- d) SHIPPING MARK

15.2.3 Appropriate caution notices such as "FRAGILE", "HANDLE WITH CARE", "KEEP DRY", "KEEP UPRIGHT" along with visual display symbols internationally accepted shall be conspicuously displayed on the outside surfaces of boxes, crates and packages.

15.3 Delivery

15.3.1 The Contractor shall be responsible for transportation and delivery of materials to site or to the storage space and shall continue to be responsible for its safe storage, handling, erection and commissioning.

15.4 Specific Requirements

15.4.1 Power and Control cables

- a) Cables shall be supplied on drums of adequate strength in the longest possible lengths consistent with the requirement.
- b) Each cable drum shall have a distinct identification number displayed on the outside flange. It shall also display following additional particulars
 - i) Voltage designation
 - ii) Length
 - iii) Conductor Size
 - iv) No. of cores
 - v) Drum No.
 - vi) Gross and net weights
- c) The cable shall be inscribed with Jaipur Metro Rail Corporation.

- d) An arrow showing direction of rolling shall be shown. Both ends of the cables shall have heat shrinkable caps. The caps shall incorporate a sealant which melt on heating at temperatures well above outdoor ambient expected in Jaipur area.

15.4.2 Sub assemblies

- 15.4.2.1 All the products shall be completely assembled before packing and shipping. If impracticable, the products shall be delivered in sub-assemblies clearly marking on each such assembly the identity of the particular assembly to which it belongs so that lots of different sub assemblies can be collected and stored together to form full assemblies at site.

15.4.3 Gas Insulated Switchgear

- 15.4.3.1 All enclosures of GIS shall be filled with inert gas before packing.
- 15.4.3.2 Necessary precautions shall be taken during shipping, handling and storage as per manufacturer's recommendations.

15.4.4 Rigid OCS

- 15.4.4.1 Necessary precautions shall be taken during shipping, handling and storage as per manufacturer's recommendations

END OF CHAPTER

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CHAPTER – 16

INSTALLATION

16 INSTALLATION

16.1 General Requirements

- 16.1.1 The Contractor shall comply with all Enactments in executing the Works, including but not limited to all statutory provisions on occupational health and safety.
- 16.1.2 The Contractor shall co-ordinate with Other Contractors in the execution of the Works.
- 16.1.3 The Contractor shall also co-operate with all Relevant Authorities in the execution of the Works.
- 16.1.4 The installation of all equipment shall be undertaken at all times by suitably trained and competent employees of the Contractor, to the satisfaction of the Employer's Representative.
- 16.1.5 Only appropriate tools, plant, equipment and vehicles shall be used.
- 16.1.6 Installation of all equipment shall be in accordance with the Construction and Installation Plan described in the GS.
- 16.1.7 Installation of all equipment shall conform to the best industry practices.
- 16.1.8 Precautions shall be undertaken to ensure the safety of personnel and equipment for all installation works.
- 16.1.9 The Contractor shall, prior to starting any installation work, identify any possible hazards, and implement measures of eliminating and/or controlling such potential hazards, in line with safe working practices.
- 16.1.10 Further details on Site safety management are described in Chapter 17 and Appendix 2 of the GS.
- 16.1.11 The Contractor shall ensure that all areas of work are sufficiently illuminated for the works to be undertaken and that a safe system of work is employed for all activities.
- 16.1.12 The Contractor shall operate a robust system for the control of persons entering or working upon the site. The system shall include as a minimum:
 - a) register of all employees;
 - b) personal identification, with photograph;
 - c) levels of competency;
 - d) date of expiry;
 - e) date of issue;
 - f) signature; and
 - g) register of all visitors.
- 16.1.13 The Contractor shall co-operate, at all times, with the Engineer and Other Contractors to ensure that the Site is protected from unauthorised admission, either wilfully or otherwise.
- 16.1.14 The Contractor shall make due provision for the safe access and egress to the Site of Works for its staff and subcontractors. This access shall be maintained such that it is free of all hazards and is in a safe condition throughout the duration of the Works.

16.2 Specific Requirements

- 16.2.1 The installation work pertaining to this Contract shall include, but not be limited to the following: -
- a) Finalisation of the Construction and Installation Programme;
 - b) Survey on Site and review the technical requirements shown in this Specification and the Employer's Drawings;
 - c) Production of the calculation sheets and installation drawings for Site installation;
 - d) Installation in accordance with the finalized installation drawings;
 - e) Co-ordination with Other Contractors;
 - f) Submission of the installation reports and records;
 - g) Testing and commissioning, as per finalized protocol and programme.
 - h) Production of as built drawings, documents, calculation sheets, and records.

16.3 Construction and Installation Plan

- 16.3.1 The Contractor shall undertake installation work in stages as shown in the detailed installation programme. Installation, testing and commissioning of later stages shall not impact revenue operation of earlier stages.

- 16.3.2 As a minimum, the detailed Construction and Installation Plan shall include but not be limited to all the activities described in clause 16.2 of this TS and clause 3.6.1 of the GS, installation details and methods of all activities equipments and tools to be used for installation, safety issues, supervision, temporary land occupation needed and the vehicles to be used for installation.

16.3.3 Manual Handling

To facilitate handling of traction and auxiliary power equipment in underground stations during installation and maintenance thereafter, the Contractor shall closely co-ordinate and interface with Civil Contractors for installation of the material handling equipment necessary for loading/ unloading of electrical equipment from flat rail cars on tracks, including any travelling hoist arrangements required as well as for provision of hatches wherever required.

The work of installation of the hoists, if needed, shall be closely coordinated with Civil Contractors who will have to design the structures, install the beams at appropriate locations and provide the hoists.

The entire material handling plan for the movement of bulky equipment, such as 25 kV interrupters etc. shall be carefully planned.

16.4 Works Area

- 16.4.1 The Contractor will be given temporary work sites as stipulated in clause 3.8 of this Specification.
- 16.4.2 The Contractor shall comply with the requirements specified in Chapter 17 of the GS in relation to the use of works sites allocated to the Contractor.

16.5 Temporary Works

- 16.5.1 The design of the Temporary Works shall be submitted to the Engineer for review.
- 16.5.2 All Temporary Works shall be removed on completion of the Section, or as directed by the Employer's Representative.
- 16.4.3 All Temporary Works shall be clearly distinguishable from the Permanent Works.

16.6 Works Train

- 16.6.1 The Contractor shall provide a minimum of one set of rail cum road vehicle for construction with exhaust pollution norms of minimum EURO-II.
- 16.6.2 For the use of any Works Train, the Contractor shall ensure its safe loading, restraint against shifting while in motion and that the dimensions of materials and/or equipment carried shall not exceed the space constraints (Schedule of moving dimensions) of tunnels and that no other track and tunnel related installation will be damaged during its use.
- 16.6.3 The Contractor is advised to carefully consider the Works Train design so that the working platforms have the flexibility to enable the train to pass the height restriction and yet be of sufficient height for safe and efficient installation of the OCS, when on Site.

16.7 Site Supervision and Safety Issues

- 16.7.1 The Contractor shall set up a Site supervision system, which shall be part of the overall safety, system assurance and quality management system.
- 16.7.1.1 Details of Health and Safety requirements at Site are described in Chapter 18 of the GS and Safety & Health Manual.

16.7.2 Quality Management

- 16.7.1.2.1 The Contractor shall adopt an appropriate quality management system throughout the entire Site installation period to ensure that the System performance requirements as specified in Chapter 4 of this TS are achieved.
- 16.7.1.2.2 The Contractor shall provide sufficient number of suitably experienced supervisors and skilled workers to ensure that the progress and quality of the work, both on Site and in the Contractor's workshops, are maintained to the satisfaction of the Employer's Representative.
- 16.7.1.2.3 Supervisors shall have a minimum of five years' previous experience in a supervisory capacity on similar projects and all the skilled workers including linesmen electricians fitters and craftsmen, shall have a minimum of two years' previous experience in installation of similar systems.

- 16.7.1.2.4 The Contractor's supervision system shall be responsible not only for the supervision of the Concerned system installation but also for the supervision of the installation of the primary fixing system (civil inserts), the earth mats systems, etc. that are to be installed by the Civil Contractors. The supervisors shall work on a full-time basis during the entire installation process.
- 16.7.1.2.5 The Contractor shall maintain a set of drawings at each project site which accurately reflect the current status of field changes. The Contractor shall obtain letter of no objection from the Engineer for any such changes. The Contractor shall prepare final drawings showing the as built configuration. These drawings shall be developed in a logical format to facilitate routine system maintenance and troubleshooting. All drawings and details shall be endorsed by the Contractor.
- 16.7.1.2.6 The Engineer reserves the right to undertake, at any time, checks on the proficiency of the Contractors staff, licensing and all associated documentation. Should any of the Contractors staff be found incompetent or unlicensed he shall be removed from the site until their Competency has been established.

16.8 Installation of Cables

16.8.1 Laying of Cables

- 16.8.1.1 The Contractor shall co-ordinate with the Civil Contractors for the installation of cables in cable galleries, trenches, ducts, troughs, risers and shafts.
- 16.8.1.2 The cable system shall, during installation, be fully protected from mechanical damage and be generally accessible at all points for inspection along its entire route. Suitable cable markers shall be provided for covered cables upon completion of installation.
- 16.8.1.3 Should it prove necessary to cut any cable during installation, all cut ends shall be properly sealed.
- 16.8.1.4 The maximum pulling force of any cable during installation shall not exceed the design force of cables.
- 16.8.1.5 All cables shall be installed in the formed cable trenches, shafts, tunnels, hangers, trays and brackets. The minimum recommended bending radius of the cables shall not be exceeded during installation. Cable shall be laid as per relevant IS & IEC Standards.
- 16.8.1.6 All materials used for termination, jointing and installation of cables in tunnel and confined spaces shall have flame retardant, low smoke, halogen free characteristics.

16.9 Workmanship

16.9.1 General

- 16.9.1.1 All the installation shall be carried out according to the instructions shown in this Specification and Employer's Drawings.
- 16.9.1.2 All assemblies of equipment and their components and parts shall be completely interchangeable if they are of similar type
- 16.9.1.3 The style and procedure of the workmanship shall be consistent throughout the Works. Unless otherwise specified, the Engineer shall decide the final colours for all paint work and other finishes to be applied to any part of the Works.

16.9.1.4 All parts, which are subject to, wear or damage by dust shall be completely enclosed in dust proof housings.

END OF CHAPTER

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CHAPTER – 17

SUPERVISION AND PLANNING OF MAINTENANCE

17 SUPERVISION AND PLANNING OF MAINTENANCE

17.1 General

- 17.1.1 The scope and requirements of supervision and planning of maintenance are stipulated in Chapter 12 of GS
- 17.1.2 The following outlines the Employer's maintenance strategy, different levels of maintenance, the Maintenance Management System and the arrangement for maintenance.
- 17.1.3 The Contractor shall make use of all relevant information to provide supervision of maintenance.

17.2 Employer's Maintenance Strategy

17.2.1 Maintenance Strategy

- 17.2.1.1 The Contractor shall ensure that the design of the software and hardware of the system designed, installed and commissioned is supportable throughout the service life of the System to address, as a minimum, the following:
 - a) design errors in the System;
 - b) operational changes;
 - c) environment changes; and
 - d) changes in infrastructure.
- 17.2.1.2 According to the maintenance strategy, all equipment and infrastructure supplied for the 'Project' must be designed for minimum or no maintenance. Maintenance activities required must be capable of being performed with little or no impact on the train service. In addition, the maintenance work systems shall ensure safety of personnel and equipment.
- 17.2.1.3 During the Defects Liability Period (DLP) maintenance of all Works will be conducted by the Employer under the supervision of the Contractor.
- 17.2.1.4 The Contractor shall ensure that in order to supervise maintenance during the DLP, personnel are always available with the relevant skills and level of competence.
- 17.2.1.5 The Contractor, upon noticing any defects, deficiency in quality and quantity of spares and materials shall without delay arrange for alternative source of supply and submit his proposal to the Engineer for review.
- 17.2.1.6 The consumable (if any) during DLP will be supplied by Contractor.

17.3 Different Levels of Planned Maintenance

- 17.3.1 Routine preventative maintenance will be carried out at regular intervals based on condition, reliability, usage, and service history and equipment manufacturers' recommendations. The Operating and Maintenance Manual shall describe the different levels of planned maintenance.

17.4 Supervisory Staff

- 17.4.1 For this Contract, clause 17.4.2 of this Specification supersedes clause 12.3.1 of GS.
- 17.4.2 The Contractor shall provide supervisory maintenance staff who are expert in all the different levels of fault finding, maintenance and repair of the various systems supplied under the Contract covering at least the following: -
- a) Cabling system 25 kV ac traction and return, and 415V ac
 - b) 25 kV SS/SP, isolating and earthing switches
 - c) 25 kV rigid OCS and return circuits
 - d) EMI protective provisions, earthing and bonding.
- 17.4.3 Stipulations of clauses 12.3.2, 12.3.3 and 12.3.4 of the GS shall apply here.

17.5 Maintenance during DLP

17.5.1 Maintenance Management System (MMS) and Maintenance Arrangement

- 17.5.1.1 During non-operation time, sections of line will be closed for maintenance work. The minimum time for possession periods is 3 hours. Ideally, this time shall be the free time available for work. It excludes time required for trains to return to their stabling point and time required to take and give up possession. This time is, however, not available for maintenance in depot.

17.5.2 Competency of Personnel

- 17.5.2.1 During the DLP the Contractor shall support the Employer with sufficient trained and competent personnel.
- 17.5.2.2 Such persons shall have their generic competence established and must demonstrate their specific competence and knowledge in the particular systems, environment and procedures.
- 17.5.2.3 The Contractor shall provide evidence of specific competence and knowledge, which shall include:
- a) assessment and certified training in particular software applications and operations;
 - b) recording of competence and work in the license holders logbook; and
 - c) receiving or in receipt of sufficient and current exposure to the area of work that the holder is licensed for.
- 17.5.2.4 Routine spot checks on licensing may be carried out from time to time by the Engineer qualified personnel on the proficiency of the Contractor staff.
- 17.5.2.5 In the event of a failure, the Contractor shall undertake the management and investigation necessary to identify and rectify the cause.
- 17.5.2.6 Should the Employer, during the DLP require further investigations at other Sites throughout the system, the Employer will formally request the Contractor to Undertake such investigations.
- ##### **17.5.3 Testing and Re-commissioning of System and Equipment**
- 17.5.3.1 In the event of a failure requiring modifications to the System, the Contractor shall undertake any testing and re-commissioning required.

17.5.3.2 Any such modification shall be submitted for review by the Engineer.

17.5.4 Temporary Alterations to Restore Service

17.5.4.1 The Contractor shall undertake any temporary modifications necessary to maintain service.

17.5.4.2 Any such modification shall be submitted for review by the Engineer.

17.5.5 Discrepancies between Installation and Design Records

17.5.5.1 Should the Contractor discover inconsistencies between the maintenance drawings and documentation and the installed equipment, the Contractor shall correct all such errors within two weeks.

17.5.6 Communications

17.5.6.1 The Contractor shall ensure that adequate communication facilities are provided to its staff during the DLP.

17.5.7 Location of Staff

17.5.7.1 The Contractor shall be responsible for locating staff such that the Contractor meets its obligations.

17.5.8 Storage of Equipment and Materials During the Maintenance Period

17.5.8.1 The Contractor shall ensure that no equipment is to be stored along the trackside.

17.5.8.2 The Employer will provide defined storage locations for the support of the different levels of Maintenance.

17.5.8.3 The Contractor shall satisfy itself and the Engineer that the storage locations for equipment and materials will meet the performance requirements of this TS.

17.5.9 Maintenance Regimes

17.5.9.1 The Contractor shall provide documented maintenance regimes to be followed by the Employer upon substantial completion of various components of the work until the end of the DLP.

17.5.9.2 The Contractor shall produce a maintenance regime for the equipment that shall comprise two constituent parts, corrective and routine/preventative maintenance.

17.5.9.3 Routine/preventative maintenance shall be non-intrusive to the day-to-day operation of the train service and be capable of being pre-planned in advance of the work.

17.5.9.4 Corrective maintenance shall be available 24 hours per day, able to respond to all foreseeable circumstances.

17.5.9.5 The maintenance regime shall cover all parts and equipment of the system designed, installed and commissioned by the Contractor.

17.5.9.6 The Contractor shall take into account the requirements of the operations and maintenance when determining and proposing its maintenance regime.

17.5.10 Scope and Hours of Coverage

17.5.10.1 The regime and structure of corrective maintenance shall be robust in design.

The Contractor shall provide a full 24 hour On-Call coverage and shall be such that initial response and rectification of failure are in accordance with the following:

- a) assistance to first line and corrective maintainer within 30 minutes, upon request of first line maintainer;
- b) 24 hour from notification to collection for third line maintenance; and
- c) replacement or repair of component from factory within 2 weeks including transportation time. Any extension to this time shall be agreed with the Employers and a replacement provided.

17.5.10.2 All elements of First Line preventative maintenance shall be carried out and completed during non-traffic hours without interrupting train services.

17.5.11 Failure Investigations

17.5.11.1 The Contractor shall conduct failure investigations.

17.5.11.2 The OCC Controller will determine priorities in the event of a conflict between the Contractor and other contractors during failure investigation.

17.5.11.3 Disputes between the Contractor and other Contractors will be resolved by the Engineer.

17.5.11.4 The Contractor shall make available to the Employer all test and failure data as required.

17.6 Not used

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 18

SPARES, SPECIAL TOOLS, TESTING AND DIAGNOSTIC EQUIPMENT AND MEASURING INSTRUMENTS

18 SPARES, SPECIAL TOOLS, TESTING AND DIAGNOSTIC EQUIPMENT AND MEASURING INSTRUMENTS**18.1 General**

18.1.1 The Contractor shall supply spare parts, special tools and test equipment in accordance with the requirements of Chapter 13 of GS and this Specification.

18.2 Contract Spares

18.2.1 The Contractor shall supply quantity of spare parts in accordance with clause 13.3 of GS.

18.2.2 Notwithstanding clause 13.3.5 and 13.3.6 of GS, the Contractor shall supply a minimum quantity of the following items of Spares as given below in Table 18.2-1. The price of below quantity of spare should be quoted in the item provided in cost centre C-spares of pricing document. The evaluation of the tender shall be done considering this price of spares. Upon approval of the Engineer the procurement of spares should be done by contractor.

Table 18.2-1 Minimum Quantity of Contract Spares *

Sr. No.	Item	Quantity	
A	Rigid OCS Spares		For JP/EW/1B/E2
1	Rigid OCS with all its components, fittings and fixtures including contact wire, OPC, TEW, RC and any other material required for installation.		0.5 track kilometres
2	25kV cable		0.5 km (in appropriate number of drums)
3	25kV cable straight joints		5 Nos.
4	25kV cable termination kits		2 of each type
B	27.5 kV GIS Spares		
7	Vacuum Circuit Breaker 2000 A consisting of 2 Vacuum Chambers in series		1 nos
7.1	Vacuum Circuit Breaker 1250 A		1 no.
8	Drive motor for VCB		1 no.
9	Drive Motor for Disconnecter		1 no.
10	Metal enclosed Voltage Transformer (VT)		1 no.
11	Closing Coils		2 nos.

Sr. No.	Item	Quantity	
12	Tripping Coils		2nos.
13	Blocking Diodes		2nos.
14	SF6 leakage detector		1 no.
15	One light weight assembling type ladder trolley		1 no.
16	Gas Analyzer (Dew point meter of latest specifications)		1 no.
17	Conductor mounting trolley – Aluminium type		1 no.

Conductor mounting trolley shall be capable of safely installation and dismantling of all ROCS components (e.g. conductor rail etc.). The trolley should be capable of running on both tracks as well as ground section of tunnels.

- ;
- Spare shall be procured only after the approval from the engineer. The quantity of spares given can be increased or decreased by the engineer. The equipments/kits supplied should be as per latest specifications/models and should be compatible with the system (ROCS & ASS) being installed in this contract. Approval for the specifications should be taken from engineer before placement of the order.

18.3 Second Sourcing

- 18.3.1 The Contractor shall identify principal and second-source suppliers that can supply the Contract Spares
- 18.3.2 The Contractor shall ensure that second-source supplier information is maintained up to date upto a period of 10 years after taking over of whole works. The Contractor will provide support to the Employer to a reasonable extent regarding the second-source supplier information throughout the service life of the system.
- 18.3.3 The Contractor shall make the second-source supplier information available to the Engineer at the time of submission of the final design and taking over of the works.

18.4 Long Lead Times

- 18.4.1 The Contractor shall identify the lead times for all spare parts. Parts with long lead times shall be identified in the spares list.

18.5 Routine Change

- 18.5.1 In the event that any item of the supply requires to be routinely changed or calibrated regardless of whether it appears in the spares list or not, it shall be identified to the Engineer together with the routine change interval.

18.6 Shelf Life

- 18.6.1 In the event that any of the spares identified have a particular life or storage requirement, this shall be made known to the Engineer with the submission of the spares list, including the necessary action for disposal or storage.

18.7 Special Tools, Testing and Diagnostic Equipment and Measuring Instruments

The Contractor shall supply adequate quantity of special tools, testing and diagnostic equipment and measuring instruments in accordance with clause 13.6 of GS in order to carry out all the functions necessary for operation and maintenance of the entire system and also considering the requirements as described in the Operation and Maintenance Manuals. The special tools, testing and diagnostic equipment and measuring instruments shall also include apart from the other necessary items.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 19

TRAINING AND TRANSFER OF TECHNOLOGY

19 TRAINING AND TRASFER OF TECHNOLOGY

19.1 General Requirements

- 19.1.1 The Contractor shall provide comprehensive training to the Employer's staff in accordance with the requirements contained in this TS and in the GS (Chapter 10). A central training school has been planned in the Depot area for this purpose.
- 19.1.2 The training shall be carried out at such locations where the greatest benefit for trainees may be gained. This may be in India, abroad, at place of manufacture, assembly or testing, or at such other locations as may be necessary. All places of training shall be subject to review by Employer's Representative.
- 19.1.3 The training courses and/or sessions shall include system performance requirements and all major equipment and works designed, by the Contractor.
- 19.1.4 The specific objectives of each course, training facilities to be used, the qualification and experience of the training instructors and the assessment criteria shall be developed by the Contractor and submitted to the Engineer for review at least three months before any course is conducted.
- 19.1.5 Manuals to be used for training, including the manuals to the instructors and trainees, shall be delivered to the Engineer at least six months before the issue of the Substantial Completion Certificate for the Works, as required under Chapter 10 of the GS. The training manuals shall be submitted in original plus five hard copies and in electronic format.
- 19.1.6 The Contractor shall provide full-time on-Site management and co-ordination of the entire training programme to ensure the continuity of classes, and proper distribution of training materials, and be responsible for interfacing with the instructors.
- 19.1.7 The training courses shall be delivered to all relevant Employer's staff, including instructors, operation and maintenance engineering staff.
- 19.1.8 The proposed training requirements are given in Appendix K of this Specification

19.2 Mock Up for Training

- 19.2.1 The Contractor shall install mock up equipment for system and any such facility(s) considered necessary for the training of Employer's staff in the training school.
- 19.2.2 **The training mock up shall include but not limited to the following: -**
 - a) OCS system components
 - b) Contact, messenger and aerial earth wires;
 - c) Section insulator;
 - d) Jumper and cable connections to OHE;
 - e) Rail bonds and cable rail connections of return circuits;
 - f) Circuit breakers, Interrupters and their component assemblies;
 - g) Isolators;
 - h) Pantograph of rolling Stock, Circuit Breaker, GIS, etc.

- i) Clear photographs of various equipment such as transformers, their windings, rectifier and inverter sets;
 - j) Samples of various clamps and fitting used;
 - k) Control panel, protection schemes, earthing and bonding arrangement;
- 19.2.3 The Contractor shall submit full details of the training span and other mock up equipment, photographs etc. including proposed training activities and objectives, for the Engineer review.
- 19.2.4 The Contractor for training purposes shall also supply any special tools and equipment required to be used.
- 19.3 Training Plan**
- 19.3.1 The Contractor shall submit a Training Plan in accordance with the requirements of the General Specification. In addition, the Training Plan shall include the following:
- 19.3.1.1 Details of the Contractor's ability to carry out the necessary training.
 - 19.3.1.2 Details of the proposed approach to structuring and providing the courses required.
 - 19.3.1.3 Course details including duration, maximum number of trainees, ratio of trainees to trainers, facilities required or available and prerequisites for attending the course.
 - 19.3.1.4 Recommendations for additional training or alternative means by which the Employer's training objectives may be met.
- 19.3.2 The Training Plan shall be submitted for review by the Engineer and will be Implemented in a timeframe such that complete and comprehensive training has been received by the designated Employer's staff prior to the System Acceptance test.
- 19.4 Training of Employer's Training Instructors (ETI)**
- 19.4.1 The objective of the training is to enable the Employer's Training Instructors to be competent to deliver future courses for other employees of the Employer.
- 19.4.2 The Contractor shall provide training to the Employer's Training Instructors on the various Systems. Aspects covered shall include, but not be limited to, the following:
- a) Configuration of the entire System, including interface with the JMRC Traction Sub Stations supply system at the in feed points;
 - b) Feature and functional principles of the entire System;
 - c) System design aspects including but not limited to design standards, design criteria and parameters, short-circuit and other calculations, insulation and protection co-ordination;
 - d) Details of major equipment and material including but not limited to 25 kV circuit breakers, isolators, voltage and current transformers, OCS conductors, fittings, assemblies and protection relays, batteries and chargers, and cables of different types and their joints used in the System;
 - e) System operation and maintenance management and procedures;
 - f) Earthing and bonding arrangement, covering safety aspects of touch and step potential safety to personnel, passengers and outsiders.

19.5 Operations Staff Training

- 19.5.1 The objective of the training is to enable the Employer's operations staff to be familiar with the Systems, with focus on the operational aspects under normal and emergency conditions.
- 19.5.2 The training shall also enable the trainee to acquire full capability for identification, trouble shooting and rectification of faults in the specified duration. After classroom training which includes mock ups of equipment, the staff shall be trained in actual operation.

19.6 Maintenance Staff Training

- 19.6.1 The objective of the training is to enable the Employer's maintenance staff and Engineering staff to be familiar with the Systems focus on the maintenance aspects of the System including but not limited to the following:-
- a) Full understanding of all the equipment, sub-systems and system, their function, maintenance and overhaul requirements.
 - b) Procedures to be followed for unscheduled maintenance and repair.
 - c) Identification of failed components and sub-systems in electronic equipment by use of special test kit as necessary.
 - d) Modification in the software to extend or modify the control, monitoring and protection functions.

19.7 Not used

19.8 Transfer of Technology

- 19.8.1 Bidder shall submit the detailed plan of transfer of technology along with MOU with suitable Indian companies or company having proven track record and working in related areas for major systems / subsystems in accordance with clause 10.7 of GS.
- 19.8.2 TOT shall be essential and shall include system assembly, installation, maintenance and software modification / customisation and training of Employer's personnel to cover the systems/ subsystems:
- Rigid OCS
 - GIS
 - Traction Power Supply equipment
- 19.8.3 TOT shall essentially include the following aspects as a minimum:
- Engineering or extensions and up gradations of the System
 - Re-engineering to suit changed traffic conditions
 - Incorporation of optional facilities
 - Change in parameters of Rolling Stock
 - Any other configuration / programmes required for maintenance / up gradation of hardware software.
- 19.8.4 The Transfer of Technology shall require involvement of Employer's personnel in each of Sub-systems during the Contract period. The sponsored engineers shall be under the

technical administrative control of the Contractor. It is tentatively proposed to deploy 2 No. Employer's personnel for this purpose.

- 19.8.5 The Contractor shall undertake to supply or make arrangement with the original manufacture supply additional equipment required for replacement or expansion of the network in future.
- 19.8.6 The contractor shall undertake to provide, if required during the life of the equipment ordered, technical assistance in the form of additional drawings, maintenance practices and technical advice.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 20

OPERATION AND MAINTENANCE

DOCUMENTATION

20 OPERATION AND MAINTENANCE DOCUMENTATION

20.1 General

- 20.1.1 The Contractor shall provide Operation and Maintenance manuals, for use by supervisory, operating and technical staff of Employer. All Operation & Maintenance manuals shall provided in English and Hindi language both. The Contractor shall provide the Operation and Maintenance manuals in soft copy also (4 set).
- 20.1.2 Requirements of submission have been furnished in Chapter 11 of GS.
- 20.1.3 Each and every manual shall be divided into indexed sections explaining the subject matter in logical steps. Most manuals shall consist of A4-size printed sheets bound in stiff-cover wear-resistant binders clearly and uniformly marked with the subject matter and reference number. Where alternative sizes are proposed, (e.g. A5/A6 pocket books of schematic wiring diagrams) these shall be submitted for review of Employer. The binding shall allow for all subsequent changes and additions to be readily effected.
- 20.1.4 Information shall be provided in pictorial form wherever possible and shall include step-by-step instructions and views of the particular equipment including exploded views. Programmable equipment shall be supplied with sufficient flow charts and fully documented programmes to enable faults to be quickly identified and system modification to be undertaken at any time.
- 20.1.5 The Contractor shall provide clarifications and amendments to the Operation and Maintenance manuals as necessary during the Defects Liability Period. Updates shall be provided for the originals and all copies.

20.2 Operation Manuals

- 20.2.1 The Contractor shall provide operation manuals explaining the purpose and operation of the complete system together with its component subsidiary systems and individual item of equipment. The characteristics, ratings and any necessary operating limits of the Equipment and Sub-systems shall be provided. The Operation Manuals shall focus on operation aspects under normal and emergency conditions.

20.3 Maintenance Manuals

- 20.3.1 The Contractor particulars of operating parameters, tools for dismantling and testing, methods of assembly and disassembly, tolerances, repair techniques and all other information necessary to set up a repair and servicing programme.
- 20.3.2 The Contractor shall provide documentation for all hardware and software for computer systems and other associated electronic equipment to meet the following requirements. Such documents shall include but not be limited to:
- i) manufacturers' documentation supplied as standard with the equipment;
 - ii) hardware configuration with details of expansion capabilities and options;
 - iii) programme loading instructions, including runtime environment configuration;
 - iv) programme listing including comprehensive 'comment statements' in hard copy and soft format for source code, compilers and development tools necessary to modify and recompile software;

- v) Flow charts, data flow diagrams and state diagrams as appropriate;
 - vi) description of software modules including purpose, linkage with other modules, error routines and any special considerations;
 - vii) memory maps for both internal and peripheral memory showing description of all programmes, data files, overlay areas, memory available for expansion and the like;
 - viii) loading and operating instructions for diagnostic programmes and specifically developed debugging tools; and
 - ix) programming manuals relevant to operating systems, languages, development tools, etc.
- 20.3.3 The manual shall also include inspection/overhaul procedure and periodicity of various inspection/overhaul schedules in detail including the tools, special tools/plants, and facilities required. The manual shall be subject to review by the Engineer.
- 20.3.4 The maintenance manual shall also include an illustrated parts catalogue of all plant supplied and shall contain sufficient information to identify and requisition the appropriate part by maintenance staff. The catalogue shall comprise 3 sub-sections.
- 20.3.5 The first shall be an alphanumeric parts list, which shall include the following information:
- i) Part number
 - ii) Description
 - iii) Name of manufacturer
 - iv) Quantity and Unit
 - v) Part number of next higher assembly (usually a line replaceable unit).
 - vi) Cross-reference to figure number.
 - vii) Category : e.g. consumable, line replaceable unit, repairable.
 - viii) Life-expected life, Mean time between failure or mean distance between failure where available.
 - ix) General or specific purpose
- 20.3.6 The second is a series of illustrations to indicate the location of each replaceable item which shall be clear and progressive with exploded views to enable parts to be identified easily by cross-reference with the alpha-numeric list.
- 20.3.7 And the third an indicative price list which shall list in alpha-numeric sequence the part number with the price, lead time and vendor.
- 20.4 **Interactive Manual**
- 20.4.1 The contractor shall submit in English language Interactive Electronic Technical Manuals (IETMs) to manage technical documentation. IETMs shall compress volumes of text into CD-ROMs which may include sound and video, and shall allow readers to locate needed information rapidly than in paper manuals.
- 20.4.2 This IETM shall follow the structure and format of a printed book, with indexes and table of contents that are hyperlinked into the content of the document. All figures, tables and section references shall be linked.

- 20.4.3 The data to be stored in a relational database, obtaining benefits of data integrity and removal of data redundancy. Relationships in the content that are presented as hyperlinks are mapped directly to relations in the database scheme. The IETM shall be able to change the content dynamically based on user's navigation and input through the content; the content may now be user specific.

20.5 **Quantity of Manuals**

- 20.5.1 The Contractor shall supply Original plus five hard copies of Operating Manuals; Maintenance Manuals and Subsystems / Systems spare parts catalogue. These Manuals and Catalogue shall also be submitted in electronic interactive format.
- 20.5.2 The format of the electronic copies shall be proven in at least two other applications and shall allow for links between parts catalogue and maintenance instructions.
- 20.5.3 The Documents Management System and Language used shall be subject to Engineer's review.

20.6 **Working model for training**

The Contractor shall develop a working model for the training institute which will be used as a reference for producing a working prototype. This model shall represent the key physical characteristics of the selected ROCS system or process by having different types of switching stations, cable connections, OCS sections, transition arrangements, overlaps etc.

The model shall be minimum 10 meter in length and shall depict all the key information about the ROCS system so that the same can be simply understudied by the engineers.

The working model shall be provided indoor as well as outdoor for training of staff. The model will as per architectural, technical working models. The model should be designed to provide all the details and sections required for understanding the ROCS. The design of models shall be submitted to Engineer for approval.

END OF CHAPTER

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 21

PROGRAMME REQUIREMENTS

The programme requirements (Key Dates) for JP/EW/1B/E2 Lot 1 and JP/EW/1B/E2 Lot 2
have been defined in the Appendix-1A of Form of Tender

CONTRACT PACKAGE – JP/EW/1B/E2

CHAPTER – 22

SITE FACILITIES

22 SITE OFFICE

22.1 General

The Contractor shall have their site office accommodation, equipment, communication and drawing facilities and transport throughout the course of the works and for so long a period of time during the defects liability period as the Engineer may require. The details of the accommodation and other facilities are as under.

22.2 Site Offices

Site office of the contractor should be fully equipped with the following basic adequate facilities:

- Fax & Phones (Telephone P&T line)
- Photocopier
- Computer with coloured A4 size printer & other
- Peripheral CS Writer, CD, Floppy
- Plotter
- Digital Camera

END OF CHAPTER



**Procurement of Plant
Design, Supply and Installation
JAIPUR METRO RAIL CORPORATION LIMITED
BIDDING DOCUMENT
for
Procurement
of**

NCB No.-JP/EW/1B/E2

**DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION,
TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV
AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA
SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID
TRANSPORT SYSTEM PROJECT PHASE-1B**

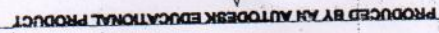
PART-II REQUIREMENTS

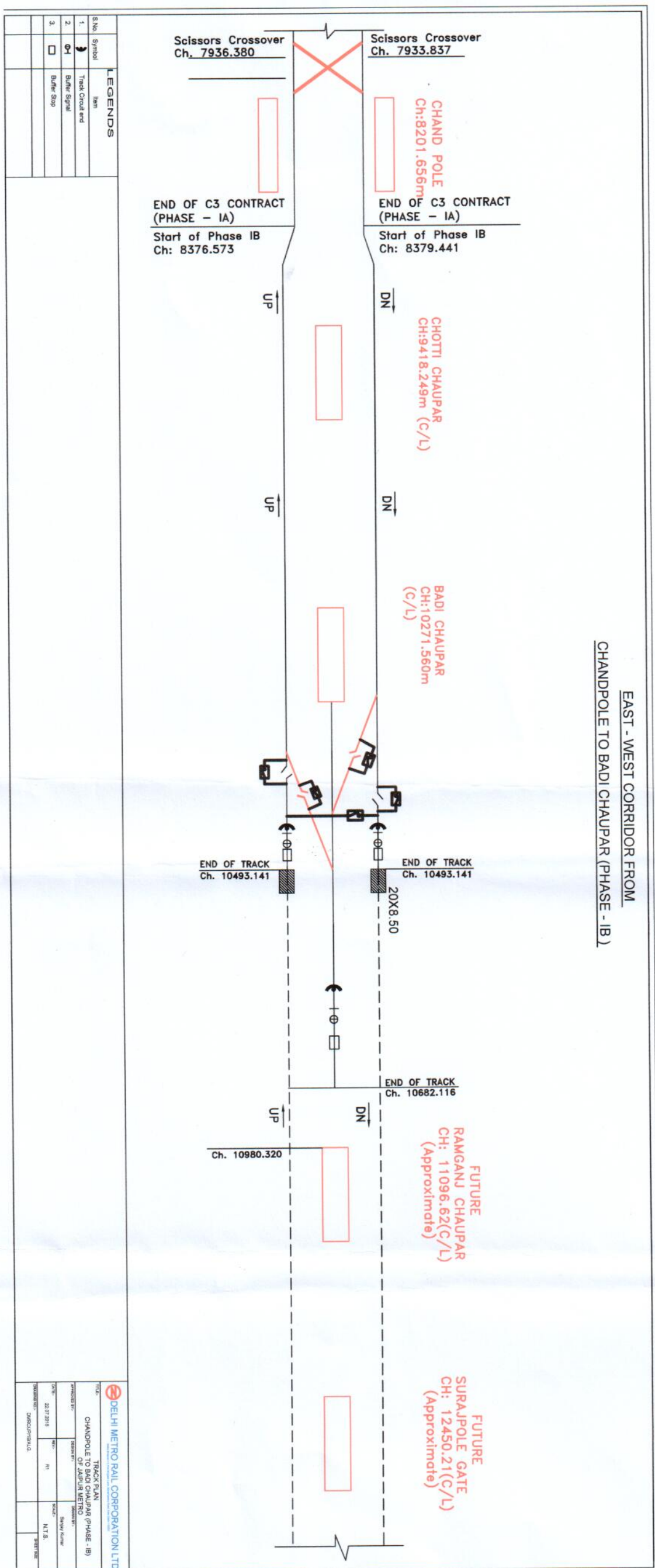
Section 6 - Employer's Requirements (ERQ)

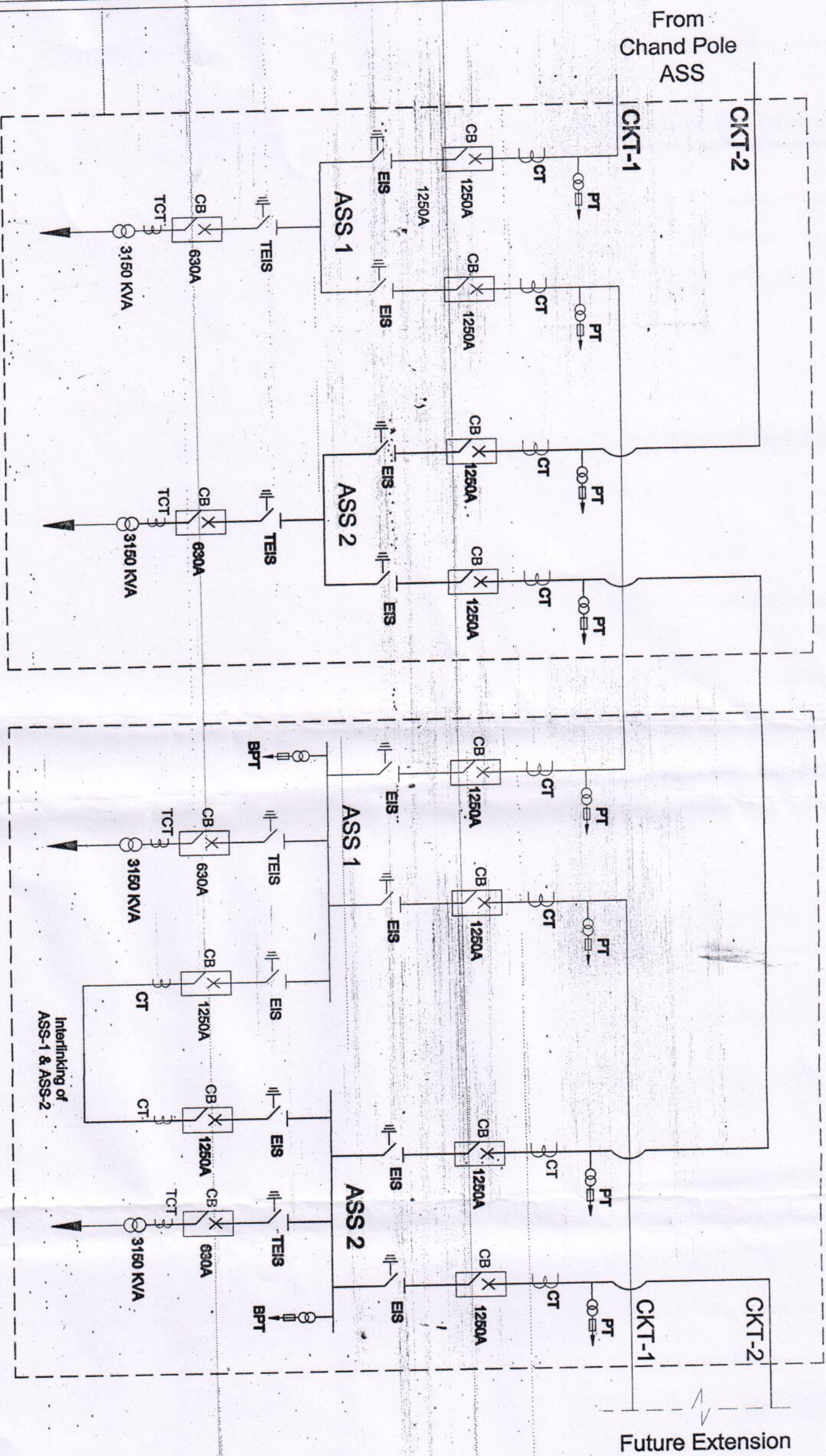
Volume – III Bid Drawings

JAIPUR METRO RAIL CORPORATION LTD.

**Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**







CHOTTI CHAUPAR ASS

BADI CHAUPAR ASS

TENDER DRAWING

LEGENDS

S.No.	Symbol	Item
1.		PT
2.		CT
3.		CIRCUIT BREAKER
4.		TRANSFORMER

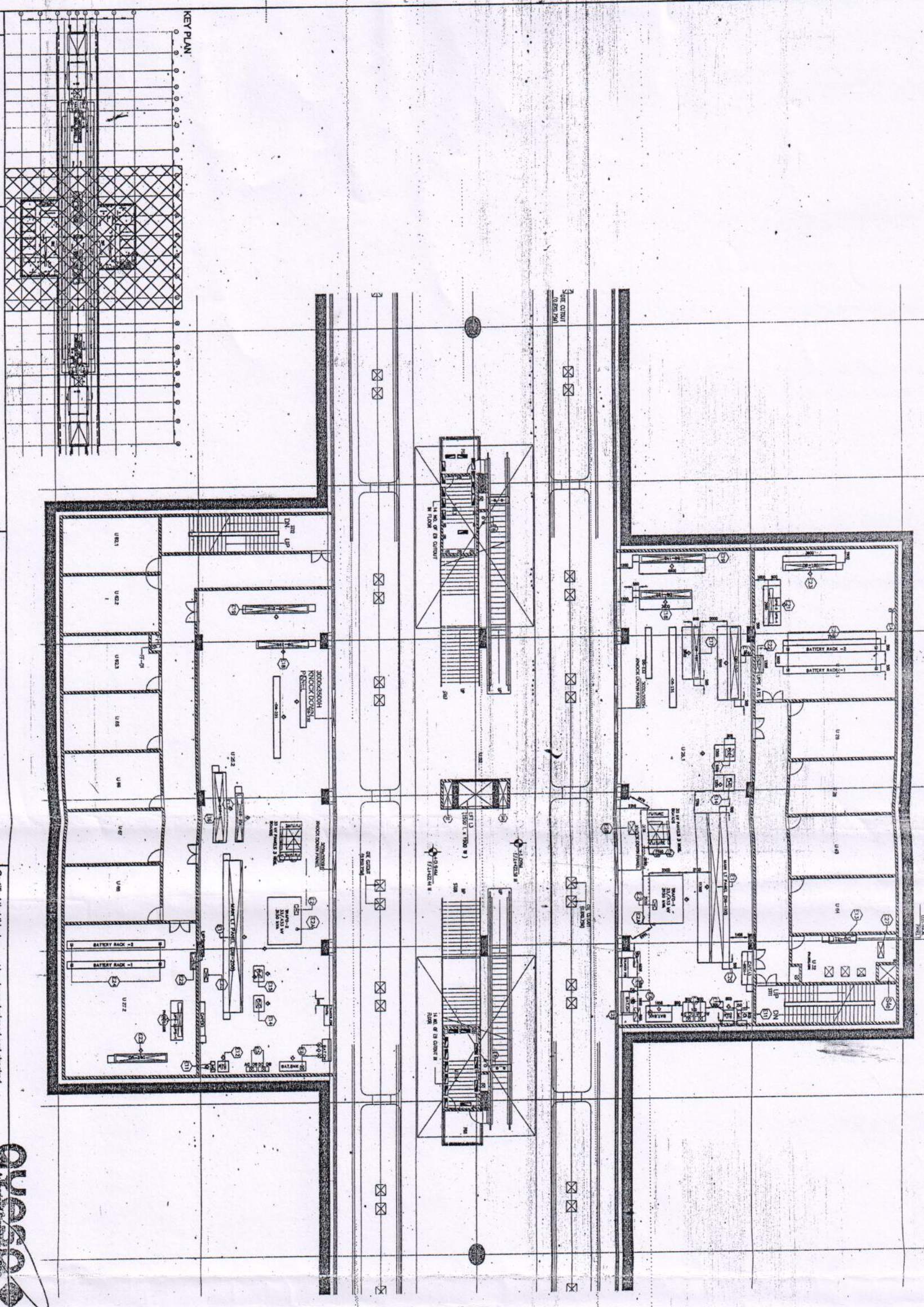


DELHI METRO RAIL CORPORATION LTD.

AUXILIARY POWER SUPPLY DIAGRAM
CHOTTI CHAUPAR ASS TO BADI CHAUPAR ASS (PHASE - IB)
OF JAIPUR METRO

APPROVED BY:-	DESIGN BY:-	DRAWN BY:-
DATE:- 09.07.2015	REV:- R1	SCALE:- N.T.S.
DRAWING NO:- DMRC/JP/IB/A.G.		SHEET SIZE

9 11500 10 11500 11 11500 12 11500 13 11500 14 11500 15 11500



REVISIONS

APPROVAL BY DMRC

Certified that this document has been designed and checked in accordance with DDC Quality Assurance Plan.

Quero
Authorized Signatory for DDC

DELHI METRO RAIL CORPORATION LTD.
Metro Bhawan, Fire Brigade Lane, Barakhamba Road, New Delhi-110001

GENERAL NOTES:
1. ALL DIMENSIONS ARE IN METERS.
2. ANY DIMENSIONS NOT SPECIFIED SHALL BE AS PER THE STANDARD PRACTICES.
3. THE WORK SHALL BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS AND STANDARDS OF THE DELHI METRO RAIL CORPORATION LTD.
4. THE WORK SHALL BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS AND STANDARDS OF THE DELHI METRO RAIL CORPORATION LTD.
5. THE WORK SHALL BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS AND STANDARDS OF THE DELHI METRO RAIL CORPORATION LTD.

REV	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	10/01/2015

REV	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	10/01/2015

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REV	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	10/01/2015

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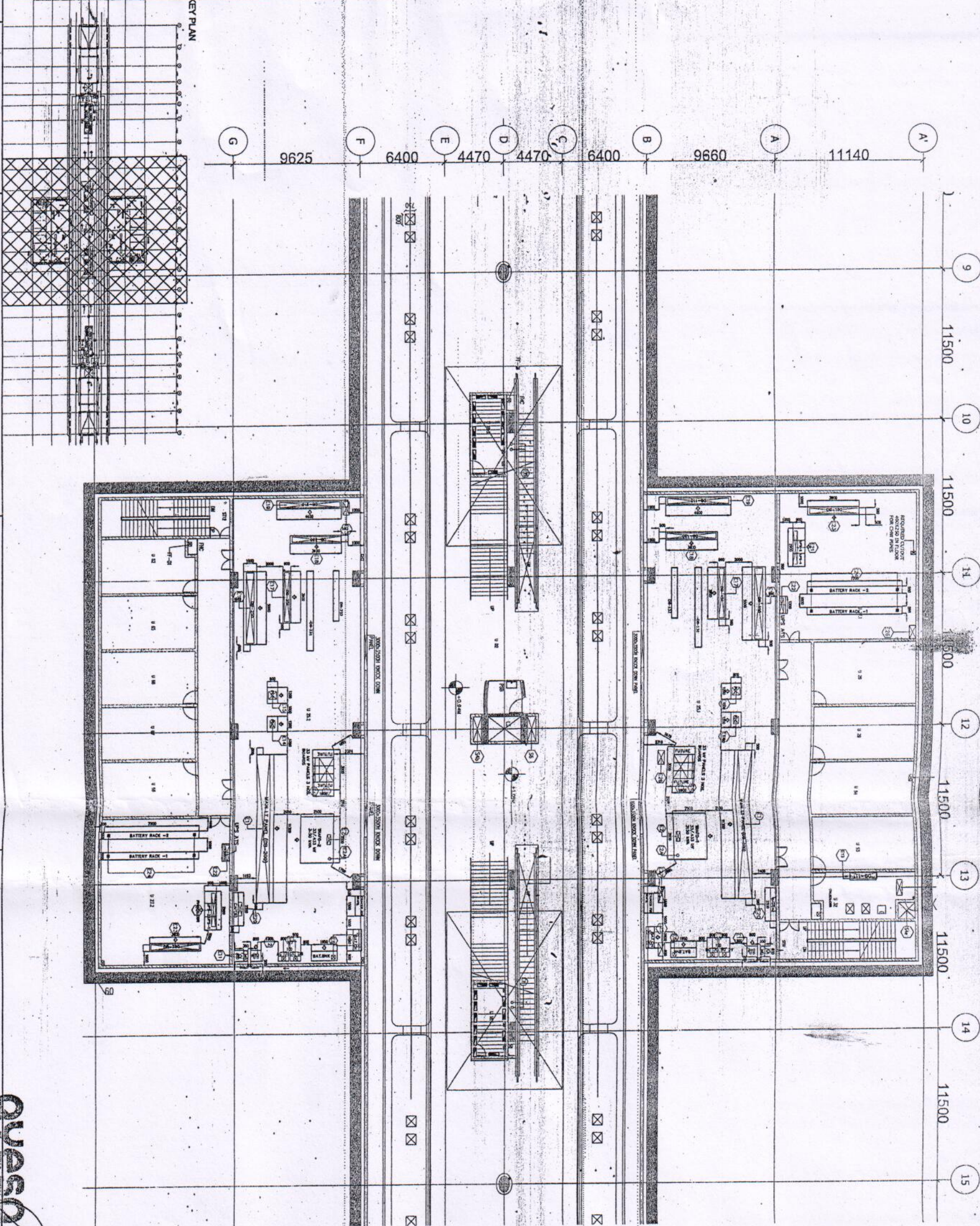
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25	STATION	1500 x 1500	15.00
26	STATION	1500 x 1500	15.00

ROOM SCHEDULE			
Sl. No.	Room No.	Room Name	Area (sq.m)
1	001	PHASE 1B STATION	136.07
2	002	PHASE 1B STATION	136.07
3	003	PHASE 1B STATION	136.07
4	004	PHASE 1B STATION	136.07
5	005	PHASE 1B STATION	136.07
6	006	PHASE 1B STATION	136.07
7	007	PHASE 1B STATION	136.07
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25	025	PHASE 1B STATION	136.07

ELECTRICAL CUT OUT SCHEDULE			
Sl. No.	Room No.	Room Name	Area (sq.m)
1	001	PHASE 1B STATION	136.07
2	002	PHASE 1B STATION	136.07
3	003	PHASE 1B STATION	136.07
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9	009	PHASE 1B STATION	136.07
10	010	PHASE 1B STATION	136.07
11	011	PHASE 1B STATION	136.07
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13	013	PHASE 1B STATION	136.07
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25	025	PHASE 1B STATION	136.07



Certified that this document has been designed and checked in accordance with DDC Quality Assurance Plan.

DETAIL DESIGN CONSULTANT (DDC) FOR CIVIL, ARCHITECTURAL & BUILDING WORKS OF TWO UNDERGROUND STATION (CHOTTI CHOUPAR & BADI CHOUPAR), SHAFT AND TUNNELS OF PHASE 1B OF JAIPUR METRO

ayesa Engineering, Information, Integration.

56, Indo-Asia House, Institutional Area, Sector-44 Gurgaon - 122002 (Haryana)

DELHI METRO RAIL CORPORATION LTD.

Station: CHOTTI CHOUPAR

DRAWING TITLE: EQUIPMENT LAYOUT

DRAWING NO. 1150

DATE: 31-03-2015

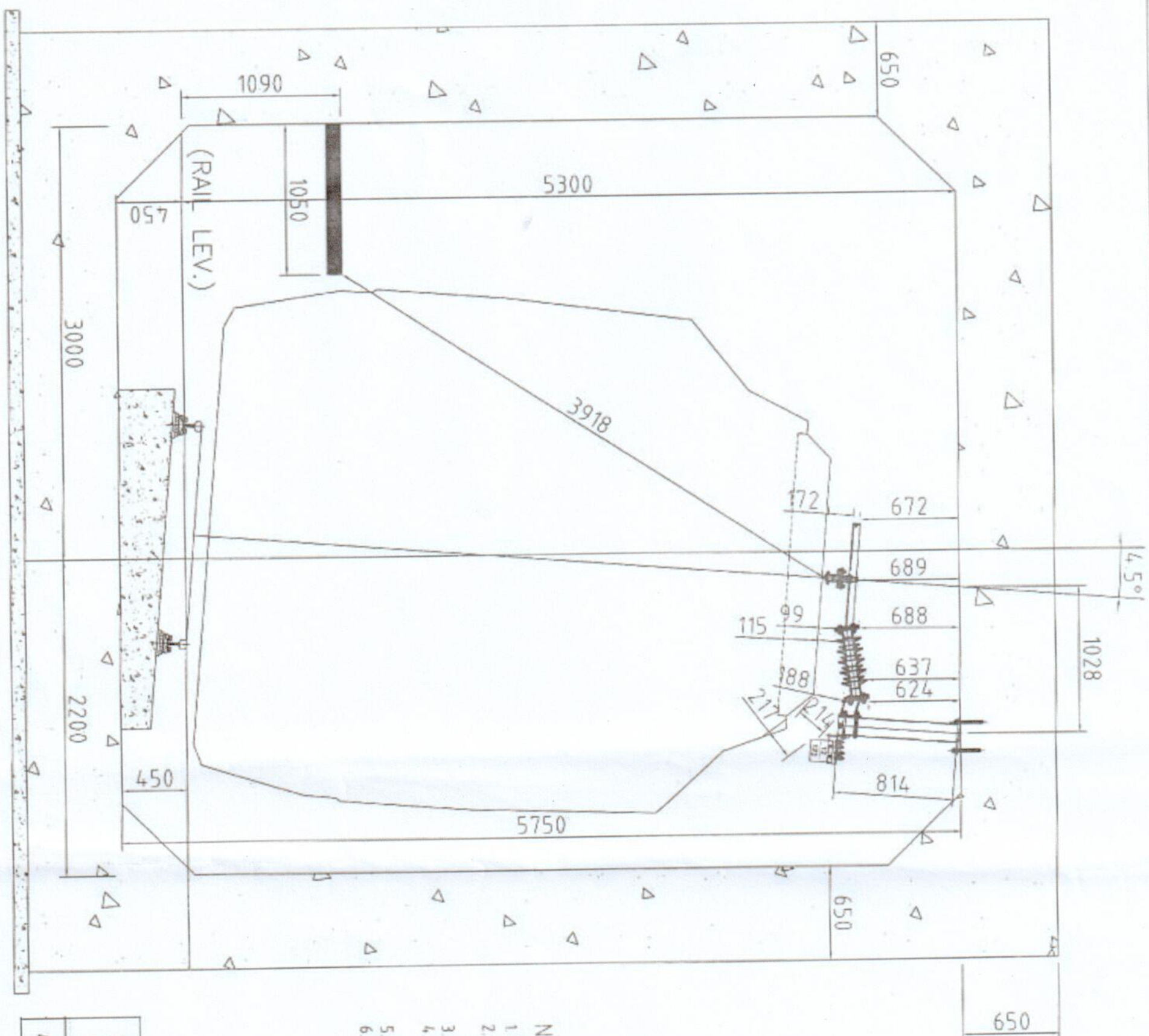
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DATE: 31-03-2015

DRAWING NO. 1150

DATE: 31-03-2015

DRAWING NO. 1150

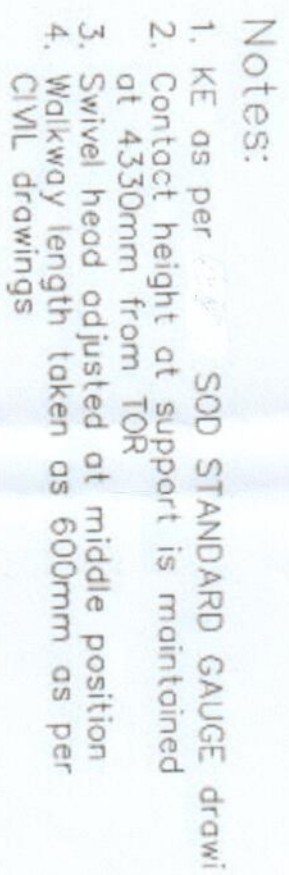


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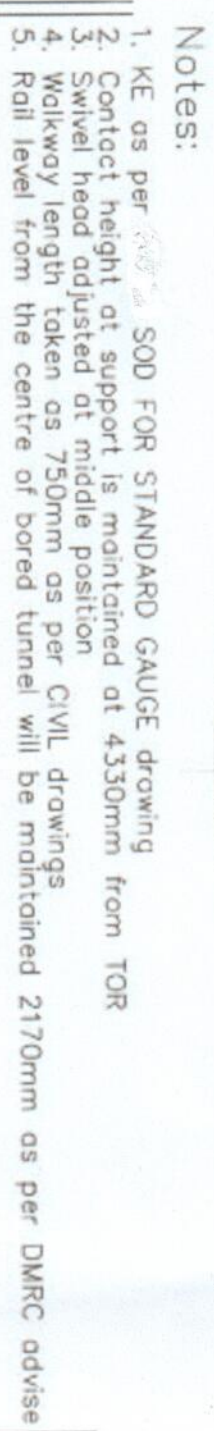
1. KE as per SOD FOR STANDARD GAUGE drawing
2. Contact height at support is maintained at 4330mm from TOR
3. Swivel head adjusted at middle position
4. Walkway length taken as 1050mm as per CIVIL drawing
5. Rail level taken as per DMRC note
6. CIVIL Drawing for tunnel cross section

Cut & Cover Tunnel, Standard gauge
Canted Track

44.0.0.0831-S1.08



440.0831-S1.21



440.0.0831-S1.34



**Procurement of Plant
Design, Supply and Installation
JAIPUR METRO RAIL CORPORATION LIMITED
BIDDING DOCUMENT
for
Procurement
of**

NCB No.-JP/EW/1B/E2

**DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION,
TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV
AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA
SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID
TRANSPORT SYSTEM PROJECT PHASE-1B**

PART-II REQUIREMENTS

Section 6 - Employer's Requirements (ERQ)

Volume – IV Safety, Health and Environment (SHE) Manual

JAIPUR METRO RAIL CORPORATION LTD.

**Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**



JAIPUR METRO RAIL CORPORATION LIMITED

SAFETY, HEALTH AND ENVIRONMENT (SHE) MANUAL

CONDITIONS OF CONTRACT ON
SAFETY, HEALTH AND ENVIRONMENT
(NOVEMBER 2013)





Safety, Health and Environment (SHE) Manual

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PART – I : SHE MANAGEMENT



1.0 General

1.1 Scope

- 1.1.1 This document defines the principal requirements of the Employer on Safety, Health and Environment (SHE) associated with the contractor / sub-contractor and any other agency to be practiced at construction worksites at all time.

1.2 Definition / languages

1.2.1 In this document

- i) The use of 'shall' indicates a mandatory requirement.
- ii) The use of 'should' indicates a guideline that is strongly recommended.
- iii) The use of 'may' indicates a guideline that is to be considered.
- iv) 'SHE' means Safety, Health and Environment.
- v) **"Employer"** means JAIPUR METRO RAIL CORPORATION LIMITED (JMRC), its legal successors and assignees
- vi) **"Designer"** means the Contractor, or part of the group forming the contractor, person, firm or company or group of companies, or any replacement, carrying out the Design of Works or part thereof.
- vii) Chief Safety Officer means an officer nominated by JMRC who is overall responsible for monitoring all SHE functions prescribed in this document.
- viii) BOCWA means Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996
- ix) BOCWR means Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Central Rules, 1998
- x) RBOCWR means Rajasthan Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 2009
- xi) CIIBC means Chief Inspector of Inspection of Building and Other Construction as appointed by Govt. of Rajasthan.

1.3 Application of this document

- 1.3.1 This document applies to all aspects of the contractor's scope of work, including all aspects conducted by sub-contractors and all other agencies. There shall be no activity associated to the contract, which is exempted from the purview of this document.

1.4 Purpose of this document

- 1.4.1 The objective of these guidelines is to ensure that adequate precautions are taken to avoid accidents, occupational illness and harmful effects on the environment during construction.

1.4.2 This document:

- i) Describes the SHE interfaces between Employer and the Contractor.
- ii) Details the processes by which the contractor shall manage SHE issues while carrying out the work under the contract.
- iii) Describes by reference, the practices and procedures as given in the JMRC Project Safety, Health & Environment manual for best SHE performance.



- 1.4.3 These requirements shall be read together with JMRC Project SHE Manual, OHSAS 18001-1999, Occupational Health and Safety Management System and ISO 14001: 2004 Environmental Management Systems. Definition of key terms used in these requirements related to OHSAS 18001 and ISO 14001 standard are found in JMRC's Project SHE Manual.

2.0 'SHE' Targets and Goals

- 2.1 The SHE targets, goals and aim for the Works are to achieve:
- i) Zero total recordable injuries.
 - ii) Zero reportable environmental incidents
 - iii) All personnel inducted in accordance with the approved contractor SHE plan
 - iv) Total compliance of conducting inspections and audits as per approved SHE plan
 - v) 100% incident recording and reporting
 - vi) 100% adherence of usage of appropriate PPEs at work.
 - vii) Executing construction work with least disturbance to the environment, adjoining road users and traffic.

3.0 Compliance

3.1 Memorandum of Understanding (MOU)

- 3.1.1 A Memorandum of Understanding placed at **Appendix No.: 1** shall be executed before the award of contract by the contractor with regard to various provisions on Safety, Health and Environment to be practiced during the construction work.

3.2 JMRC's SHE Policy and Management Systems

- 3.2.1 The construction works shall be undertaken in accordance with JMRC's SHE Policy and Management Systems as amended from time to time provided in Project SHE Manual.

3.3 Indian statutory requirements

3.3.1 Primary statutory regulations

- 3.3.1.1 **Contractor shall develop thorough understanding about Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996, Central Rules 1998, Rajasthan BOCW Rules 2009, Building and Other Construction Workers' Welfare Cess Act, 1996 and Central Rules, 1998 and Rajasthan Building Construction Workers' Welfare Board Rules, not only to satisfy the Inspectors' perspective but the use of legislation as the strong tool for effective SHE management at construction worksites. Contractor is strongly advised to practice the principle of voluntary compliance.**

- 3.3.1.2 In order to facilitate the contractor for better understanding on the various provisions of the above Act and Rajasthan Govt. Rules, a tabulated information highlighting the Sections/Rules referring to the corresponding registration of contractors, maintenance of registers and records, hours of work and wages, welfare, medical facilities and safety requirements are given in **Appendix No.: 2**. It is an indicative one and not a limiting list.



3.3.2 In addition, the construction works shall be undertaken in accordance with all applicable legislation including amendment made hereunder and Indian statutory requirements listed below but not limiting to:

- i) The Metro Railways (Construction of Works) Act 1978 and rules made thereunder
- ii) The Metro Railways (Operation and Maintenance) Act 2002 and rules made thereunder
- iii) The Electricity Act 2003 and The Indian Electricity Rules 1956
- iv) National Building Code, 2005
- v) The Factories Act, 1948, Rajasthan Factories Rules 1951.
- vi) Motor Vehicles Act as amended in 1994 and The Central Motor Vehicles Rules, 1989.
- vii) Indian Road Congress Code IRC: SP: 55-2001 'Guidelines on Safety In Road Construction Zones.
- viii) The Petroleum Act, 1934 and Rules 2002
- ix) Gas Cylinder Rules, 2004
- x) Indian Explosives Act. 1884, along with the Explosives substance Act 1908 and the Explosives Rules 1983
- xi) The (Indian) Boilers Act, 1923, Rajasthan Boiler Rules, 1954
- xii) The Public Liability Insurance Act 1991 and Rules 1991
- xiii) Minimum Wages Act, 1948 and Rules 1950
- xiv) Contract Labour Act, 1970 and Rules 1971
- xv) Child Labour (Prohibitions & Regulations) Act, 1986 and Rules 1988
- xvi) Environment Protection Act, 1986 and Rules 1986
- xvii) Air (Prevention and control of Pollution) Act, 1981 and Rules 1982
- xviii) Water (Prevention and Control of Pollution) Act, 1974 and Rules 1975
- xix) The Noise Pollution (Regulation & Control) Rules, 2000
- xx) Notification on Control of Noise from Diesel Generator (DG) sets, 2002
- xxi) Recycled Plastic Usage Rules, 1998
- xxii) Notification, Central Ground Water Board, Act January 1997
- xxiii) Manufacture, Storage & Import of Hazardous Chemicals Rules, 1989
- xxiv) The Hazardous Waste (Management & Handling) Rules, 1989
- xxv) Hazardous Waste Management Rules 1989 (amended 1999)
- xxvi) The Bonded Labour System (Abolition) Act, 1976 and Rules 1976
- xxvii) Batteries (Management and Handling) Rules, 2012
- xxviii) Fly ash utilization notification, Sept 1999 as amended in August 2003

3.3.3 The Employee's Compensation Act, 1923 along with allied Rules

3.3.3.1 The contractor shall ensure that all his employees / workmen are covered under 'Employee Compensation Act' and shall pay compensation to his workmen as and when the eventuality for the same arises.

3.3.4 Notwithstanding the above Act/Rules, there is nothing in those to exempt the contractor from the purview of any other Act or Rule in Republic of India for the safety of men and materials.

3.3.5 If the requirements stated in this document are less stringent than or in conflict with the country's applicable legislation, the latter shall apply.



- 3.4 International Standards, Guidelines & ISO Certifications
- 3.4.1 The works should be undertaken in accordance with the applicable international guidelines, standards and specifications on SHE and every contract shall aim to achieve ISO certifications listed below during the currency of the contract:
- OHSAS 18001-1999 : Occupational Health and Safety Management System.
ISO 14001-2004 : Environmental Management Systems.
- 3.4.2 The process of certification shall start immediately after the award of the work and complete within reasonable time. Towards this, the contractor shall undertake the required steps including appointment of ISO consultant for obtaining the certification on Occupational Health and Safety Management System and Environment Management System.
- 3.4.3 **In case of failure on the part of the contractor, the Employer at the cost of the contractor shall do the same.**
- 4.0 Contractor SHE Policy and Plan**
- 4.1 The contractor as per Section 39 of the BOCW Act shall formulate a SHE policy and get it approved by DG/CIIBC respectively and display it at conspicuous places at work sites in Hindi and a local language understood by the majority of construction workers.
- 4.2 Within 4 weeks of the notification of acceptance of the tender, the Contractor shall submit a detailed and comprehensive Contract specific SHE Plan. The SHE Plan shall include detailed policies, procedures and regulations which, when implemented, will ensure compliance of the contract provisions. The SHE Plan shall include the following but not be restricted to:
- i) A statement of the Contractor's policy, organisation and arrangements for SHE
 - ii) The name(s) and experience of person(s) within the Contractor's proposed management who shall be responsible for co-ordinating and monitoring the Contractor's SHE performance;
 - iii) The number of SHE staff who shall be employed on the Works, their responsibilities, authority and line of communication with the proposed Contractor's agent;
 - iv) A statement of the Contractor's policy and procedures for identifying and estimating hazards, and the measures for addressing the same;
 - v) A list of SHE hazards anticipated for this Contract and sufficient information to demonstrate the Contractor's proposals for achieving effective and efficient health and safety procedures;
 - vi) A description of the SHE training courses and emergency drills which shall be provided by the Contractor, with an outline of the syllabus to be followed;
 - vii) Details of the safety equipment which shall be provided by the Contractor, including personal protective equipment;
 - viii) A statement of the Contractor's policy and procedures for ensuring that Contractor's Equipment used on the Project Site are maintained in a safe condition and are operated in a safe manner;
 - ix) A statement of the Contractor's policy and procedures for ensuring that sub-contractors comply with the Contractor's safety plan;
 - x) A statement of the Contractor's disciplinary procedures with respect to SHE related matters, and



- xi) A statement of the Contractor's procedure for reporting and investigating accidents, dangerous occurrences or occupational illnesses
- 4.3 The Contractor shall, from time to time and as necessary are required by the Employer to produce supplements to the SHE Plan such that it is at all times a detailed, comprehensive and contemporaneous statement by the Contractor of his site safety, industrial health and environment obligations, responsibilities, policies and procedures relating to work on Site. Any and all submissions of supplements to the SHE Plan shall be made to the Employer in accordance with the agreed procedures.
- 4.4 If at any time the SHE plan is, in the Employer's opinion, insufficient or requires revision or modification to ensure the security of the Works and the safety of all workmen upon and visitors to the Site, the Employer may instruct the Contractor to revise the SHE plan and the Contractor shall within 7 days submit the revised plan to the Employer for review.
- 4.5 Any omissions, inconsistencies and errors in the SHE Plan or the Employer's acceptance or rejection of the SHE Plan and/or supplements thereto shall be without prejudice to the Contractor's obligations with respect to site safety, industrial health and environment and shall not excuse any failure by the contractor to adopt proper and recognised safety practices throughout the execution of the Work.
- 4.6 The Contractor shall adhere to the SHE Plan and shall ensure, as far as practically possible, that all sub-contractors of all tiers require that contracting parties each have a copy of the Site SHE Plan and comply with its provisions.
- 4.7 The details of contents to be covered in the site SHE plan are given in **Appendix No.: 3**

5.0 Designer's role

- 5.0 Designer's role in Safety, Health and Environment
- 5.1 Designer's primary role includes to minimise the risk to health and safety of those who are going to construct, maintain, clean, repair, dismantle or demolish the structures and any one else like adjoining road users/general public, who might be affected by the work.
- 5.2 General philosophy
 - 5.2.1 When considering health and safety in designer's work, they shall be expected to do what is reasonable at the time the design is prepared. It may be possible for hazards, which cannot be addressed at the feasibility stage to be looked at during detailed design. In deciding what is reasonably practicable, the risk to health and safety produced by a feature of the design has to be weighed against the cost of excluding the feature. The overall design process does not need to be dominated by a concern to avoid all risks during the construction phase and maintenance. However, a judgement has to be made by weighing up one consideration against another so the cost is counted not just in financial terms, but also those of fitness for purpose, aesthetics, buildability or environmental impact. By applying these principles, it may be possible to make decisions at the design stage, which will avoid or reduce risks during construction work. In many cases, the large number of design considerations will allow a number of equally valid design solutions. What is important is the approach to the solutions of design problems. This should involve a proper exercise of judgement, which takes account of health and safety issues.
- 5.3 Hierarchy of Risk Control



- 5.3.1 Designers shall need, so far as reasonably practicable, to avoid or reduce risks by applying a series of steps known as the hierarchy of risk control or principles of prevention and protection. The steps to be adopted shall include the following:
- i) consider if the hazard can be prevented from arising so that the risk can be avoided (eg, alter the design to avoid the risk);
 - ii) if this cannot be achieved, the risk should be combated at source (eg, ensure the design details of items to be lifted include attachment points for lifting);
 - iii) failing this, priority should be given to measures to control the risk that will protect all people;
 - iv) only as a last resort should measures to control risk by means of personal protection be assumed (eg, use of safety harnesses).

5.4 Duty to provide health and safety risks in the drawing itself

- 5.4.1 In case of situations where the designers have carried out the design work and concluded that there are risks, which was not reasonably practicable to avoid, detailed information shall be given about the health and safety risks, which remain. This information needs to be included with the design to alert others to the risks, which they cannot reasonably be expected to know. This is essential for the parties who have to use the design information.

- 5.4.2 If the designers' basic design assumptions affect health or safety, or health and safety risks are not obvious from the standard design document, the designer shall provide additional information. The information shall include a broad indication of the assumptions about the precautions for dealing with the risks. The information will need to be conveyed in a clear manner; it shall be included on drawings, in written specifications or outline method statements. The level of detail to be recorded will be determined by the nature of the hazards involved and the associated level of risk.

5.5 Employer's approval

- 5.5.1 Every structure like scaffold, false work, launching girder, earth retaining structures etc. shall have its design calculations included in the method statements in addition to health and safety risks. Employers' designer or his approved proof check consultants as applicable as per the contract conditions shall approve all these designs.

- 5.6 Any non-standard structures like trestles made up of re-bars or structures which are very old, corroded, repaired for many times etc. for which no design calculations can be made accurately from any national standards, shall not be allowed to be used at sites even for short duration.

- 5.7 If any of the above mentioned clauses are not adhered to, penalty shall be imposed depending upon the gravity of the unsafe act and/or condition.

6.0 Contractor SHE Organisation

6.1 Education and Experience

- 6.1.1 The contractor shall appoint the required SHE personnel as prescribed in General Instruction **JMRC/SHE/GI/001** (enclosed at the end) based upon the statutory requirement and establish the safety organisation based upon the contract value. The minimum educational qualification and the work experience are given in General Instruction **JMRC/SHE/GI/002**.



- 6.1.2 **In order to effectively interact on labour welfare matters with the Employer and the statutory authorities enforcing the labour welfare legislations every contractor shall employ a full time Labour Welfare Officer duly qualified and experienced as per Clause 6.1.1.**
- 6.2 Conduct and competency
- 6.2.1 The conduct and functioning of the contractor SHE personnel shall be monitored by the Employer. Any default or deficiency shall attract penalty as per details given under penalty clause 56.0 of this document.
- 6.2.2 The Contractor shall ensure that all personnel are competent to perform the job assigned to them. In the event that the Contractor is unable to demonstrate the competency of any person whose activities can directly impact on the Works' SHE performance, the Employer shall remove that person from the site without any procedural formalities.
- 6.3 Approval from Employer
- 6.3.1 The name, address, educational qualification, work experience and health condition of each personnel deployed for SHE jobs shall be submitted to the Employer in the format prescribed for the purpose for comments and approval well before the start of the work. Only on approval by the Employer these personnel are authorised to work. In case any of the SHE personnel leaves the contractor the same shall be intimated to the Employer. The contractor shall recruit new personnel and fill up the vacancy.
- 6.4 **Responsibility of SHE personnel**
- 6.4.1 **For all works carried out by the contractor and his sub-contractors, the responsibility of ensuring the required SHE manpower lies with the main contractor only. The minimum required manpower indicated by the Employer includes the sub-contractors' work also. It shall be the responsibility of the main contractor to provide required SHE manpower for all the works executed by all contractors. Necessary conditions shall be included in all sub-contract documents executed by the main contractor.**
- 6.5 Employment status of SHE personnel
- 6.5.1 No contractor shall engage SHE manpower from any outsourcing agencies in which case the effectiveness would be lost. All SHE manpower shall be on the payroll of the main contractor only and not on the payroll of any subcontractor or outsourcing manpower agencies etc. This condition does not apply to positions like traffic marshals who are engaged almost on a daily requirement basis.
- 6.6 Reporting of SHE personnel
- 6.6.1 All SHE personnel are to report to the Chief SHE Manager who shall report directly to the Chief Project Manager. The Employer shall monitor adherence to this procedure at all times. In case of non-adherence penalty shall be levied as indicated in the penalty clause.
- 6.7 **Inadequate SHE personnel**



- 6.7.1 In case if the contractor fail to provide the minimum required manpower as illustrated in General Instruction JMRC/SHE/GI/001, or fail to fill up vacancies created within 14 days, the same shall be provided by the Employer at contractor's cost. Any administrative expenses involved to provide the same like paper advertisement or manpower consultant charges, etc shall also be at the cost of contractor.
- 6.8 Prohibition of performance of other duties
- 6.8.1 As per Schedule VI of RBOCWR no SHE personnel shall be required or permitted to do any work which is unconnected to, inconsistent with or detrimental to the performance of the SHE duties for respective category mentioned in General Information JMRC/SHE/GI/001
- 6.9 Facilities to be provided to SHE personnel
- 6.9.1 As per schedule VIII of BOCWR, the contractor shall provide all SHE personnel with such facilities, equipment and information that are necessary to enable him to discharge his duties effectively.
- 6.9.2 The minimum Employer's requirements of such facilities / equipments to be provided for SHE personnel are given in the General Instruction JMRC/SHE/GI/003.
- 7.0 Contractor SHE Committee**
- 7.1 All employees should be able to participate in the making and monitoring of arrangements for safety, industrial health and environment at their place of work. The establishment of site SHE committees in which employees and Contractor and sub-contractor management are represented can increase the involvement and commitment of employees. The contractor shall ensure the formation and monitor the functioning of contractor SHE committees.
- 7.2 Terms of Reference
- 7.2.1 The Terms of Reference for the committee shall be as follows;
- i) To establish company safety policies and practices
 - ii) To monitor the adequacy of the contractor's site SHE plan and ensure its implementation
 - iii) To review SHE training
 - iv) To review the contractor's monthly SHE report.
 - v) To identify probable causes of accident and unsafe practices in building or other construction work and to suggest remedial measures.
 - vi) To stimulate interest of Employer and building workers in safety by organizing safety week, safety competition, talks and film-shows on safety, preparing posters or taking similar other measures as and when required or as necessary.
 - vii) To go round the construction site with a view to check unsafe practices and detect unsafe conditions and to recommend remedial measures for their rectifications including first-aid medical and welfare facilities.
 - viii) Committee team members should perform a site inspection before every committee meetings and to monitor SHE inspection reports.
 - ix) To bring to the notice of the Employer the hazards associated with use, handling and maintenance of the equipment used during the course of building and other construction work



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- x) To suggest measures for improving welfare amenities in the construction site and other miscellaneous aspect of safety, health and welfare in building or other construction work.
- xi) To look into the health hazards associated with handling different types of explosives, chemicals and other construction materials and to suggest remedial measures including personal protective equipment.
- xii) To review the last safety committee meeting minutes and to take action against persons/sub-contractors for non-compliance if any.

7.3 Within 14 days of award of contract, the SHE committee shall be constituted and notification regarding the same shall be communicated to the members and employees as per the format provided in **Form No.: SF 001**

7.4 Site SHE Committee meeting shall be conducted at least once in a **month** with the minimum members listed below:

Chairman	Project Manager
Secretary	SHE Manager (In-charge)
Members	<ul style="list-style-type: none">i) Labour Welfare Officerii) In charge of plant and machineryiii) In charge of site electricsiv) In charge of stores.v) Senior Managers/ Engineers heading different sub functions.vi) Sub – contractor's representativevii) Labour Contractor's representativeviii) Workers' representativeix) Co-contractor representative.x) SHE staffs
Employer's Representatives	JMRC SHE in charge and other representatives

7.5 Construction SHE Committee meeting shall be conducted at least once in a **week** with the minimum members listed below:

Chairman	Project Manager
Secretary	SHE Manager (In-charge)
Members	<ul style="list-style-type: none">i) Labour Welfare Officerii) In charge of plant and machineryiii) In-charge of site electricsiv) Senior Managers / Engineers heading different sub functionsv) Sub- Contractor's representativevi) Labour contractor's representativevii) Workers' representativesviii) All SHE Staffs



- 7.6 Co-contractors' participation
- 7.6.1 In case of depot, station and other contiguous areas where more than one main contractors are working together, the Employer shall instruct the other contractors to join for the monthly SHE committee meeting of the main civil contractor, so as to discuss and decide about the common provision of security, lighting, toilet, drinking water etc. and sharing the maintenance cost of the same etc.
- 7.6.2 **The general principle for sharing the cost shall be either based on the contract value of works executed at the contiguous area or the daily average number of workmen employed by each contractor in the contiguous area.**
- 7.7 Minimum time between two monthly SHE Committee meetings
- 7.7.1 A minimum period of **21 days** shall be maintained between any two SHE monthly committee meetings.
- 7.8 **Agenda**
- 7.8.1 The Secretary shall circulate the agenda of the meeting at least seven working days in advance of the scheduled date of the meeting to all members.
- 7.8.2 The agenda should broadly cover the following:
- i) Confirmation of minutes
 - ii) Chairman's review/overview of site SHE performance / condition
 - iii) Previous month SHE statistics
 - iv) Incident and Accident Investigation / dangerous occurrence / near miss report
 - v) Site SHE inspection
 - vi) Sub-contractors' SHE issues
 - vii) Safety presentation by Members
 - viii) Report from Employer
 - ix) Matters arising
 - x) Any other business
- 7.9 Minutes of the meeting
- 7.9.1 The Minutes of the meeting shall be prepared as per the format provided at **Form No.: SF-002** and sent to all members within 2 working days preferably by mail/fax followed by hardcopy. Safety Committee meeting minutes shall also be displayed in the notice board for wider publicity to all concerned.
- 7.10 **Disciplinary Action**
- 7.10.1 The chairman shall inform the members of any outstanding issues in the meeting and in case of repeated offence/ non-compliance by some members or other co/sub contractors and propose suitable disciplinary action including provisions of monetary penalty as per the relevant contract clauses, the Employer shall ensure that the same is implemented.



8.0 ID Card and First day at work, SHE orientation training

- 8.1 The Contractor shall ensure that all personnel working at the site receive an induction SHE training explaining the nature of the work, the hazards that may be encountered during the site work and the particular hazards attached to their own function within the operation. The training shall cover the contents as given in the General Instruction **JMRC/SHE/GI/004.**
- 8.2 **All personnel shall be issued a photo identity card of size 85mm x 55mm duly signed by the authorized representative of the contractor before they are engaged for any work as per the format given in the General Instruction **JMRC/SHE/GI/005.****
- 8.3 Contractor shall also issue a personnel SHE handbook in a language known to the workers, which provides information on SHE and emergency procedures that all personnel working on contract are required to know and the need to follow. Contractor shall ensure that this is distributed and its content introduced to all personnel working at the site.

9.0 SHE Training

- 9.1 The behaviour of people at all levels of the contractor is critical for SHE performance.
- 9.2 The contractor shall organise quality SHE training to engage Managers, supervisors and other personnel in behavioural change and improve safety performance.
- 9.3 The Contractor shall analyse the training requirements for all the employees and initiate a training program to demonstrate that all persons employed, including subcontractors, are suitably qualified, competent and fit. This will include:
- i) Detailed Job descriptions for all personnel, to include their specific SHE responsibilities
 - ii) Specification of qualifications, competency and training requirements for all personnel
 - iii) Assessment and recording of training needs for all personnel, including subcontractors' employees in the workforce, vendor representatives and site visitors
 - iv) A system for assessing new hirers e.g. previous training
 - v) A means of confirming that the system is effective
 - vi) A matrix and schedule of training requirements, covering general, task-specific and SHE-related training, showing the training frequency and interval between refresher courses
 - vii) Timely, competent delivery of training courses
- 9.4 The contractor shall arrange behavioural-based training programmes for all the executives to identify, recognise and eliminate unsafe act and unsafe conditions.
- 9.5 The minimum Employer's requirement of training needs for various categories of employees are given in general instruction **JMRC/SHE/GI/006**
- 9.6 The contents of SHE training to Managers/Supervisors as given in general instruction **JMRC/SHE/GI/007** shall be conducted.
- 9.7 **The refresher-training programme to all employees shall be conducted once in six months.**



- 9.8 **Toolbox talk as given in the Employer's Project SHE manual shall be conducted to all high-risk workmen everyday.**
- 9.9 **On-the spot practical skill development training on height safety including scaffold safety, crane safety, welding safety, electrical safety, traffic safety for marshals shall also be conducted to all foremen/ workmen who were associated to the concerned jobs.**
- 9.10 **Daily Safety Oath as given in Project SHE manual shall be taken by every employee including workman without fail.**
- 9.11 **All vehicle drivers including Hydra operators shall be trained on defensive driving at any Government authorized Institute or Maruti Institute of Driver Training and Research at Wazirabad Road, Adjoining Loni Road Flyover, Delhi-110094. All vehicle drivers shall also undergo refresher training on defensive driving provided by the same institute once in 6 months.**
- 9.12 All the above listed training programmes except at Clause **9.11** shall be organised by the contractor only after taking approval from the Employer for the training faculty / organisation, content and durations.
- 9.13 **In case of failure on the part of the contractor to provide all the above-mentioned training programs to all employees in time, the same shall be provided by the Employer through accredited agencies if required by formulating a common scheme to all contractors. Any administrative expenses and training fee towards the same shall be at the cost of the contractor.**
- 10.0 SHE Inspection**
- 10.1 The contractor shall evolve and administer a system of conducting SHE inspections and other risk management analysis on a periodical basis.
- 10.2 The purpose of SHE inspection is to identify any variation in construction activities and operations, machineries, plant and equipment and processes against the SHE Plan and its supplementary procedures and programs.
- 10.3 Following SHE inspections program shall be adopted.
- i) Planned General Inspection
 - ii) Routine Inspection
 - iii) Specific Inspection
 - iv) Other Inspection
- 10.3.1 Planned General Inspection
- 10.3.1.1 Planned general inspections are performed at predetermined intervals and it usually involves the representation from both Contractor and the Employer.
- 10.3.1.2 Inspections that will be classified under this inspection program are:
- i) Monthly contractor and subcontractors site safety committee Inspection.
 - ii) Weekly safety inspection by construction supervisors (Contractors and Sub-contractors).



- iii) Daily safety inspection by contractor site SHE team.

10.3.2 Routine Inspection

- 10.3.2.1 Routine inspections are often referring to the inspection of work site, equipment and temporary structures performed by site and equipment operators and temporary structure erectors.

Inspections that will be classified under this inspection program are:

- i) Daily Inspection of plant and equipment by operator
- ii) Weekly Inspection of scaffold by scaffolding supervisor
- iii) Monthly Inspection of electrical hand tools by competent electrical supervisor
- iv) Quarterly Inspection of temporary electrical systems by competent electrical supervisor
- v) Half-yearly inspection of lifting machinery, lifting appliances, equipment and gears by Govt. approved competent person.

- 10.3.2.2 The list mentioned above is not exhaustive. Contractor may add additional categories. Contractors' Site SHE Manager will ensure that a system of routine inspections are carried out periodically to all plants, equipment, powered tools and any other temporary structures that will pose a hazard to operators and workmen.

10.3.3 Specific Inspection

- 10.3.3.1 Specific inspections are performed on activities without a predetermined date. Competent supervisors usually perform inspections for ensuring an activity whether it is executed in accordance to a general set of rules; method statement submitted or developed procedures.

The following are examples that will be commonly performed as required on the construction site:

- i) Inspection performed before a heavy lifting operation.
- ii) Inspection performed before and after the entry of person into a confined space.
- iii) Inspection performed before and after a welding and gas cutting operation.
- iv) Inspection of formwork before concreting by formwork erector.

The list mentioned above is not exhaustive. The contractor shall ensure that a competent supervisor inspects all high-risk processes and activities.

10.3.4 Other Inspection

Other inspections includes the following:

- i) Mandatory Inspections by Labour Department of Government.
- ii) JMRC site SHE management team

- 10.3.5 The contractor shall prepare all required safety inspection checklist for all activity operations and equipment. Checklists will be prepared based on the Indian standards, rules and regulations and Employer's requirements. The formats provided in the Project SHE manual may be referred.

- 10.3.6 All inspection records and reports will be properly kept and filed for audit purpose. Inspection reports of Planned General Inspection and Routine Inspection will be used for discussion during Safety Committee Meetings.



11.0 SHE Audit

11.1 General

11.1.1 The purpose and scope of SHE audit is to assess potential risk, liabilities and the degree of compliance of construction Safety, Health & Environmental plan and its supplementary procedures and programs against applicable and current SHE legislation regulations and requirements of the employer.

11.1.2 Project Manager holds the ultimate responsibility in ensuring implementation of SHE audit program during the construction work.

11.2 Monthly Audit Rating Score (M A R S)

11.2.1 **Monthly Audit Rating Score (MARS) will be performed once in a month. A team consisting of Project manager and Employer representative based on the pre-designed score-rating format will conduct it. The details of the pre-designed monthly audit score rating formats are given in the Project SHE manual.**

11.2.2 This Monthly SHE Audit Rating Score (MARS) report will enable the Employer to evaluate the general compliance by the Contractor with the Conditions of Contract, the Employer's Project SHE Manual and the Contractor's site specific SHE Plan.

11.2.3 Monthly Audits will be conducted in accordance with JMRC Guidelines. The Project Manager accompanied by the Employer's representatives shall carry out the Audit. The Contractor's senior manager and SHE in-charge should also be invited to attend.

11.2.4 Timing

The Monthly Audit Rating Score (MARS) should be conducted at least 7 days prior to the scheduled date of Monthly SHE Committee meeting.

11.2.5 Evaluation

11.2.5.1 The numerical scoring has been weighed on a 1-10 scale. The audit team will use their observations noted in evaluating the points to be awarded against each of the elements of the audited section. Wherever some topics and sub-topics are not applicable the score rating need not be given. The overall audit ratings shall be achieved by:

$$\text{Overall Audit rating} = \frac{\text{Actual Score Achieved}}{\text{Maximum Possible Score}} \times 100$$

11.2.5.2 The criticality of the required actions for the respective sections of the Audit will be classified as:

Sl. No.	Score	Description	Action
1	< 60%	Immediate	Require Contractor to rectify within 24 hours and confirm in writing to Employer
2	< 75%	Improvement Necessary	Contractor rectification within 7 days and



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			confirmed in writing to Employer
3	< 90%	Improvement Desirable	Contractor rectification within one month and confirmed in writing to Employer

11.2.6 Report

A copy of each Audit Report will be sent to Employer and to all subcontractors, with whom it will then be discussed in detail at the Monthly SHE Committee Meeting in order to ensure that any corrective actions are agreed upon.

11.3 Monthly Electrical Safety Audit

11.3.1 A team comprising of contractor's senior SHE (Electrical) engineer and Employer's representative shall conduct monthly electrical safety audit covering the following and submit the report to Employer.

- i) Electrical accidents investigation findings and remedy
- ii) Adequacy of power generation and power requirements
- iii) Power distribution and transmission system in place
- iv) Updated electrical single line diagram showing the current condition of power source and distribution including the IP44 DBs arrangement.
- v) Electrical protection devices – selection, installation and maintenance.
- vi) Earth or ground connection and earth pit maintenance details
- vii) Education and training of electrical personnel undertaken
- viii) Routine electrical inspection details
- ix) Electrical maintenance system and register.
- x) Name plate details of major electrical equipment
- xi) Classified zones in the site, if any.

11.4 External SHE Audit

11.4.1 External SHE audits are to be conducted by external agencies that are competent with ISO qualified auditors with the prior approval of the Employer.

11.4.2 Areas of competence of Audit team

11.4.2.1 Practical understanding of BOCW Act and Rules, statutory requirements on health/medical and welfare of workmen, construction hazards and its prevention and control, traffic management, electrical safety, rigging, safety of construction equipment and environment management.

11.4.2.2 Audit shall be conducted as per the guidelines of ISO, ILO, and national standards. Audit report shall also be presented as per the above formats.

11.4.3 External SHE audit shall be conducted on a quarterly basis throughout the currency of the contract.

11.4.4 Targets of SHE Audit:

The contents and coverage of the external audit shall include the following items



11.4.4.1 SHE management:

- i) Organization
- ii) Communication and Motivation
- iii) Time office
- iv) Inspection
- v) Emergency preparedness
- vi) Budget allocation
- vii) Education and Training
- viii) Work permit system

11.4.4.2 Technical:

- i) Building and Structure
- ii) Construction operational safety
- iii) Material safety
- iv) Hand tools and Power tools
- v) Electrical system
- vi) Safety Appliances
- vii) Fire prevention and control
- viii) Housekeeping
- ix) Maintenance and Machinery safety
- x) First-aid and Medical Facilities
- xi) Welfare measures
- xii) Environmental Management

11.4.5 **Audit Documents:**

11.4.5.1 Contractor shall make the below listed documents available for the review by the Audit team.

- i) **SHE policy**
- ii) **SHE manual**
- iii) **SHE Rules and Regulation**
- iv) **SHE organization chart**
- v) **Annual SHE objectives / programs**
- vi) **Accident / near miss statistics and analysis**
- vii) **SHE Training program / records for all personnel**
- viii) **Operating manuals and maintenance manual of all equipments**
- ix) **Safe worthiness certificates of all lifting appliances and gears**
- x) **Medical fitness record for all personnel**
- xi) **Risk identification, assessment and control details**
- xii) **Environmental management reports**
- xiii) **Emergency management records including mock drill**

11.4.6 Audit Preparation:



- i) Audit team members are required to gather information by observations through interviews and by checks of hardware and documentation.
- ii) Audit team shall prepare checklist to cover all parts based on SHE legislations rules and regulations and JMRC requirements.
- iii) Audit team members shall verify the facts and findings leading to the identified gaps and weakness.
- iv) Audit leader has overall responsibility for reaching a conclusion.

11.4.7 Reporting:

11.4.7.1 Audit report shall be prepared and directly sent to the Employer within 7 days of conducting the audit with a copy to the contractor.

11.4.8 Report contents:

- i) Executing summary - based on the finalized checklists as written the findings to the Employer by the audit team members, the audit leader will compile a concise and accurate summary of observations and findings.
- ii) Introduction - this will contain basic information regarding the facilities or organization audited, the specific audit dates (inclusion of those for preparation and post-audit activities).
- iii) Principal positive findings - This will contain the summary of positive aspects as observed by the auditors. It will also contain highlights of those issue, which may warrant dissemination as best practice regarding methodology used or achievement.
- iv) Audit Findings - All audit findings as detailed in the audit checklists shall be grouped together as priority 1 and 2 as detailed below in a separate listing.
 - a) Priority 1: Actions to rectify gaps or weakness should generally be implemented within two-weeks time, if risk potential is high or unacceptable.
 - b) Priority 2: Actions should be generally implemented or rectified with a maximum of 3 – 4 weeks, if not rectified would create a likelihood of minor injury or business loss.

11.4.9 Conformity Report & Action by Employer

11.4.9.1 The auditor shall inspect the site after 14 days of conducting initial audit for checking the adequacy of implementation of items maintained under priority 1 by the contractor and shall submit a conformity / non-conformity report to the Employer with a copy to the contractor.

11.4.9.2 The auditor shall again inspect after 28 days of conducting initial audit for checking the adequacy of implementation of items mentioned under priority 2 by the contractor and shall submit a conformity / non-conformity report to the Employer with a copy to the contractor.

11.4.9.3 In case of non-conformity of items mentioned by auditor, the Employer shall take necessary steps including stoppage of work and or imposing any penalty for getting the item implemented.

11.4.10 Failure of contractor to conduct External SHE Audit

11.4.10.1 **If the contractor fails to conduct the external SHE audit in time, the Employer at the cost of contractor shall get it done.**



12.0 SHE Communication

- 12.1 The contractor shall take every effort to communicate the Safety, Occupational health and Environment management measures through posters campaigns / billboards / banners / glow signs being displayed around the work site as part of the effort to rise safety awareness amongst to the work force. Posters should be in Hindi, English and other suitable language deemed appropriate. Posters / billboards / banners/ glow signs should be changed at least once in a month to maintain the impact.
- 12.2 The contractor shall also observe important days as listed in General Instruction **JMRC/SHE/GI/008** and printing and displaying safety signage and posters as listed in General Instruction **JMRC/SHE/GI/009**.
- 12.3 The list indicated are the minimum requirements of the Employer and the contractor is encouraged to further the SHE communication activities by formulating suitable reward schemes for safety performers and any other activities, which deem fit for the purpose.

13.0 SHE Submittals to the Employer

- 13.1 The contractor's SHE management should send the following reports to the Employer periodically:
- i) Daily Reporting of total no of workmen (as given in Clause **13.2**)
 - ii) Monthly SHE Report (as given in Clause **13.3**)
 - iii) SHE Committee Meeting Minutes (as given in Clause **7.9.1**)
 - iv) SHE Inspection Reports
 - v) SHE Audit Reports
 - a) Monthly Audit Rating Score (MARS) report
 - b) External SHE Audit
 - c) Electrical Safety Audit
 - vi) Air and Noise Quality monitoring report
- 13.2 **Daily Reporting of total no of workmen**
- 13.2.1 **The contractor shall report to the Employer the total no of workmen engaged by all including any subcontractor within 2 hours of starting of any shift in any day. This reporting shall be the primary duty of the Chief SHE Manager of the contractor and reporting shall be through tele-fax / email. The onus of checking the receipt of the same by the Employer lies with the contractor. If the information is not received or received more than 2 hrs after starting of the shift, penalty shall be levied as per relevant clause.**
- 13.3 Monthly SHE Report
- 13.3.1 The contractor shall prepare a monthly SHE report consisting of the following and submit 3 copies within 7th of next month to the Employer as specified in the Project SHE manual.
- i) Monthly man-hour details as specified in the Project SHE manual
 - ii) Monthly accident / incident details as specified in the Project SHE manual
 - iii) SHE committee details



- iv) Details of SHE training conducted in the month
- v) SHE Inspection
- vi) SHE internal audit details like electrical audit etc.
- vii) SHE Communication activities under taken in the month indicating the number of posters displayed and balance availability in stock.
- viii) Air quality / Noise monitoring details
- ix) Toolbox talks details
- x) PPE details: Quantity purchased, issued to the workmen and stock available.
- xi) Details on IP 44 panel boards, lighting poles, welding and cutting equipments, Ladders, Hoists, tools & tackles.
- xii) Monthly Lux meter study results
- xiii) Housekeeping
- xiv) Barricade maintenance details
- xv) No of critical excavations
- xvi) Health & Welfare activities
- xvii) Safety walk conducted by Contractors' Project Manager in the month
- xviii) SHE Activities Planned for next month

14.0 Accident reporting and investigation

14.1 Reporting to Employer

14.1.1 All accidents and dangerous occurrences shall immediately be informed verbally to the Employer. This will enable the Employer to reach to the scene of accident / dangerous occurrences to monitor/assist any rescue work and/or start conducting the investigation process so that the evidences are not lost.

14.1.2 Reports of all accidents (fatal / injury) and dangerous occurrences shall also be sent within 24 hours as per format provided in the Employer's Project SHE manual.

14.1.3 No accident / dangerous occurrences is exempted from reporting to the Employer.

14.1.4 Any wilful delay in verbal and written reporting to the Employer shall be penalised as per relevant clause.

14.2 Reporting to Government organisations

14.2.1 In addition to the above verbal and written reporting to the Employer, as per Rule 210 of BOCWR, notice of any accident to a worker at the building or construction site that:

- a) causes loss of life; or
- b) disables a worker from working for a period of 48 hours or more immediately following the accident;
- c) shall forthwith be sent by telegram, telephone, fax, or similar other means including special messenger within four hours in case of fatal accidents and 72 hours in case of other accidents, to:
 - i) the Regional Labour Commissioner (central), wherein the contractor has registered the firm/work
 - ii) the board with which the worker involved was registered as a beneficiary;



- iii) Director General and
- iv) the next of kin or other relative of the worker involved in the accident;

14.2.2 Further, notice of accident shall be sent in respect of an accident which

- (a) causes loss of life; or
- (b) disables the injured worker from work for more than 10 days to
 - i) the officer-in-charge of the nearest police station;
 - ii) the District Magistrate or, if the District Magistrate by order so desires, to
 - iii) the Sub-Divisional Magistrate

14.2.3 In case of an accident causing minor injury, first-aid shall be administered and the injured worker shall be immediately transferred to a hospital or other place for medical treatment.

14.2.4 Where any accident causing disablement that subsequently results in death, notice in writing of such death, shall be sent to the authorities mentioned in clause **14.2.1** and **14.2.2** above within 72 hours of such death.

14.2.5 Reporting of dangerous occurrences:

14.2.5.1 The following classes of dangerous occurrences shall be reported to the Inspector having jurisdiction, whether or not any disablement or death caused to the worker, namely:

- (a) collapse or failure of lifting appliances, or hoist, or conveyors, or similar equipment for handling of building or construction material or breakage or failure of rope, chain or loose gears; or overturning of cranes used in construction work;
- (b) falling of objects from height;
- (c) collapse or subsidence of soil, tunnel, pipe lines, any wall, floor, gallery, roof or any other part of any structure, launching girder, platform, staging, scaffolding or means of access including formwork;
- (d) explosion of receiver or vessel used for storage of pressure greater than atmospheric pressure, of any gas or gases or any liquid or solid used as building material;
- (e) fire and explosion causing damage to any place on construction site where building workers are employed;
- (f) spillage or leakage of any hazardous substance and damage to their container;
- (g) collapse, capsizing, toppling or collision of transport equipment;
- (h) leakage or release of harmful toxic gases at the construction site;

14.2.6 In case of failure of launching girder, lifting appliance, loose gear, hoist or building and other construction work, machinery and transport equipment at a construction site, such appliances, gear, hoist, machinery or equipment and the site of such occurrence shall, as far as practicable, be kept undisturbed until inspected by the Authorities;

14.2.7 Every notice given for fatal accidents or dangerous occurrences shall be followed by a written report to the concerned Authorities under Section 39 of BOCWA and the Director General in the specified Form XIV of BOCWR.

14.3 Accident investigation



14.3.1 General

14.3.1.1 Investigations should be conducted in an open and positive atmosphere that encourages the witnesses to talk freely. The primary objective is to ascertain the facts with a view to prevent future and possibly more serious occurrences

14.3.1.2 Accidents and Dangerous Occurrences which result in death, serious injury or serious damage must be investigated by the Contractor immediately to find out the cause of the accident/occurrence so that measures can be formulated to prevent any recurrence.

14.3.1.3 Near misses and minor accidents should also be investigated by the Contractor as soon as possible as they are signals that there are inadequacies in the safety management system.

14.3.2 Procedure of incident investigation

14.3.2.1 It is important after any accident or dangerous occurrence that information relating to the incident is gathered in an organised way. The following steps shall be followed;

- a) take photographs and make sketches
- b) examine involved equipment, workpiece or material and the environmental conditions
- c) interview the injured, eye-witnesses and other involved parties
- d) consult expert opinion where necessary
- e) identify the specific contractor or sub-contractor involved.

14.3.2.2 Having gathered information, it is then necessary to make an analysis of incident

- a) establish the chain of events leading to the accident or incident
- b) find out at what stage the accident took place
- c) consider all possible causes and the interaction of different factors that led up to the accident, and identify the most probable cause. The cause of an accident should never be classified as carelessness. The specific act or omission that caused the accident must be identified.

14.3.2.3 The next stage is to proceed with the follow-up action

- a) report on the findings and conclusions
- b) formulate preventive measures to avoid recurrence
- c) publicise the findings and the remedial actions taken

14.4 Employers' independent incident investigation

14.4.1 In case of fatal / dangerous occurrence the Employer shall also conduct independent investigation. Contractor and his staff shall extend necessary co-operation and testify about the accident.

14.4.2 The contractor shall take every effort to preserve the scene of accident till the Employer completes the investigation.

14.4.3 All persons summoned by the Employer in connection to witness recording shall obey the instructions without delay. Any wilful suppression of information by any person shall be removed from the site immediately and / or punishable as per relevant penalty clause.



15.0 Emergency preparedness plan

- 15.1 The Contractor shall prepare an Emergency Response Plan for all work sites as a part of the Contractor SHE Plan. The plan shall integrate the emergency response plans of the Contractor and all other subcontractors. The Emergency Response Plan shall detail the Contractor's procedures, including detailed communications arrangements, for dealing with all emergencies that could affect the Site. This include where applicable, injury, sickness, evacuation, fire, chemical spillage, severe weather and rescue.
- 15.2 The contractor shall ensure that an Emergency Response Plan is prepared to deal with emergencies arising out of:
- i) Fire and explosion
 - ii) Collapse of lifting appliances and transport equipment
 - iii) Collapse of building, sheds or structure etc.
 - iv) Gas leakage or spillage of dangerous goods or chemicals
 - v) Bomb threatening, Criminal or Terrorist attack
 - vi) Drowning of workers
 - vii) Landslides getting workers buried floods, Earthquake, storms and other natural calamities.
- 15.3 Arrangements shall be made for emergency medical treatment and evacuation of the victim in the event of an accident or dangerous incident occurring, the chain of command and the responsible persons of the contractor with their telephone numbers and addresses for quick communication shall be adequately publicized and conspicuously displayed in the workplace.
- 15.4 Contractors shall require to tie-up with the hospitals and fire stations located in the neighbourhood for attending to the casualties promptly and emergency vehicle kept on standby duty during the working hours for the purpose.
- 15.5 Contractor shall conduct an onsite emergency mock drill once in every month for all his workers and his subcontractor's workers.
- 15.6 It shall be the responsibility of the contractor to keep the Local Law & Order Authorities informed and seek urgent help, as the case may be, so as to mitigate the consequences of an emergency. Prompt communication to JMRC, telephonically initially and followed by a written report, shall be made by the contractor.

16.0 Experts / Agencies for SHE services

- 16.1 Contractors may utilise the services of experts/agencies empanelled under Rule 250 of BOCWR and Rule 277 of RBOCWR for the purpose of training, internal audit and any other SHE services with prior approval of the Employer.
- 16.2 As an aide to contractors, a list of experts/agencies and the offered service are given in General Instruction **JMRC/SHE/GI/010** for ready reference. In addition to it if the contractor would like to use any expert/agencies' services for any SHE activities the same can also be allowed provided that they are competent and meet to the general requirements of Employer. In every case prior approval of the Employer is mandatory.



PART – II : SAFETY



17.0 Housekeeping

- 17.1 Housekeeping is the act of keeping the working environment cleared of all unnecessary waste, thereby providing a first-line of defence against accidents and injuries.
- 17.2 Contractor shall understand and accept that improper housekeeping is the primary hazard in any construction site and ensure that a high degree of house keeping is always maintained. Indeed "Cleanliness is indeed next to Godliness"
- 17.3 Housekeeping is the responsibility of all site personnel, and line management commitment shall be demonstrated by the continued efforts of supervising staff towards this activity.
- 17.4 General House keeping shall be carried out by the contractor and ensured at all times at Work Site, Construction Depot, Batching Plant, Labour Camp, Stores, Offices and toilets/urinals. Towards this the Contractor shall constitute a special group of house keeping personnel as per General Instruction JMRC/SHE/GI/001. This group shall ensure daily cleaning at work sites and surrounding areas and maintain a register as per the approved format by the Employer.
- 17.5 Adequate time shall be assigned to ensure that good housekeeping is maintained. This shall be carried out by team of housekeeping squad.
- 17.6 The contractor shall be responsible to provide segregated containers for disposal of debris at required places and regular cleaning of the same.
- 17.7 Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the surrounding area from excavated soil, rubbish etc, which may cause inconvenience to and endanger the public. The barricade especially those exposed to public shall be aesthetically maintained by regular cleaning and painting as directed by the Employer. These shall be maintained in one line and level.
- 17.8 The structure dimension of the barricade, material and composition, its colour scheme, JMRC logo and other details shall be in accordance with specifications laid down in tender document.
- 17.9 All stairways, passageways and gangways shall be maintained without any blockages or obstructions. All emergency exits passageways, exits fire doors, break-glass alarm points, fire fighting equipment, first aid stations, and other emergency stations shall be kept clean, unobstructed and in good working order.
- 17.10 Lumber with protruding nails shall be either bent / removed and properly stacked.
- 17.11 All surplus earth and debris are removed/disposed off from the working areas to officially designated dumpsites. Trucks carrying sand, earth and any pulverized materials etc. in order to avoid dust or odour impact shall be covered while moving. **The tyres of the trucks leaving the site shall be cleaned with water, wherever the possibility of spillage on carriageways meant for regular road traffic exists.**
- 17.12 No parking of trucks/trolleys, cranes and trailers etc. shall be allowed on roads, which may obstruct the traffic movement.



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- 17.13 Roads shall be kept clear and materials like: pipes, steel, sand boulders, concrete, chips and brick etc. shall not be allowed on the roads to obstruct free movement of road traffic.
- 17.14 Water logging or bentonite spillage on roads shall not be allowed. If bentonite spillage is observed on road endangering the safety of road users, the contractor shall be penalised as per relevant clause.
- 17.15 Proper and safe stacking of material are of paramount importance at yards, stores and such locations where material would be unloaded for future use. The storage area shall be well laid out with easy access and material stored / stacked in an orderly and safe manner.
- 17.16 Flammable chemicals / compressed gas cylinders shall be safely stored.
- 17.17 Unused/surplus cables, steel items and steel scrap lying scattered at different places within the working areas shall be removed to identified locations(s).
- 17.18 All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from work place to identified location(s).
- 17.19 Empty cement bags and other packaging material shall be properly stacked and removed.
- 17.20 The Contractor shall ensure that all his sub-contractors maintain the site reasonably clean through provisions related to house keeping

18.0 Working at Height

18.1 Definitions

- 18.1.1 "access" and "egress" include ascent and descent.
- 18.1.2 "fragile surface" means a surface, which would be able to fail if any reasonably foreseeable loading were to be applied to it.
- 18.1.3 "line" includes rope, chain or webbing
- 18.1.4 "personal fall protection" means -
(a) a fall prevention, work restraint, work positioning, fall arrest or rescue system, other than a system in which the only safeguards are collective safeguards; or
(b) rope access and positioning techniques;
- 18.1.5 "work at height" means -
(a) work in any place, including a place at or below ground level;
(b) obtaining access to or egress from such place while at work, except by a staircase in a permanent workplace,
where, if protective measures were not taken, a person could fall a distance liable to cause personal injury;
- 18.1.6 "work equipment" means any machinery, appliance, apparatus, tool or installation for use at work (whether exclusively or not) and includes
(a) a guard-rail, toe-board, barrier or similar collective means of protection



- (b) a working platform
 - (c) a net, airbag or other collective safe guard for arresting falls.
 - (d) personal fall protection system
 - (e) ladders
- 18.1.7 “working platform”
 - (a) means any platform used as a place of work or as a means of access to or egress from a place of work;
 - (b) includes any scaffold, suspended scaffold, cradle, mobile platforms, trestle, gangway, gantry and stairway which is so used.
- 18.2 Organisation and planning
The contractor shall ensure that work at height is
 - i) properly planned for any emergencies and rescue
 - ii) appropriately supervised; and
 - iii) carried out in a manner, which is reasonably practicable safe.
- 18.3 The contractor shall ensure that work at height is carried out only when the weather conditions do not jeopardise the health or safety of persons involved in the work.
- 18.4 Competence
The contractor shall ensure that no person engages in any activity, including organization, planning and supervision, in relation to work at height or work equipment for use in such work unless he is competent to do so or, if being trained, is being supervised by a competent person.
- 18.5 Avoidance of risks from work at height
The contractor shall ensure that work is not carried out at height where it is reasonably practicable to carry out the work safely otherwise than at height.
- 18.6 Where work is carried out at height, the contractor shall take suitable and sufficient measures as given below to prevent, so far as is reasonably practicable, any person falling a distance liable to cause personal injury.
 - (a) his ensuring that the work is carried out
 - (i) from an existing place of work; or
 - (ii) (in the case of obtaining access or egress) using an existing means, complying to the requirements as given in **18.15** where it is reasonably practicable to carry it out safely and under appropriate ergonomic conditions; and
 - (b) where it is not reasonably practicable for the work to be carried out in accordance with sub-paragraph (a), his providing sufficient work equipment for preventing, so far as is reasonably practicable, a fall occurring.
- 18.7 Where the measures taken under clause **18.6** do not eliminate the risk of a fall occurring, every contractor shall
 - (a) so far as is reasonably practicable, provide sufficient work equipment to minimise -
 - (i) the distance and consequences; or
 - (ii) where it is not reasonably practicable to minimise the distance, the consequences, of a fall; and



- (b) Without prejudice to the generality of clause **18.4**, provide such additional training and instruction or take other additional suitable and sufficient measures to prevent, so far as is reasonably practicable, any person falling a distance liable to cause personal injury.

18.8 Selection of 'work equipment' for work at height

- 1) the contractor, in selecting work equipment for use in work at height, shall
 - a) give collective protection measures priority over personal protection measures; and
 - b) take account of
 - i) the working conditions and the risks to the safety of persons at the place where the work equipment is to be used;
 - ii) in the case of work equipment for access and egress, the distance to be negotiated;
 - iii) the distance and consequences of a potential fall;
 - iv) the duration and frequency of use;
 - v) the need for easy and timely evacuation and rescue in an emergency; and
 - vi) any additional risk posed by the use, installation or removal of that work equipment or by evacuation and rescue from it;
- (2) The contractor shall select work equipment for work at height which:
 - a) has characteristics including dimensions which:
 - (i) are appropriate to the nature of the work to be performed and the foreseeable loadings; and
 - (ii) allow passage without risk; and
 - b) is in other respects the most suitable work equipment, having regard in particular to the purposes specified in **18.5** and **18.6**.

18.9 Fragile surfaces

18.9.1 The contractor shall ensure that no person at work passes across or near, or working on, from or near, a fragile surface where it is reasonably practicable to carry out work safely and under appropriate ergonomic conditions without his doing so.

18.9.2 Where it is not reasonably practicable to carry out work safely and under appropriate ergonomic conditions without passing across or near, or working on, from or near, a fragile surface, every contractor shall,

- (a) ensure, so far as is reasonably practicable, that suitable and sufficient platforms, coverings, guard rails or similar means of support or protection are provided and used so that any foreseeable loading is supported by such supports or borne by such protection;
- (b) where a risk of a person at work falling remains despite the measures taken under the preceding provisions of this regulation, take suitable and sufficient measures to minimise the distances and consequences of his fall.



- 18.9.3 Where any person at work may pass across or near, or work on, from or near, a fragile surface, every contractor shall ensure that
- (a) prominent warning notices are so far as is reasonably practicable affixed at the approach to the place where the fragile surface is situated; or
 - (b) where that is not reasonably practicable, such persons are made aware of it by other means.
- 18.10 Falling objects
- 18.10.1 The contractor shall, where necessary to prevent injury to any person, take suitable and sufficient steps to prevent, so far as is reasonably practicable, the fall of any material or object.
- 18.10.2 Where it is not reasonably practicable to comply with the requirements of **18.9**, every contractor shall take suitable and sufficient steps to prevent any person being struck by any falling material or object which is liable to cause personal injury.
- 18.10.3 The contractor shall ensure that no material or object is thrown or tipped from height in circumstances where it is liable to cause injury to any person.
- 18.10.4 Every employer shall ensure that materials and objects are stored in such a way as to prevent risk to any person arising from the collapse, overturning or unintended movement of such materials or objects.
- 18.11 Danger areas
- 18.11.1 Without prejudice to the preceding requirements of these Regulations, every contractor shall ensure that
- (a) where a workplace contains an area in which, owing to the nature of the work, there is a risk of any person at work
 - i) falling a distance; or
 - ii) being struck by a falling object,which is liable to cause personal injury, the workplace is so far as is reasonably practicable equipped with devices preventing unauthorised persons from entering such area; and
 - (b) such area is clearly indicated.
- 18.12 Inspection of work equipment
- 18.12.1 The contractor shall ensure that, where the safety of work equipment depends on how it is installed or assembled, it is not used after installation or assembly in any position unless it has been inspected in that position.
- 18.12.2 The contractor shall ensure that work equipment exposed to conditions causing deterioration which is liable to result in dangerous situations is inspected
- (a) at suitable intervals; and
 - (b) each time that exceptional circumstances which are liable to jeopardise the safety of the work equipment have occurred,
- to ensure that health and safety conditions are maintained and that any deterioration can be detected and remedied in good time.



- 18.12.3 Without prejudice to paragraph **18.12.1**, the contractor shall ensure that a working platform
- (a) used for construction work; and
 - (b) from which a person could fall 2 metres or more,
- is not used in any position unless it has been inspected in that position or, in the case of a mobile working platform, inspected on the site, within the previous 7 days.
- 18.12.4 The contractor shall ensure that the reports of all inspections are properly maintained and shown to the Employer as and when required.
- 18.12.5 In this clause "inspection",
- (a) means such visual or more rigorous inspection by a competent person as is appropriate for safety purposes;
 - (b) includes any testing appropriate for those purposes,
- 18.13 Inspection of places of work at height
- 18.13.1 The contractor shall so far as is reasonably practicable ensure that the surface and every parapet, permanent rail or other such fall protection measure of every place of work at height are checked on each occasion before the place is used.
- 18.14 Duties of persons at work
- 18.14.1 Any workmen employed by the contractor shall report to the supervisor about any defect relating to work at height which he knows is likely to endanger the safety of himself or another person.
- 18.14.2 Every workmen shall use any work equipment or safety device provided to him for work at height by the contractor, in accordance with
- (a) any training in the use of the work equipment or device concerned which have been received by him; and
 - (b) the instructions respecting that use which have been provided to him by the contractor as per the requirements of the Employer
- 18.15 Requirements for existing places of work and means of access or egress at height
- Every existing place of work or means of access or egress at height shall
- (a) be stable and of sufficient strength and rigidity for the purpose for which it is intended to be or is being used;
 - (b) where applicable, rest on a stable, sufficiently strong surface;
 - (c) be of sufficient dimensions to permit the safe passage of persons and the safe use of any plant or materials required to be used and to provide a safe working area having regard to the work to be carried out there;
 - (d) possess suitable and sufficient means for preventing a fall;
 - (e) possess a surface which has no gap
 - (i) through which a person could fall;
 - (ii) through which any material or object could fall and injure a person; or
 - (iii) giving rise to other risk of injury to any person, unless measures have been taken to protect persons against such risk;



- (f) be so constructed and used, and maintained in such condition, as to prevent, so far as is reasonably practicable -
 - (i) the risk of slipping or tripping; or
 - (ii) any person being caught between it and any adjacent structure;
- (g) where it has moving parts, be prevented by appropriate devices from moving inadvertently during work at height.

18.16 Requirements for guardrails, toe-boards, barriers and similar collective means of protection

- i) Unless the context otherwise requires, any reference in this section to means of protection is to a guardrail, toe-board, barrier or similar collective means of protection.
- ii) Means of protection shall
 - (a) be of sufficient dimensions, of sufficient strength and rigidity for the purposes for which they are being used, and otherwise suitable;
 - (b) be so placed, secured and used as to ensure, so far as is reasonably practicable, that they do not become accidentally displaced; and
 - (c) be so placed as to prevent, so far as is practicable, the fall of any person, or of any material or object, from any place of work.
- iii) In relation to work at height involved in construction work
 - (a) the top guard-rail or other similar means of protection shall be at least 950 millimetres above the edge from which any person is liable to fall;
 - (b) toe-boards shall be suitable and sufficient to prevent the fall of any person, or any material or object, from any place of work; and
 - (c) any intermediate guardrail or similar means of protection shall be positioned so that any gap between it and other means of protection does not exceed 470 millimetres.
- iv) Any structure or part of a structure which supports means of protection or to which means of protection are attached shall be of sufficient strength and suitable for the purpose of such support or attachment.

18.17 Requirements for all Working Platforms

- i) Every working platforms requires a supporting structure for holding it
- ii) Any surface upon which any supporting structure rests shall be stable, of sufficient strength and of suitable composition safely to support the supporting structure, the working platform and any loading intended to be placed on the working platform.
- iii). Stability of supporting structure
Any supporting structure shall
 - (a) be suitable and of sufficient strength and rigidity for the purpose for which it is being used;
 - (b) in the case of a wheeled structure, be prevented by appropriate devices from moving inadvertently during work at height;
 - (c) in other cases, be prevented from slipping by secure attachment to the bearing surface or to another structure, provision of an effective anti-slip device or by other means of equivalent effectiveness;
 - (d) be stable while being erected, used and dismantled; and
 - (e) when altered or modified, be so altered or modified as to ensure that it remains stable.
 - (f) Have suitable base plates and properly footed thereby.
- iv). Stability of working platforms



A working platform shall

- (a) be suitable and of sufficient strength and rigidity for the purpose or purposes for which it is intended to be used or is being used;
- (b) be so erected and used as to ensure that its components do not become accidentally displaced so as to endanger any person;
- (c) when altered or modified, be so altered or modified as to ensure that it remains stable; and
- (d) be dismantled in such a way as to prevent accidental displacement.

v) Safety on working platforms

A working platform shall

- (a) be of sufficient dimensions to permit the safe passage of persons and the safe use of any plant or materials required to be used and to provide a safe working area having regard to the work being carried out there;
- (b) possess a suitable surface and, in particular, be so constructed that the surface of the working platform has no gap
 - i) through which a person could fall;
 - ii) through which any material or object could fall and injure a person; or
 - iii) giving rise to other risk of injury to any person, unless measures have been taken to protect persons against such risk; and
- (c) be so erected and used, and maintained in such condition, as to prevent, so far as is reasonably practicable
 - i) the risk of slipping or tripping; or
 - ii) any person being caught between the working platform and any adjacent structure.

vi) Loading

A working platform and any supporting structure shall not be loaded so as to give rise to a risk of collapse or to any deformation, which could affect its safe use.

vii) Additional requirements for scaffolding

Strength and stability calculations for scaffolding shall be carried out unless

- (a) a note of the calculations, covering the structural arrangements contemplated, is available; or
- (b) it is assembled in conformity with a generally recognised standard configuration.

viii) Depending on the complexity of the scaffolding selected, a competent person shall draw up an assembly, use and dismantling plan. This may be in the form of a standard plan, supplemented by items relating to specific details of the scaffolding in question.

- ix) A copy of the plan, including any instructions it may contain, shall be kept available for the use of persons concerned in the assembly, use, dismantling or alteration of scaffolding until it has been dismantled.
- x) The dimensions, form and layout of scaffolding decks shall be appropriate to the nature of the work to be performed and suitable for the loads to be carried and permit work and passage in safety.



- xi) While a scaffold is not available for use, including during its assembly, dismantling or alteration, it shall be marked with general warning signs in accordance with and be suitably delineated by physical means preventing access to the danger zone.
- xii) Scaffolding may be assembled, dismantled or significantly altered only under the supervision of a competent person and by persons who have received appropriate and specific training in the operations envisaged which addresses specific risks which the operations may entail and precautions to be taken, and more particularly in
 - (a) understanding of the plan for the assembly, dismantling or alteration of the scaffolding concerned;
 - (b) safety during the assembly, dismantling or alteration of the scaffolding concerned;
 - (c) measures to prevent the risk of persons, materials or objects falling;
 - (d) safety measures in the event of changing weather conditions which could adversely affect the safety of the scaffolding concerned;
 - (e) permissible loadings;
 - (f) any other risks which the assembly, dismantling or alteration of the scaffolding may entail.

18.18 Requirements for collective safeguards for arresting falls

- i) Collective safeguard are a safety net, airbag or other collective safeguard for arresting falls
- ii) A safeguard shall be used only if
 - (a) a risk assessment has demonstrated that the work activity can so far as is reasonably practicable be performed safely while using it and without affecting its effectiveness;
 - (b) the use of other, safer work equipment is not reasonably practicable; and
 - (c) a sufficient number of available persons have received adequate training specific to the safeguard, including rescue procedures.
- iii) A safeguard shall be suitable and of sufficient strength to arrest safely the fall of any person who is liable to fall.
- iv) A safeguard shall
 - (a) in the case of a safeguard which is designed to be attached, be securely attached to all the required anchors, and the anchors and the means of attachment thereto shall be suitable and of sufficient strength and stability for the purpose of safely supporting the foreseeable loading in arresting any fall and during any subsequent rescue;
 - (b) in the case of an airbag, landing mat or similar safeguard, be stable; and
 - (c) in the case of a safeguard, which distorts in arresting a fall, afford sufficient clearance.
- v) Suitable and sufficient steps shall be taken to ensure, so far as practicable, that in the event of a fall by any person the safeguard does not itself cause injury to that person.

18.19 Requirements for personal fall protection systems



- i) A personal fall protection system shall be used only if
 - (a) a risk assessment has demonstrated that
 - (i) the work can so far as is reasonably practicable be performed safely while using that system; and
 - (ii) the use of other safer work equipment is not reasonably practicable; and
 - (b) the user and a sufficient number of available persons have received adequate training specific to the operations envisaged, including rescue procedures.
- ii) A personal fall protection system shall
 - (a) be suitable and of sufficient strength for the purposes for which it is being used having regard to the work being carried out and any foreseeable loading;
 - (b) where necessary, fit the user;
 - (c) be correctly fitted;
 - (d) be designed to minimise injury to the user and, where necessary, be adjusted to prevent the user falling or slipping from it, should a fall occur; and
 - (e) be so designed, installed and used as to prevent unplanned or uncontrolled movement of the user.
- iii) A personal fall protection system designed for use with an anchor shall be securely attached to at least one anchor, and each anchor and the means of attachment thereto shall be suitable and of sufficient strength and stability for the purpose of supporting any foreseeable loading.
- iv) Suitable and sufficient steps shall be taken to prevent any person falling or slipping from a personal fall protection system.

18.20 Requirements for Ladders

- 1) Every contractor shall ensure that a ladder is used for work at height only if a risk assessment has demonstrated that the use of more suitable work equipment is not justified because of the low risk and
 - i) The short duration of use; or
 - ii) Existing features on site, which he cannot alter.
- 2) Only metal ladders shall be allowed. Bamboo ladders are prohibited.
- 3) Any surface upon which a ladder rests shall be stable, firm, of sufficient strength and of suitable composition safely to support the ladder so that its rungs or steps remain horizontal, and any loading intended to be placed on it.
- 4) A ladder shall be so positioned as to ensure its stability during use
- 5) A suspended ladder shall be attached in a secure manner and so that, with the exception of a flexible ladder, it cannot be displaced and swinging is prevented.
- 6) A portable ladder shall be prevented from slipping during use by -
 - i) securing the stiles at or near their upper or lower ends;
 - ii) an effective anti-slip or other effective stability device; or
 - iii) any other arrangement of equivalent effectiveness.
- 7) A ladder used for access shall be long enough to protrude sufficiently above the place of landing to which it provides access, unless other measures have been taken to ensure a firm handhold.
- 8) No interlocking or extension ladder shall be used unless its sections are prevented from moving relative to each other while in use.
- 9) A mobile ladder shall be prevented from moving before it is stepped on.



- 10) Where a ladder or run of ladders raises a vertical distance of 9 metres or more above its base, there shall, where reasonably practicable, be provided at suitable intervals sufficient safe landing areas or rest platforms.
- 11) Every ladder shall be used in such a way that
 - (a) a secure handhold and secure support are always available to the user; and
 - (b) the user can maintain a safe handhold when carrying a load unless, in the case of a step ladder, the maintenance of a handhold is not practicable when a load is carried, and a risk assessment has demonstrated that the use of a stepladder is justified because of
 - (i) the low risk; and
 - (ii) the short duration of use.

19.0 Overhead protection

All contractors shall provide overhead protections as per Rule 41 of BOCWR

- i) Overhead protection should be erected along the periphery of every building which is under construction and the building height shall be 15m or above after construction.
- ii) Overhead protection shall be minimum 2m wide and the outer edge shall be 150mm higher than the inner edge and an angle not more than 20° to its horizontal sloping into the building.
- iii) Overhead protection shall not be erected more than a height of 5m from the base of the building.
- iv) Areas of inadvertent hazard of falling of material shall be guarded or barricaded or roped-off thereby by the contractor.

20.0 Slipping, Tripping, Cutting, Drowning and Falling Hazards

As per Rule 42 of BOCWR,

- i) All places should be free from dust, debris or similar materials.
- ii) Sharp projections or any protruding nails or similar objects shall be suitably guarded or shall even be avoided to make the place safe to work.
- iii) Contractor shall not allow workmen to work or use platforms, scaffolds/passageways or any walkways, which has water, or oil or similar substances spilt and has a slipping hazard, unless it is cleaned off or covered or sanded or saw dusted or make it safe with any suitable material.
- iv) When workers are exposed to areas where fall into water is possible, the contractor shall provide suitable and adequate equipment for saving the workers from drowning and rescuing from such hazard. If the Employer considers, the contractor shall provide well-equipped boat or launch, manned with trained personnel at the work place.
- v) Open side or opening where worker, equipment, vehicle or lifting appliance may fall at a building or outside shall be guarded suitably except in places of free access by reasons of nature of work.
- vi) Suitable safety net shall be provided at places of material / man falling is possible in accordance with national standards.

21.0 Lifting Appliances and Gear

- 21.1 (a) Lifting appliances means a crane, hoist machinery, derrick, winch, gin pole, sheer legs, jack, hoist drum, slewing machinery, slewing bearing fasteners, luffing machinery sheaves, pulley blocks, hooks or other equipment used for lifting materials, objects or building workers and



lifting gears means ropes, chain slings, shackles, hooks, lifting lugs, wire ropes, lifting eyebolts and eyenuts and other accessories of a lifting appliance.

(b) Use of “Tractor Transmission Type “Pick and Carry Hydra crane

“Tractor Transmission Type “Pick and Carry Hydra crane – 1st Generation model is prohibited at JMRC works. Contractor shall mobilize ‘Truck Transmission Type’ pick and hydra crane – 2nd Generation model only

- 21.2 No machine shall be selected to do any lifting on a specific job until its size and characteristics are considered against:
- i) the weights, dimensions and lift radii of the heaviest and largest loads
 - ii) the maximum lift height, the maximum lift radius and the weight of the loads that must be handled at each
 - iii) the number and frequency of lifts to be made
 - iv) how long the crane will be required on site
 - v) the type of lifting to be done (for example, is precision placement of loads important?
 - vi) the type of carrier required (this depends on ground conditions and machine capacity In its operating quadrants: capacity is normally greatest over the rear, less over the side, and non-existent over the front
 - vii) whether loads will have to be walked or carried
 - viii) whether loads will have to be suspended for lengthy periods
 - ix) the site conditions, including the ground where the machine will be set up, access roads and ramps it must travel, space for erection and any obstacles that might impede access or operation
- 21.3 The contractor shall ensure that a valid certificate of fitness issued as per clause **21.5** is available for all lifting appliances including synchronised mobile jacks, pre-stressing hydraulic jacks, jacks fitted with launching girders etc. and Employers approval before inducting to the site. **Only after obtaining the approval from the Employer any lifting appliances and gear shall be used.**
- 21.4 **The laminated photocopies of fitness certificate issued by competent person, the Employers’ approval letter, the operators’ photo, manufacturer’s load chart and competency certificate shall always be either kept in the operator cabin or pasted on the visible surface of the lifting appliances.**
- 21.5 **All lifting appliances and loose gears shall be clearly marked for its safe working load and identification by stamping or other suitable means.**
- 21.6 The contractor shall also maintain a register containing a system of identification of all tools and tackles, its date of purchase, safe working load, competent person date of examination etc.
- 21.7 Test and periodical examination of lifting appliances and gears
- 21.7.1 All lifting appliances including all parts and gears thereof, whether fixed or movable shall be thoroughly tested and examined by a competent person once at least in every six months or after it has undergone any alterations or repairs liable to affect its strength or stability. Within the validity, if the lifting appliances are shifted to a new site, re-examination by the same competent person for ensuring its safety shall also be done.



- 21.7.2 Contractors can utilise the services of any competent person as defined in Factories Act, 1948 and approved by Chief Inspector of Factories with the permission of the Employer.
- 21.7.3 All alarms and signals like automatic safe load indicators (SLI), boom angle indicators, boom extension indicators, over lift boom alarm, swing alarm, hydraulic safety valves, mechanical radius indicators, load moment indicators etc. shall be periodically examined and maintained always in working condition
- 21.8 Automatic safe load indicators
- 21.8.1 **As stipulated in Rule 100 of RBOCW Rules, every lifting appliances and gears like cranes, hydras etc, if so constructed that the safe working load may be varied by raising or lowering of the jib or otherwise shall be attached with an automatic indicator of safe working loads approved by Bureau of Indian standards/ International certifying bodies which gives a warning to the operator and arrests further movements of the lifting parts.**
- 21.9 Qualification of operator of lifting appliances and of signaller etc
- 21.9.1 The contractor shall not employ any person to drive or operate a lifting machine like crane, hydra etc whether driven by mechanical power or otherwise or to give signals to work as a operator of a riggers or derricks unless he
- i) is above twenty-one years of age and possesses a valid heavy transport vehicle driving licence as per Motor Vehicle Act and Rules.
 - ii) is absolutely competent and reliable
 - iii) possesses the knowledge of the inherent risks involved in the operation of lifting appliances by undergoing a formal training at any institution of national importance acceptable to Employer
 - iv) is medically examined periodically as specified in schedule VII of BOCW Rules.
- 21.10 General requirements of appliances
- 21.10.1 Out-of level
- 21.10.1.1 One of the most severe effects of being out-of fit level is that side loads develop in the boom. Because of side loads all mobile cranes lose capacity rapidly as the degree of out-of-level increases and therefore
- 21.10.2 Boom
- i) The boom is one of the more critical elements of the crane and must be in perfect condition at all time. No boom section with a bent lattice member shall be allowed
 - ii) All welds shall be crack and corrosion free
 - iii) No member of the boom shall be bent
 - iv) All telescopic boom shall be free from cracks, rust, flaking or cracked paint, bulges, greases or varnishes
- 21.10.3 The sweep area (work area) of the construction machinery shall be always free from obstructions.



21.10.4 All hydraulic piping and fittings shall be maintained leak proof.

21.10.5 The operator cab shall possess good and safe:

- i) structure, windows and windshield wipers
- ii) Drivers chair and foot rest
- iii) Control handles
- iv) Cab instrumentation
- v) Telecommunication
- vi) Cab out fitting
- vii) wind indicator with an adjustable set point shall be in a position representative for the wind on the crane. The indicator shall give continuous information regarding constant speeds and gusts.

21.11 Mandatory rigging requirements

21.11.1 Rigging shall be done under experienced and qualified rigger only.

21.11.2 The primary requirement in rigging shall be to assess the weight of load before attempting any lift.

21.11.3 All hooks shall be fitted with Master Rings having certificate of fitness from the competent person, so that the hooks are subjected to balanced vertical loading only.

21.11.4 Only four legged slings shall be allowed which includes master link (ring), intermediate master link (ring) if necessary, chain / wire rope sling, sling hook or other terminal fitting.

21.11.5 Hand spliced slings up to 32mm diameter shall not be used at site for any lifting purpose.

21.11.6 No load shall be slewed over public areas without stopping the pedestrians and road traffic first.

21.11.7 Requirements of outriggers

- i) All outriggers shall be fully extended and all tyres are clear of the ground
- ii) Heavy duty blocking having large bearing area shall be necessary to prevent sinking of floats

21.11.8 All loads shall have tag-lines attached in order to ensure that the load can be controlled at all times.

21.11.9 No close working to any live overhead power line is permitted without the operation of a strict Permit to Work.

21.11.10 Minimum lighting is to be ensured at all lifting operations.

21.12 Failure to do any of the above shall attract penalty from the Employer as per relevant clause



22.0 Launching Operation

- 22.1 As launching operation is one of the riskiest job, the contractor shall take utmost precaution at all stages like; planning, establishing casing yard, casting segments, transporting segments, fabrication and erection of launching girders, launching of segments, pre-stressing, auto launching of girders and dismantling of launching girders.
- 22.2 The contractor shall prepare a comprehensive Method Statement for the launching operation, adhering to the SHE conditions laid down in conditions of contract on SHE and project SHE manual. Particular reference shall be made to the provisions on working at height. As the entire process of launching has to be undertaken at an elevated level the safety of workers and the girder is paramount important. The following general guidelines shall be adhered throughout the launching operation.
- i) Necessary 'working platforms' and fall protection anchorage arrangement shall be provided in the launching girder itself.
 - ii) Provisions for mounting light fittings shall also be made available in the launching girder.
 - iii) The casting yard shall be established ensuring the provision given in clause **38.0**
 - iv) The workmen engaged in fabrication of reinforcement, concreting the segment shall be provided with necessary PPEs including compulsory hand protection gloves.
 - v) Casting and curing of segment shall be undertaken under the direct supervision of the responsible engineer of the contractor.
 - vi) Trucks with valid registration, licence, safe worthiness certificate, Employer's approval certificate, and pollution under check certificate shall only be used for transport of segments
 - vii) Drivers engaged for driving these trucks, shall be trained once in 6 months on defensive driving at any Government authorized Institute or Maruti Institute of Driver Training and Research at Wazirabad Road, Adjoining Loni Road Flyover, Delhi-110094.
 - viii) Drivers shall also have undergone proper medical examination as per relevant clause mentioned under 'Medical Facilities'.
 - ix) The segments shall rigidly secured to the truck with necessary wooden wedges and necessary red indicators/safety tapes provided so that the vehicle is clearly seen by other road users both in day / night time.
 - x) Every launching girder shall have a responsible engineer on duty all the time.
 - xi) All the time from erection to dismantling the area between the two piers wherein launching is in progress shall always be barricaded.
 - xii) Unloading of segments from trucks, lifting of segments, shifting of segments, gluing shall be done under the direct supervision of the approved engineer of the contractor.
 - xiii) Auto launching shall be done only after approval from the Employer. After every auto launching the stability of launching girder shall be ensured.
 - xiv) The vertical deflection of launching girder shall be monitored at all critical stages like with/without loads and after every auto launching.
 - xv) A register containing all important operational details from erection to dismantling of launching girders shall be maintained and made available to Employer whenever called for.
 - xvi) Test certificate for all lifting gears including Macalloy bars shall be maintained at a location closer to the launching girder itself so that it can be referred during all inspections.
 - xvii) Adequate lighting at all time shall be ensured in the entire area of operation.
 - xviii) Access to drinking water & toilet shall be ensured to all workmen engaged for launching process.



- xix) Proper access ladders/stairways shall be maintained for safe ascending / descending of workmen / engineers.

22.3 Non-adherence to any of the clauses mentioned above shall be viewed seriously by the Employer and penalty levied as per relevant clause.

23.0 Construction machinery

23.1 Construction machineries may include dumpers and dump trucks, lift trucks and telescopic handlers piling rigs, vibro hammers, rail welding equipments, mobile elevating work platforms, cranes, tipper lorries, lorry loaders, skip wagons, 360° excavators, 180° backhoe loaders, crawler tractors, scrapers, graders, loading shovels, trenchers, side booms, pavers, planers, chippers, road rollers, locomotives, tankers and bowsers, trailers, hydraulic and mechanical breakers etc.

23.2 Safe worthiness certificate

23.2.1 Every construction equipment shall be in sound mechanical working condition and certified by either competent person under Factories Act or manufacturers' warranty in case of brand new equipments or authorized persons / firms approved by Employer before induction to any site.

23.2.2 Every such certificate shall have the date of purchase, main overhauling undertaken in the past, any accident to the equipment, visual examination details, critical components safety check, list of safety devises and its working condition, manufacturer's maintenance checklist, past projects wherein the equipments were used etc as its minimum content.

23.3 Reverse Horns

23.3.1 All Vehicles shall be fitted with audible reverse alarms and maintained in good working condition. Reversing shall be done only when there is adequate rear view visibility or under the directions of a banksman.

23.4 General operating procedures

- i) Drivers entering site shall be instructed to follow the safe system of work adopted on site. These shall be verbal instructions or, preferably, written instructions showing the relevant site rules, the site layout, delivery areas, speed limits, etc.
- ii) No passengers shall be carried, unless specific seating has been provided in accordance with the manufacturers recommendations.
- iii) Working on gradients beyond any equipments capability shall not be allowed.
- iv) Prevention of dumper and dump truck accidents should be managed by providing wheel stops at a sufficient distance from the edges of excavations, spoil heaps, pits, etc.
- v) The manufacturer's recommended bucket size must not be exceeded in excavators.
- vi) If excavators operating on a gradient which cannot be avoided, it must be ensured that the working cycle is slowed down, that the bucket is not extended too far in the downhill direction, and that travel is undertaken with extreme caution. A large excavator must never be permitted to travel in a confined area, or around people, without a banksman to guide the driver, who should have the excavator attachment close in to the machine, with the bucket just clear of the ground. On wheeled excavators, it is essential that the tyres are in good condition and correctly inflated. If stabilizing devices are fitted, they should be employed when the machine is excavating.



- vii) When the front shovel of the 180⁰ backhoe loaders is being employed, the backhoe attachment shall be in its “travel” position, with the safety locking device in place.
- viii) When operating the backhoe in poor ground conditions, the stabilisers tend to sink into the surface of the ground, reducing stability. Therefore frequent checks shall be made for the stability of the machine. The loading shovel should always be lowered to the ground to stabilise the machine when the backhoe is employed.
- ix) The netting operation of the skip wagons should be carried out prior to lifting the skip to reduce the risks of working on the rear platform
- x) If a tractor dozer is employed on clearing scrub or felling trees, it shall be provided with adequate driver protection.
- xi) When two or more scrapers are working on the same job, a minimum distance of at least 25m shall be kept between them.
- xii) In case of hydraulic breakers, hydraulic rams and hoses shall be in good working condition

23.5 All wood working machines shall be fitted with suitable guards and devices such as top guard, riving knife, push stick, guards for drive belts and chains, and emergency stop switch easily accessible by the operator.

23.6 Penalty

23.6.1 If any of the above clauses are not adhered, penalty shall be imposed as per relevant clause depending upon the gravity of the unsafe act and or condition.

24.0 Machine and general area guarding

24.1 The contractor shall ensure at the construction site all motors, cogwheels, chains and friction gearing, flywheels, shafting, dangerous and moving parts of machinery are securely fenced or legged. The fencing of dangerous part of machinery is not removed while such machinery is in motion or in use.

25.0 Manual lifting and carrying of excessive weight

25.1 The contractor shall ensure at his construction site of a building or other construction work that no building worker lifts by hand or carries overhead or over his back or shoulders any material, article, tool or appliances exceeding in weight as said below as per Rule 38 of BOCWR, Unless aided by another building worker or device.

Person	Maximum weight in kg.
Adult man	55
Adult woman	30

25.2 No building worker aided by other building worker shall lift or carry weight higher than or exceeding the sum of total of maximum limits set out for each building worker separately as mentioned in the table above.

26.0 Site Electricity

26.1 Competency of Electrical personnel:



- 26.1.1 The contractor shall employ qualified and competent electrical personnel as specified in general instruction **JMRC/SHE/GI/001**.
- 26.2 Assessment of power
- 26.2.1 The contractor shall assess the size and location of the electrical loads and the manner in which they vary with time during the currency of the contract.
- 26.2.2 The contractor shall elaborate as to how the total supply is to be obtained / generated. The details of the source of electricity, earthing requirement, substation / panel boards, distribution system shall be prepared and necessary approval from Employer obtained before proceeding of the execution of the job.
- 26.2.3 **The main contractor shall take consideration, the requirements of the sub / petty contractors' electric power supply and arrive at the capacity of main source of power supply from diesel generators.**
- 26.2.4 **As the sub / petty contractors' small capacity generators create more noise and safety hazard, no small capacity diesel generators shall be allowed for whatsoever the type of job to be executed under this contract.**
- 26.2.5 **If any unsafe noise making small capacity diesel generators are found used by sub / petty contractors the main contractor shall only be penalised.**
- 26.3 **Work on site**
- 26.3.1 **The contractor shall also submit electrical single line diagram, schematic diagram and the details of the equipment for all temporary electrical installation and these diagrams together with the temporary electrical equipment shall be submitted to the Employer's for necessary approval. Failure to do so shall invite penalty as per relevant clause.**
- 26.4 Strength and capability of electrical equipment
- 26.4.1 No electrical equipment shall be put into use where its strength and capability may be exceeded in such a way as may give rise to danger.
- 26.5 Adverse or hazardous environments
- 26.5.1 Electrical equipment which may reasonably foreseeably be exposed to-
- (a) mechanical damage;
 - (b) the effects of the weather, natural hazards, temperature or pressure;
 - (c) the effects of wet, dirty, dusty or corrosive conditions; or
 - (d) any flammable or explosive substance, including dusts, vapours or gases, shall be of such construction or as necessary protected as to prevent, so far as is reasonably practicable, danger arising from such exposure.
- 26.6 Distribution system:
- 26.6.1 The contractor shall provide distribution system for control and distribution of electricity from a main AC supply of 50Hz for typical appliances,



- i) Fixed plant – 400V 3 phase
- ii) Movable plant fed via trailing cable over 3.75 kW – 400 3 phase
- iii) Installation in site buildings – 230V single phase
- iv) Fixed flood lighting – 230V single phase
- v) Portable and hand tools – 115V single phase
- vi) Site lighting - 115V single phase
- vii) Portable hand lamps – 115V single phase

26.7 Electrical protection circuits

26.7.1 Precautions shall be taken, either by earthing or by other suitable means, to prevent danger arising when any conductor (other than a circuit conductor) which may reasonably foreseeable become charged as a result of either the use of a system, or a fault in a system, becomes so charged. A conductor shall be regarded as earthed when conductors of sufficient strength and current-carrying capability to discharge electrical energy to earth connect it to the general mass of earth.

If a circuit conductor is connected to earth or to any other reference point, nothing which might reasonably be expected to give rise to danger by breaking the electrical continuity or introducing high impedance shall be placed in that conductor unless suitable precautions are taken to prevent that danger.

26.7.2 Appropriate electrical protection shall be provided for all circuits, against over load, short circuit and earth fault current.

26.7.3 The contractor shall provide sufficient ELCBs (maintain sensitivity 30 mA) / RCCBs for all the equipments (including Potable equipments), electrical switchboards, distribution panels etc. to prevent electrical shocks to the workers.

26.7.4 All protection devices shall be capable of interrupting the circuit without damage to any equipments and circuits in case of any fault may occur.

26.7.5 Rating of fuses and circuit breakers used for the protection of circuits should be coordinate with equipment power ratings.

26.7.6 Protection against lightning shall be ensured to all equipment kept in open at sites.

26.8 Cables:

26.8.1 Cables shall be selected after full consideration of the condition to which they shall be exposed and the duties for which they are required. Supply cable up to 3.3 kV shall be in accordance with BS 6346.

26.8.2 For supplies to mobile or transportable equipment where operating of the equipment subjects the cable to flexing, the cable shall conform to any of these codes BS 6007 / BS 6500 / BS 7375.

26.8.3 Flexible cords with a conductor cross sectional area smaller than 1.5 mm² shall not be used and insulated flexible cable shall conform to BS 6500 and BS 7375.

26.8.4 Where low voltage cables are to be used, reference shall be made to BS 7375. The following standards shall also be referred to particularly for under ground cables BS 6346 and BS 6708



- 26.8.5 Cables buried directly in the ground shall be of a type incorporating armour or metal sheath or both. Such cables shall be marked by cable covers or a suitable marking tape and be buried at a sufficient depth to avoid their being damaged by any disturbance of the ground. Cable routes shall be marked on the plans kept in the site electrical register.
- 26.8.6 Cabling passing under the walk way and across way for transport and mobile equipment shall be laid in ducts at a minimum depth of 0.6 meters.
- 26.8.7 Cables that need to cross open areas, or where span of 3m or more are involved, a catenary wire on poles or other supports shall be provided for convenient means of suspension. Minimum height shall be 6 m above ground.
- 26.8.8 Cables carrying a voltage to earth in excess of 65V other than supply for welding process shall have metal armour or sheath, which has been effectively earthed and monitored by the contractor. In case of flexible and trailing cables such earthed metal sheath and/or armour should be in addition to the earth core in the cable and shall not be used as the protective conductor.
- 26.8.9 Armoured cables having an over-sheath of polyvinyl chloride (PVC) or an oil resisting and flame retardant compound shall be used whenever there is a risk of mechanical damage occurring
- 26.9 **Plugs, socket-outlets and couplers:**
- 26.9.1 **The contractor shall ensure plugs, socket-outlets, and couplers available in the construction site as “splash proof” type. The minimum degree of Ingress Protection should be of IP44 in accordance with BS EN 60529.**
- 26.9.2 Only plugs and fittings of the weatherproof type shall be used and they should be colour coded in accordance with the Internationally recognised standards for example as detailed as follows:
- (a) 110 volts : Yellow.
 - (b) 240 volts : Blue.
 - (c) 415 volts : Red.
- 26.10 Connections
- 26.10.1 **Every joint and connection in a system shall be mechanically and electrically suitable for use to prevent danger. Proper cable connectors as per national/international standards shall only be used to connect cables.**
- 26.10.2 **No loose connections or tapped joints shall be allowed any where in the work site, office area, stores and other areas. Penalty as per relevant clause shall be put in case of observation of any tapped joints.**
- 26.11 Portable and hand-held equipments:
- 26.11.1 The contractor shall ensure the use of double insulated or all-insulated portable electrical hand equipment may be used without earthing (i.e. two core cables), but they shall still be used only on 110V because of the risk of damage to trailing leads.



26.12 Other equipments:

- 26.12.1 All equipment shall have the provision for major switch/cut-off switch in the equipment itself.
- 26.12.2 All non-current carrying metal parts of electrical equipment shall be earthed through insulated cable
- 26.12.3 Isolate exposed high-voltage (over 415 Volts) equipment, such as transformer banks, open switches, and similar equipment with exposed energized parts and prevent unauthorised access.
- 26.12.4 Approved perimeter markings shall be used to isolate restricted areas from designated work areas and entryways and shall be erected before work begins and maintained for entire duration of work. Approved perimeter marking shall be installed with either red barrier tape printed with the words "DANGER—HIGH VOLTAGE" or a barrier of yellow or orange synthetic rope, approximately 1 to 1.5 meter above the floor or work surface.

26.13 Work on or near live conductors

- 26.13.1 No person shall be engaged in any work activity on or so near any live conductor (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless-
 - a) it is unreasonable in all the circumstances for it to be dead; and
 - b) it is reasonable in all the circumstances for him to be at work on or near it while it is live; and
 - c) suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury.

26.14 Inspection and Maintenance

- 26.14.1 All electrical equipment should be permanently numbered and a record kept of the date of issue, date of last inspection and recommended inspection period.
- 26.14.2 Fixed installations shall be inspected at least at three monthly intervals; routine maintenance being carried out in accordance with equipment manufactures recommendations.

27.0 Lighting:

- 27.1 The contractor shall provide sufficient site lighting, of the right type and at the right place for it to be properly effective. Lighting ought not to introduce the risk of electric shock. Therefore, 230V supplies should be used for those fittings, which are robustly installed, and well out of reach e.g. flood lighting or high-pressure discharge lamps.

27.2 Selection of Luminaries:

The contractor shall select the luminaries as per the area requirement indicated below:

Type of Lighting	Area of Requirement	Luminaries
Area Lighting	Workmen and vehicles to move about in safely.	i) Shovel type: non-symmetrical ii) Symmetrical or non-symmetrical tungsten halogen



Beam flood lighting	Concentrated light over an area from a relatively great distance.	<ul style="list-style-type: none"> i) Portable flood light (Conical beam) ii) Wide angle flood (fan shaped beam) iii) Medium or narrow angle flood (Conical beam)
Dispersive lighting	Lighting for indoor	<ul style="list-style-type: none"> i) Dispersive (Mercury florescent) ii) Cargo cluster iii) Florescent trough
Walkway lighting	Lighting for stairways, ladder ways, corridors, scaffold access routs, etc.	<ul style="list-style-type: none"> i) Well glass unit ii) Bulkhead unit (tungsten filament) iii) Bulk head unit (Florescent)
Local lighting	Lighting on sites and fittings are generally accessible to operatives	<ul style="list-style-type: none"> i) PAR (Parabolic Aluminised Reflector) lamp cluster ii) Festoons (with or without shades) iii) Adjustable florescent work lamp iv) Portable flood lamp (mounted on own cable drum)

27.3 The contractor shall ensure that luminaries should always be placed so that no person is required to work in their own shadow and so that the local light for one person is not a source of glare for the others. Strongly made clamps should be available for attaching luminaries to poles and other convenient supports.

27.4 Luminaries should be robust, resistant to corrosion and rain proof especially at the point of the cable entry.

27.5 The correct type of lamp for each luminaries should always be used and when lamps need to be replaced if shall be in accordance with the supply voltage.

27.6 Lamp holders not fitted with a lamp should be capped off.

27.7 The contractor shall take every effort to illuminate the work site as per the Employer's requirement illustrated in general instruction **JMRC/SHE/GI/0011**.

28.0 Hand Tools and Power Tools

28.1 General

28.1.1 The contractor is wholly responsible for the safe condition of tools and equipment used by his employees and that of his sub-contractors.

28.1.2 Use of short / damaged hand tools shall be avoided and the contractor shall ensure all his hand tools used at his worksite are safe to work with or stored and shall also train his employees (including his sub-contractors) for proper use thereby.



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- 28.1.3 All hand tools and power tools shall be duly inspected before use for safe operation.
- 28.1.4 All hand tools and power tools shall have sufficient grip and the design specification on par with national/international standards on anthropometrics.
- 28.2 Hand tools
- 28.2.1 Hand tools shall include saws, chisels, axes and hatches, hammers, hand planes, screw drivers, crow bars, nail pullers.
- 28.2.2 The contractor shall ensure that,
- i) For crosscutting of hardwood, saws with larger teeth points (no. of points per inch) shall be preferred to avoid the saw jumping out of the job.
 - ii) Mushroom headed chisels shall not be used in the worksite where the fragments of the head may cause injury.
 - iii) Unless hatchet has a striking face, it shall be used as a hammer.
 - iv) Only knives of retractable blades shall be used in the worksite.
 - v) No screwdrivers shall be used for scraping, chiselling or punching holes.
 - vi) A pilot hole shall always be driven before driving a screw.
 - vii) Wherever necessary, usage of proper PPEs shall be used by his employees.
- 28.3 Power tools
- 28.3.1 Power tools include drills, planes, routers, saws, jackhammers, grinders, sprayers, chipping hammers, air nozzles and drills.
- 28.3.2 The contractor shall ensure that
- i) Electric tools are properly grounded or / and double insulated.
 - ii) GFCIs/ RCCBs shall be used with all portable electric tool operated especially outdoors or in wet condition.
 - iii) Before making any adjustments or changing attachments, his workers shall disconnect the tool from the power source.
 - iv) When operating in confined spaces or for prolonged periods, hearing protection shall be required. The same shall also apply to working with equipments, which gives out more noise as mentioned in clause **43.0** of this contract document.
 - v) Tool is held firmly and the material is properly secured before turning on the tool.
 - vi) All drills shall have suitable attachments respective of the operations and powerful for ease of operation.
 - vii) When any work / operation need to be performed repeatedly or continuously, tools specifically designed for that work shall be used. The same is applicable to detachable tool bit also.
 - viii) Size of the drill shall be determined by the maximum opening of the chuck in case of drill bit.
 - ix) Attachments such as speed reducing screwdrivers and buffers shall be provided to prevent fatigue and undue muscle strain to his workers.
 - x) Stock should be clamped or otherwise secured firmly to prevent it from moving.
 - xi) Workers shall never stand on the top of the ladder to drill holes in walls / ceilings, which can be hazardous, instead standing on the fourth or fifth rung shall be recommended.



- xii) Electric plane shall not be operated with loose clothing or long scarf or open jacket.
- xiii) Safety guards used on right angle head or vertical portable grinders must cover a minimum of 180° of the wheel and the spindle / wheel specifications shall be checked.
- xiv) All power tools / hand tools shall have guards at their nip points.
- xv) Low profile safety chain shall be used in case of wood working machines and the saw shall run at high rpm when cutting and also correct chain tension shall be ensured to avoid "kickback".
- xvi) Leather aprons and gloves shall be used as an additional personal protection auxiliary to withstand kickback.
- xvii) Push sticks shall be provided and properly used to hold the job down on the table while the heels moves the stock forward and thus preventing kickbacks.
- xviii) Air pressure is set at a suitable level for air actuated tool or equipment being used. Before changing or adjusting pneumatic tools, air pressure shall be turned off.
- xix) Only trained employees shall use explosive actuated tools and the tool shall also be unloaded when not in use.
- xx) Usage of such explosive actuated tools shall be avoided in case of places where explosive/flammable vapours or gases may be present.
- xxi) Explosive actuated tools and their explosives shall be stored separately and be taken out and loaded only before the time of immediate use.
- xxii) Misfired cartridges of explosive actuated tools must be placed in a container of water and be removed safely from the project.
- xxiii) No worker shall point any power operated / hand tool to any other person especially during loading / unloading.

29.0 Welding, Gouging and Cutting

- 29.1 Gas cylinders in use shall be kept upright on a custom-built stand or trolley fitted with a bracket to accommodate the hoses and equipment or otherwise secured. The metal cap shall be kept in place to protect the valve when the cylinder is not connected for use.
- 29.2 Hose clamp or clip shall be used to connect hoses firmly in both sides of cylinders and torches.
- 29.3 All gas cylinders shall be fixed with pressure regulator and dial gauges
- 29.4 Non-return valve and Flashback arrester shall be fixed at both end of cylinder and torch.
- 29.5 Domestic LPG cylinders shall not be used for Gas welding and Cutting purpose.
- 29.6 DCP or CO₂ type Fire Extinguisher not less than 5 kg shall be fixed at or near to welding process zone in an easily accessible location. Fire Extinguisher should confirm to IS 2190: 1992.
- 29.7 Use firewatchers if there is a possibility of ignition unobserved by the operator (e.g. on the other side of bulkheads).
- 29.8 Oxygen cylinders and flammable gas cylinders shall be stored separately, at least 6.6 meters (20 feet) apart or separated by a fire proof, 1.6 meters (5 feet) high partition. Flammable substances shall not be stored within 50 feet of cylinder storage areas.



- 29.9 Transformer used for electrical arc welding shall be fixed with Ammeter and Voltmeter and also fixed with separate main power switch.
- 29.10 Welding grounds and returns should be securely attached to the work by cable lugs, by clamps in the case of stranded conductors, or by bolts for strip conductors. The ground cable will not be attached to equipment or existing installations or apparatus.
- 29.11 Use a low voltage open circuit relay device if welding with alternating current in constricted or damp places.
- 29.12 Take precautions against the risk of increased fume hazards when welding with chrome containing fluxed consumables or high current metal inert gas (MIG) or tungsten inert gas (TIG) processes.
- 29.13 Avoid being in contact with water or wet floors when welding. Use duckboards or rubber protection.
- 29.14 All electrical installations shall meet the IS: 5571: 1997 and NFPA 70 for gas cylinder storage area and other hazardous areas.
- 29.15 The current for Electric arc welding shall not exceed 300 A on a hand welding operation.

30.0 Dangerous and harmful environment

As per BOCWR Rule 40,

- i) When internal combustion engines are to be used into a confined space or excavation or tunnel or any other workplace where neither natural or artificial ventilation system is inadequate to keep carbon monoxide below 50ppm, exposure of building workers shall be avoided unless suitable measures are taken and provided by the contractor.
- ii) No worker shall be allowed into any confined space or tank or trench or excavation wherein there is given off any dust, fumes / vapours or other impurities which is likely to be injurious or offensive, explosive or poisonous or noxious or gaseous material or other harmful articles unless steps are carried out by the contractor and certified by the responsible person to be safe.

31.0 Fire prevention, protection and fighting system

- 31.1 **The contractor shall ensure that construction site is provided with fire extinguishing equipment sufficient to extinguish any probable fire at construction site. An adequate water supply is provided at ample pressure as per national standard.**
- 31.2 Recharging of fire extinguishers and their proper maintenance should be ensured and as a minimum should meet Indian National Standards
- 31.3 All drivers of vehicles, foreman, supervisors and managers shall be trained on operating the fire extinguishers and fire fighting equipment.
- 31.4 The contractor shall also give consideration to the provision of adequate fire fighting arrangements within the underground and tunnelling operations including the provision of Fire Service compatible hose connections and emergency lighting



- 31.5 As per the RBOCW Rules 2009, Rule 106(a)(vii), all lifting appliances' driver cabin should be provided with a suitable portable fire extinguisher.
- 31.6 Combustible scrap and other construction debris should be disposed off site on a regular basis. If scrap is to be burnt on site, the burning site should be specified and located at a distance no less than 12 metres from any construction work or any other combustible material.
- 31.7 Every fire, including those extinguished by contractor personnel, shall be reported to the Employer representatives.
- 31.8 Emergency plans and Fire Evacuation plans shall be prepared and issued . Mock drills should be held on a regular basis to ensure the effectiveness of the arrangements and as a part of the programme, the Telephone Number of the local fire brigade should be prominently displayed near each telephone on site.

32.0 Corrosive substances

- 32.1 As per BOCWR Rule 44, corrosive substances including alkalis and acids shall be stored and used by a person dealing with such substances at a building / construction site in a manner that it does not endanger the building worker and suitable PPE shall be provided by the contractor to the worker during such handling and work. In case of spillage of such substances on building worker, the contractor shall take immediate remedial measures.

33.0 Demolition

- 33.1 The Contractor shall ensure that
- i) all demolition works be carried out in a controlled manner under the management of experienced and competent supervision.
 - ii) the concerned department of the Government or local authority be informed and permission obtained wherever required. Media shall also be informed regarding this concern.
 - iii) **all glass or similar materials or articles in exterior openings are removed before commencing any demolition work and all water, steam, electric, gas and other similar supply lines are put-off and such lines so located or capped with substantial coverings so as to protect it from damage and to afford safety to the building workers and public.**
 - iv) examine the walls of all structures adjacent to the structure to be demolished to determine thickness, method of support to such adjacent structures
 - v) no demolishing work be performed if the adjacent structure seems to be unsafe unless and until remedial measures like sheet piling, shoring, bracing or similar means be ensured for safety and stability for adjacent structure from collapsing.
 - vi) debris / bricks and other materials or articles shall be removed by means of
 - a) chutes
 - b) buckets or hoists
 - c) through openings through floors or
 - d) any other safe means
 - vii) no person other than building workers or other persons essential to the operation of demolition work shall be permitted to enter a zone of demolition and the area be provided with substantial barricades.



34.0 Excavation and Tunnelling:

34.1 Excavation

34.1.1 The contractor shall ensure

- i) where any construction building worker engaged in excavation is exposed to hazard of falling or sliding material or article from any bank or side of such excavation which is more than one 1.5 m above his footing, such worker is protected by adequate piling and bracing against such bank or side.
- ii) where banks of an excavation are undercut, adequate shoring is provided to support the material or article overhanging such bank.
- iii) excavated material is not stored at least 0.65 m from the edge of an open excavation or trench and banks of such excavation or trench are stripped of loose rocks and the banks of such excavation or trench are stripped of loose rocks and other materials which may slide, roll or fall upon a construction building worker working below such bank
- iv) metal ladders and staircases or ramps are provided, as the case may be, for safe access to and egress from excavation where, the depth of such excavation exceeds 1.5 m and such ladders, staircases or ramps comply with the IS 3696 Part 1&2 and other relevant national standards.
- v) trench and excavation is protected against falling of a person by suitable measures if the depth of such trench or excavation exceeds 1.5 m and such protection is an improved protection in accordance with the design and drawing of a professional engineer, where such depth exceeds 4m.

34.2 Tunnelling

34.2.1 The contractor shall inform in writing to the Director General within 30 days, prior to the commencement of any tunnelling work.

34.2.2 The contractor shall appoint a responsible person for safe operation for tunnelling work as per Rule 121 & 125 of BOCWR.

34.2.3 The contractor shall ensure

- i) every compressed air system in a tunnel is provided with emergency power supply for maintained continued supply of compressed air as per Rule 155 of BOCWR
- ii) watertight bulkhead doors are installed at the entrance of a tunnel to prevent flooding.
- iii) reliable and effective means of communication such as telephone or walkie-talkie are provided and maintained for arranging better effective communication at an excavation or tunnelling work as per Rule 136 of BOCWR.
- iv) all portable electrical hand tools and inspection lamp used in under ground and confined space at an excavation or tunnelling work is operated at a voltage not exceeding 24V.
- v) only flame proof equipment of appropriate type as per IS:5571:2000 and or other relevant national standard is used inside the tunnel



- vi) petrol or LPG of any other flammable substances are not used, stored inside the tunnel except with prior approval from Employer, and also no oxy-acetylene gas is used in a compressed air environment in excavation or tunnelling
- vii) adequate number of water outlets provided for fire fighting purpose, an audible fire alarm and adequate number and types of fire extinguishers are provided and maintained.
- viii) temperature in any working chamber in an excavation or tunnelling work where workers employed does not exceed 29°C as per Rule 165 of BOCWR.
- ix) all working areas in a free air tunnel are provided with ventilation system as approved by the Director General and the fresh air supplied in such tunnel is not less than 6 m³/min for each worker employed in tunnel as per Rule 153 of BOCWR.

34.3 Warning signs and notices:

34.3.1 The contractor shall ensure that

- i) suitable warning signs or notices, required for the safety of building workers carrying out the work of an excavation or tunnelling, shall be displayed or erected at conspicuous places in Hindi and in a language understood by majority of such building workers at such building such excavation or tunnelling work
- ii) such warning signs and notices with regard to compressed air working shall include
 - a) the danger involved in such compressed air work
 - b) fire and explosion hazard
 - c) the emergency procedures for rescue from such danger or hazards.

35.0 Work Permit system

35.1 The Contractor shall develop a Work Permit system, which is a formal written system used to control certain types of work that are potentially hazardous. A work permit is a document, which specifies the work to be done, and the precautions to be taken. Work Permits form an essential part of safe systems of work for many construction activities. They allow work to start only after safe procedures have been defined and they provide a clear record that all foreseeable hazards have been considered. Permits to Work are usually required in high-risk areas as identified by the Risk Assessments.

35.2 A permit is needed when construction work can only be carried out if normal safeguards are dropped or when new hazards are introduced by the work. Examples of high-risk activities include but are not limited to:

- i) Entry into confined spaces
- ii) Work in close proximity to overhead power lines and telecommunication cables.
- iii) Hot work.
- iv) To dig—where underground services may be located.
- v) Work with heavy moving machinery.
- vi) Working on electrical equipment
- vii) Work with radioactive isotopes.
- viii) Heavy lifting operations and lifting operations closer to live power line

35.3 The permit-to-work system should be fully documented, laying down:

- i) How the system works;



- ii) The jobs it is to be used for;
- iii) The responsibilities and training of those involved; and
- iv) How to check its operation;

35.4 A Work Permit authorisation form shall be completed with the maximum duration period not exceeding 12 hours.

35.5 A copy of each Permit To Work shall be displayed, during its validity, in a conspicuous location in close proximity to the actual works location to which it applies.

36.0 Traffic Management

36.1 The basic objective of the following guidelines is to lay down procedures to be adopted by contractor to ensure the safe and efficient movement of traffic and also to ensure the safety of workmen at construction sites.

36.2 All construction workers should be provided with high visibility jackets with reflective tapes as most of viaduct /tunnelling and station works or either above or under right-of-way. The conspicuity of workmen at all times shall be increased so as to protect from speeding vehicular traffic.

36.3 The guiding principles to be adopted for safety in construction zone are to

- i) Warn the road user clearly and sufficiently in advance.
- ii) Provide safe and clearly marked lanes for guiding road users.
- iii) Provide safe and clearly marked buffer and work zones
- iv) Provide adequate measures that control driver behaviour through construction zones.

36.4 Legal permission

36.4.1 In all cases, the contractor shall employ proper precautions. Wherever operations undertaken are likely to interfere with public traffic, specific traffic management plans shall be drawn up and implemented by the contractor in consultation with the approval of local police authorities and/or the concerned metropolitan/civil authorities as the case may be.

36.4.2 Such traffic management plans shall include provision for traffic diversion and selection of alternative routes for transport of equipment. If necessary, the contractor shall carry out road widening before commencement of works to accommodate the extra load

36.5 The primary traffic control devices used in work zones shall include signs, delineators, barricades, cones, pylons, pavement markings and flashing lights.

36.6 The road construction and maintenance signs which fall into the same three major categories as do other traffic signs, that are Regulatory Signs, Warning Signs and Direction (or guidelines) Signs shall only be used. The IRC: 67 (Code of Practice for Road Signs) provide a list of traffic signs. The size, colours and placement of sign shall confirm to IRC: 67.

36.7 Regulatory signs



- 36.7.1 Regulatory signs impose legal restriction on all traffic. It is essential, therefore, that they are used only after consulting the local police and traffic authorities.
- 36.8 Warning signs
- 36.8.1 Warning signs in the traffic control zone shall be utilised to warn the drivers of specific hazards that may be encountered.
- 36.8.2 The contractor shall place detour signage at strategic locations and install appropriate warning signs. In order to minimize disruption of access to residences and business, the contractor shall maintain at least one entrance to a property where multiple entrances exist.
- 36.8.3 A warning sign as given in general instruction JMRC/SHE/GI/012 shall be installed at all secondary road which merges with the primary road where the construction work is in progress at sufficient distance before it merges with the primary road so as to alert the road users regarding the 'Metro Work in Progress'.
- 36.8.4 Materials hanging over / protruded from the chassis / body of any vehicle especially during material handling shall be indicated by red indicator (red light/flag) to indicate the caution to the road users.
- 36.9 Delineators
- The delineators are the elements of a total system of traffic control and have two distinct purposes:
- i) To delineate and guide the driver to and along a safe path
 - ii) As a taper to move traffic from one lane to another.
- 36.9.1 These channelising devices such as cones, traffic cylinders, tapes and drums shall be placed in or adjacent to the roadway to control the flow of traffic. These should normally be retro-reflectors complying to IRC: 79 - Recommended Practice for Road Delineators.
- 36.9.2 Traffic cones and cylinders
- Traffic cones of 500mm, 750mm and 1000mm high and 300mm to 500mm in diameter or in square shape at base and are often made of plastic or rubber and normally have retro-reflectorised red and white band shall be used wherever required.
- 36.9.3 Drums
- Drums about 800mm to 1000mm high and 300mm in diameter can be used either as channelising or warning devices. These are highly visible, give the appearance of being formidable objects and therefore command the respect of drivers.
- 36.9.4 Barricades
- 36.9.4.1 Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the working area from the risk of accidents due to speedy vehicular movement. Same the way barricades protect the road users from the danger due to construction equipment and other temporary structures.



36.9.4.2 The structure dimension of the barricade, material and composition, its colour scheme, JMRC logo and other details shall be in accordance with specifications laid down in tender document.

36.9.4.3 All barricades shall be erected as per the design requirements of the Employer, numbered, painted and maintained in good condition and also Barricade in-charge maintains a barricade register in site.

36.9.4.4 **All barricades shall be conspicuously seen in the dark/night time by the road users so that no vehicle hits the barricade. Conspicuity shall be ensured by affixing retro reflective stripes of required size and shape at appropriate angle at the bottom and middle portion of the barricade at a minimum gap of 1000mm. In addition minimum one red light or red light blinker should be placed at the top of each barricade.**

36.9.5 The contractor shall ensure that all his construction vehicles plying on public roads (like dump trucks, trailers, etc.) have proper license to ply on public roads from the State Transport Authority. Drivers holding proper valid license as per the requirements of Motor Vehicles Act shall drive these vehicles

36.9.6 The contractor shall not undertake loading and unloading at carriageways obstructing the free flow of vehicular traffic and encroachment of existing roads by the contractor applying the excuse of work execution.

36.9.7 **Tow away vehicle**

36.9.7.1 **The contractor shall make arrangements keeping tow away van / manpower to tow away any breakdown vehicle in the traffic flow without losing any time at his cost.**

36.9.8 **Cleaning of roads**

36.9.8.1 **The contractor shall ensure the cleanliness of roads and footpaths by deploying proper manpower for the same. The contractor shall have to ensure proper brooming, cleaning washing of roads and footpaths on all the time throughout the entire stretch till the currency of the contract including disposal of sweepage.**

37.0 Work to adjacent railways

37.1 Whenever work is to be conducted in close proximity to the live railways then the following measures shall need to be addressed:

- (a) The rules provided for in the Railway's manual shall be followed.
- (b) No persons are allowed to encroach onto the railway unless specific authority has been given by the owner.
- (c) Adequate protection in accordance with the railway owner's requirements shall be followed. (Provision of Block Inspectors, Flagmen and Lookouts)
- (d) All persons shall wear high visibility clothing at all times.
- (e) Any induction training requirements of the railways shall be strictly observed

38.0 Batching Plant / Casting Yard

- i) The batching plant / casting yard shall be effectively planned for smooth flow of unloading and stacking the aggregates reinforcements and cement, batching plant,



transport of concrete, casting the segment, stacking the segment and loading the segments to the trucks. As far as possible the conflicts should be avoided.

- ii) The batching plant / casting yard shall be barricaded and made as a compulsory PPE zone
- iii) If in case of material unloading area is not maintainable as PPE zone, the same shall be segregated properly and made as a non-PPE zone with appropriate barrications.
- iv) Electrical system shall also be suitably planned so that location of diesel generator, if any, location of DBs, routing of cables and positioning of area lighting poles/masts does not infringe on any other utility and pose danger.
- v) Drainage shall be effectively provided and waste water shall be disposed after proper treatment
- vi) Time office, canteen, drinking water, toilet and rest place shall be suitably located for the easy access to workers. All the facilities shall be properly cleaned and maintained during the entire period of operation.
- vii) Manual handling of cement shall be avoided to a larger extent. Whenever it is absolutely necessary the workmen shall be given full body protection, hand protection and respiratory protection as a basic measure of ensuring better health.
- viii) The PPEs provided to cement handling workmen shall conform to international standards.
- ix) Access roads and internal circulation roads shall be well laid and maintained properly at all time.
- x) Non-adherence to any of the above provision shall be penalised as per relevant penalty clause.

39.0 Personal Protective Equipments (PPEs)

39.1 The contractor shall provide required PPEs to workmen to protect against safety and / or health hazards. Primarily PPEs are required for the following protection

- i) Head Protection (Safety helmets)
- ii) Foot Protection (Safety footwear, Gumboot, etc)
- iii) Body Protection (High visibility clothing (waistcoat/jacket), Apron, etc)
- iv) Personal fall protection (Full body harness, Rope-grap fall arrester, etc)
- v) Eye Protection (Goggles, Welders glasses, etc)
- vi) Hand Protection (Gloves, Finger coats, etc)
- vii) Respiratory Protection. (Nose mask, SCBAs, etc)
- viii) Hearing Protection (Ear plugs, Ear muffs, etc)

39.2 **The PPEs and safety appliances provided by the contractor shall be of the standard as prescribed by Bureau of Indian Standards (BIS). If materials conforming to BIS standards are not available, the contractor as approved by the Employer shall procure PPE and safety appliances.**

39.3 **All construction workers should be provided with high visibility jackets with reflective tapes confirming to the requirement specified under BS EN 471: 1994 as most of viaduct /tunnelling and station works are executed either above or under right-of-way. The conspicuity of workmen at all times shall be increased so as to protect them from speeding vehicular traffic.**

39.4 The contractor shall provide **safety helmet, safety shoe and high visibility clothing** for all employees including workmen, traffic marshal and other employees who are engaged for any work under this contract as per the following requirement.



All employees of the Contractor including workmen	Traffic marshals
<ul style="list-style-type: none"> i) Hard hat with company Logo ii) Safety boots iii) Hi-visibility waistcoat covering upper body and meeting the following requirements as per BS EN 471:1994: <ul style="list-style-type: none"> a) Background in fluorescent orange-red in colour b) Two vertical green strips of 5cm wide on front side, covering the torso at least 500 cm² c) Two diagonal strips of 5 cm wide on back in an 'X' pattern covering at least 570cm² d) Horizontal strips not less than 5cm wide running around the bottom of the vertical strip in front and 'X' pattern at back. e) The bottom strip shall be at a distance of 5cm from the bottom of the vest. f) Strips must be retro reflective and fluorescent g) Waistcoat shall have a side adjustable fit and a side and front tear-away feature on vests made of nylon. 	<ul style="list-style-type: none"> i) Hard hat with reflective tape ii) Safety boots iii) Hi-visibility jacket covering upper body and meeting the following requirements as per BS EN 471:1994 : <ul style="list-style-type: none"> a) Background in fluorescent orange-red in colour b) Jackets with full-length sleeves with two bands of retro reflective material, which shall be placed at the same height on the garment as those of the torso. The upper band shall encircle the upper part of the sleeves between the elbow and the shoulder; the bottom of the lower band shall not be less than 5cm from the bottom of the sleeve. c) Two vertical green strips of 5cm wide on front side, covering the torso at least 500 cm² d) Two diagonal strips of 5 cm wide on back in an 'X' pattern covering at least 570cm² e) Horizontal strips not less than 5cm wide running around the bottom of the vertical strip in front and 'X' pattern at back. f) The bottom strip shall be at a distance of 5cm from the bottom of the vest. g) Strips must be retro reflective and fluorescent.

39.4.1 Colour coding for helmets

Safety Helmet Colour Code (Every Helmet should have the LOGO* affixed /painted)	Person to use
White	JMRC staffs
Grey	All Designers, Architect, Consultants, etc.
Violet	Main Contractors (Engineers / Supervisors)
Blue	All Sub-contractors (Engineers / Supervisors)
Red	Electricians (Both Contractor and Sub-contractor)
Green	Safety Professionals (Both Contractor and Sub-contractor)
Orange	Security Guards / Traffic marshals
Yellow	All workmen



White (with "VISITOR" sticker)	Visitors
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Note: LOGO*

1. Logo shall have its outer dimension 2"X2" and shall be conspicuous
2. Logo shall be either painted or affixed
3. No words shall come either on Top / Bottom of Logo

Logo of the corresponding main contracting company for their employees and sub-contracting company for their employees shall only be used.

- 39.5 In addition to the above any other PPE required for any specific jobs like, welding and cutting, working at height, tunnelling etc shall also be provided to all workmen and also ensure that all workmen use the PPEs properly while on the job.
- 39.6 The contractor shall not pay any cash amount in lieu of PPE to the workers/sub-contractors and expect them to buy and use during work.
- 39.7 The contractor shall at all time maintain a minimum of 10% spare PPEs and safety appliances and properly record and show to the Employer during the inspections. Failing to do so shall invite appropriate penalty as per the provisions of the contract.
- 39.8 It is always the duty of the contractor to provide required PPEs for all visitors. Towards this required quantity of PPEs shall be kept always at the security post.

40.0 Visitors to site

- 40.1 No visitor is allowed to enter the site without the permission of the Employer. All authorised visitors should report at the site office. Contractor shall provide visitor's helmet (White helmet with visitor sticker) and other PPEs like Safety Shoe, reflective jacket, respiratory protection etc. as per requirement of the site.
- 40.2 All Visitors shall be accompanied at all times by a responsible member of the site personnel.
- 40.3 The contractor shall be fully responsible for all visitors' safety and health within the site..



**PART – III : OCCUPATIONAL HEALTH
AND WELFARE**



41.0 Physical fitness of workmen

41.1 The contractor shall ensure that his employees/workmen subject themselves to such medical examination as required under the law or under the contract provision and keep a record of the same.

41.2 The contractor shall not permit any employee/workmen to enter the work area under the influence of alcohol or any drugs.

42.0 Medical Facilities

42.1 Medical Examination

42.1.1 The contractor shall arrange a medical examination of all his employees including his sub-contractor employees employed as drivers, operators of lifting appliances and transport equipment before employing, after illness or injury, if it appears that the illness or injury might have affected his fitness and, thereafter, once in every two years up to the age of 40 and once in a year, thereafter.

- i) The Contractor shall maintain the confidential records of medical examination or the physician authorized by the Employer.
- ii) No building or other construction worker is charged for the medical examination and the cost of such examination is borne by contractor employing such building worker.
- iii) The medical examination shall include: -
 - a) Full medical and occupational history.
 - b) Clinical examination with particular reference to
 - i) General Physique;
 - ii) Vision: - Total visual performance using standard orthorator like Titmus Vision Tester should be estimated and suitability for placement ascertained in accordance with the prescribed job standards.
 - iii) Hearing: - Persons with normal must be able to hear a forced whisper at twenty-four feet. Persons using hearing aids must be able to hear a warning shout under noisy working conditions.
 - iv) Breathing: - Peak flow rate using standard peak flow meter and the average peak flow rate determined out of these readings of the test performed. The results recorded at pre-placement medical examination could be used as a standard for the same individual at the same altitude for reference during subsequent examination.
 - v) Upper Limbs: - Adequate arm function and grip
 - vi) Spine: - Adequately flexible for the job concerned.
 - vii) Lower Limbs: - Adequate leg and foot concerned.
 - viii) General: - Mental alertness and stability with good eye, hand and foot coordination.
 - c) Any other tests which the examining doctor considers necessary

42.1.2. If the contractor fails to get the medical examination conducted as mentioned above, the employer will have the right to get the same conducted by through an agency with intimation to the contractor and deduct the cost and overhead charges.



42.2 Occupational Health Centre

42.2.1 The contractor shall ensure at a construction site an occupational health centre, mobile or static is provided and maintained in good order. Services and facilities as per the scale lay down in Schedule X of BOCWR. A construction medical officer appointed in an occupational health centre possesses the qualification as laid down in Schedule XI of BOCWR.

42.3 Ambulance van and room

42.3.1 The contractor shall ensure at a construction site of a building or other construction work that an ambulance van and room are provided at such construction site or an arrangement is made with a nearby hospital for providing such ambulance van for transportation of serious cases of accident or sickness of workers to hospital promptly and such ambulance van and room are maintained in good repair and is equipped with standard facilities specified in Schedule IV and Schedule V of BOCWR.

42.4 First-aid boxes

42.4.1 The contractor shall ensure at a construction site one First-aid box for 100 workers provided and maintained for providing First-aid to the building workers. Every First-aid box is distinctly marked "First-aid" and is equipped with the articles specified in Schedule III of BOCWR.

42.5 HIV/ AIDS prevention and control

42.5.1 The contractor shall adopt the Employer's Policy on "HIV / AIDS Prevention and Control for Workmen Engaged by Contractors" and the copy of the policy is given in **Appendix No.: 4**.

42.5.2 The Employer will engage a professional agency for implementing the guidelines laid down in the policy and communicate to the contractor.

42.5.3 The Contractor shall extend necessary support to the appointed agency by deputing the workmen to attend the awareness creation programmes.

42.5.4 The contractor shall also extend necessary organizational support to the appointed agency for the effective implementation of the Employers' workplace policy on HIV/AIDS for workmen of the Contractors.

42.5.5 As laid down in the policy the contractor shall identify peer educators (1 for every 100 workers) and refer them for professional training to the Employers' appointed agency for the purpose.

42.5.6 **The peer educators on completion of the training shall serve as the focal point for any information, education and awareness campaign among the workmen throughout the contract period.**

42.5.7 The peer educators will be paid a monthly honorarium as fixed by the Employer for rendering his services in addition to his regular duty.

42.5.8 The total number of peer educators (1 for 100 workers) shall always be maintained by the contractor.



42.5.9 **In case if these peer educators leave the contractor by creating vacancy, then the contractor at his own expense train the new replacement peer educator from the Employers' appointed agency for the purpose.**

42.5.10 It is suggested to the contractor that due care should be taken to select the peer educators from among the group of workmen so that they remain with the contractor throughout the contract period.

42.6 Prevention of mosquito breeding

42.6.1 Measures shall be taken to prevent breeding at site. The measures to be taken shall include:

- i) Empty cans, oil drums, packing and other receptacles, which may retain water shall be deposited at a central collection point and shall be removed from the site regularly.
- ii) Still waters shall be treated at least once every week with oil in order to prevent mosquito breeding.
- iii) Contractor's equipment and other items on the site, which may retain water, shall be stored, covered or treated in such a manner that water could not be retained.
- iv) Water storage tanks shall be provided.

42.6.2 Posters in both Hindi and English, which draw attention to the dangers of permitting mosquito breeding, shall be displayed prominently on the site.

42.6.3 **The contractor at periodic interval shall arrange to prevent mosquito breeding by fumigation / spraying of insecticides. Most effective insecticides shall include SOLFAC WP 10 or Baytex, The Ideal Larvicide etc.**

42.7 Alcohol and drugs

42.7.1 The contractor shall ensure at all times that no employee is working under the influence of alcohol / drugs which are punishable under Govt. regulations.

42.7.2 Smoking at public worksites by any employee is also prohibited as per Govt. regulations.

43.0 Noise

43.1 The Contractor shall consider noise as an environmental constraint in his design, planning and execution of the Works and provide demonstrable evidence of the same on Employer's request. The Contractor shall, at his own expense, take all appropriate measures to ensure that work carried out by the Contractor and by his sub-Contractors, whether on or off the Site, will not cause any unnecessary or excessive noise which may disturb the occupants of any nearby dwellings, schools, hospitals, or premises with similar sensitivity to noise.

43.1.1 Without prejudice to the generality of the foregoing, noise level reduction measures shall include the following:

- i) The Contractor shall ensure that all powered mechanical equipment used in the Works shall be effectively sound reduced using the most modern techniques available including but not limited to silencers and mufflers.
- ii) The Contractor shall construct acoustic screens or enclosures around any parts of the Works from which excessive noise may be generated.



- 43.1.2 The Contractor shall ensure that noise generated by work carried out by the Contractor and his sub-Contractors during daytime and night time shall not exceed the maximum permissible noise limits, whether continuously or intermittently, as given in the project SHE Manual. The same may be varied from time to time by and at the sole discretion of the Employer. In the event of a breach of this requirement, the Contractor shall immediately re-deploy or adjust the relevant equipment or take other appropriate measures to reduce the noise levels and thereafter maintain them at levels which do not exceed the said limits. Such measures may include without limitation the temporary or permanent cessation of use of certain items of equipment.
- 43.1.3 The noise monitoring requirements including monitoring locations are given in the project SHE Manual.
- 43.2 Control Requirements
- 43.2.1 Construction material should be operated and transported in such a manner as not to create unnecessary noise as outlined below:
- i) Perform Work within the procedures outlined herein and comply with applicable codes, regulations, and standards established by the Central and State Government and their agencies.
 - ii) Keep noise to the lowest reasonably practicable level. Appropriate measures will be taken to ensure that construction works will not cause any unnecessary or excessive noise, which may disturb the occupants of any nearby dwellings, schools, hospitals, or premises with similar sensitivity to noise. Use equipment with effective noise-suppression devices and employ other noise control measures as to protect the public.
 - iii) Schedule and conduct operations in a manner that will minimize, to the greatest extent feasible, the disturbance to the public in areas adjacent to the construction activities and to occupants of buildings in the vicinity of the construction activities.
 - iv) The Contractor shall submit to the Employer a Noise Monitoring and Control Plan (NMCP) under contract specific Site Environmental Plan. It shall include full and comprehensive details of all powered mechanical equipment, which he proposes to use during daytime and night time, and of his proposed working methods and noise level reduction measures. The NMCP shall include detailed noise calculations and vibration levels to demonstrate the anticipated noise generation and vibrations by the Contractor.
 - v) The NMCP prepared by the Contractor shall guide the implementation of construction activity. The NMCP will be reviewed on a regular basis and updated as necessary to assure that current construction activities are addressed. It may appear as a regular agenda item in project coordination meetings, if noise is an issue at any location in the contract.
- 43.3 Occupational Noise
- i) Protection against the effects of occupational noise exposure should be provided when the sound levels exceeds the threshold values as provided in Project SHE Manual.
 - ii) When employees are subjected to sound levels exceeding those listed in the Table, feasible administrative or engineering controls should be utilized as given in this document and JMRC's Project SHE Manual.



- iii) If such controls fail to reduce sound levels within the levels of the table, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table.
- iv) When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. Exposure to different levels for various periods of time shall be computed according to the formula and sample computation as given in project SHE Manual.

43.4 Vibration Level

- 43.4.1 In locations where the alignment is close to historical / heritage structures, the contractor shall prepare a monitoring scheme prior to construction at such locations. This scheme for monitoring vibration level at such historical / heritage sites shall be submitted to Employer for his approval. This scheme shall include:
- i) Monitoring requirements for vibrations at regular intervals throughout the construction period.
 - ii) Pre-construction structural integrity inspections of historic and sensitive structures in project activity.
 - iii) Information dissemination about the construction method, probable effects, quality control measures and precautions to be used.
 - iv) The vibration level limits at work sites adjacent to the alignment shall conform to the permitted values of peak p velocity as given in article project SHE Manual.

44.0 Ventilation and illumination

44.1 Ventilation

- 44.1.1 The contractor shall ensure at a construction site of a building or other construction work that all working areas in a free tunnel are provided with ventilation system as approved by the DG/CIIBC and the fresh air supply in such tunnel is not less than 6m³/min for each building worker employed underground in such tunnel and the free air flow movement inside such tunnel is not less than 9m/min.

- 44.1.2 The oxygen level shall not be less than 19.5% in the working environment.

44.2 Illumination

- 44.2.1 The contractor shall take every effort to illuminate the work site as per the Employer's requirement illustrated in general instruction **JMRC/SHE/GI/0011**.

- 44.2.2 **The contractor shall conduct a monthly illumination monitoring by lux meter for all the locations and the report shall be sent to the Employer within 7th of the next month and the same shall be reviewed during the monthly SHE committee meeting.**

45.0 Radiation

- 45.1 The use of radioactive substances and radiating apparatus shall comply with the Govt. regulatory requirements and all subsidiary legislation



- 45.2 Operations involving ionising radiation shall only be carried out after having been reviewed without objection by the Employer's representative and shall be carried out in accordance with a method statement.
- 45.3 each area containing irradiated apparatus shall have warning notices and barriers, as required by the Regulations, conspicuously posted at or near the area.
- 45.4 Radioactive substances will be stored, used or disposed shall be strictly in accordance with the Govt. Enactments.
- 45.5 The contractor shall ensure that all site personnel and members of the public are not exposed to radiation.
- 46.0 **Welfare measures for workers**
- 46.1 Latrine and Urinal Accommodation
- 46.1.1 **The contractor shall provide one latrine seat for every 20 workers up to 100 workers and thereafter one for every additional 50 workers. In addition one urinal accommodation shall be provided for every 100 workers.**
- 46.1.2 When women are employed, separate latrine and urinals accommodation shall be provided on the same scale as mentioned above.
- 46.1.3 Latrine and urinals shall be provided as per Section 33 of BOCWA and maintained as per Rule 243 of BOCWR and shall also comply with the requirements of public health authorities
- 46.1.4 Moving sites
- 46.1.4.1 In case of works like track laying, the zone of work is constantly moving at elevated level or at underground level. In such cases mobile toilets with proper facility to drain the sullage shall be provided at reasonably accessible distance.
- 46.1.5 **In case if the contractor fail to provide required number of urinals and latrines or fail to maintain it as per the requirements of Public Health laws, the Employer shall have the right to provide/maintain through renowned external agencies like "Sulabh" at the cost of the contractor.**
- 46.2 **Canteen:**
- 46.2.1 **In every workplace wherein not less than 250 workers are ordinarily employed the contractor shall provide an adequate canteen conforming to Section 37 of BOCWA, Rule 244 of BOCWR and as stipulated in Rule 247 of BOCWR the charges for food stuff shall be based on 'no profit no loss' basis. The price list of all items shall be conspicuously displayed in such canteen.**
- 46.3 **Serving of tea and snacks at the workplace:**
- 46.3.1 **As per Rule 246 of BOCWR, at a building or other construction work where a workplace is situated at a distance of more than 200 m from the canteen provided under Rule 244(1) of BOCWR, the contractor employing building works shall make suitable arrangement for serving tea and light refreshment to such building works at such place.**



46.4 **Drinking water**

46.4.1 **As per Section 32 of BOCWA the contractor shall make in every worksite, effective arrangements to provide sufficient supply of wholesome drinking water with minimum quantity of 5 litres per workman per day. Quality of the drinking water shall conform to the requirements of national standards on Public Health.**

46.4.2 While locating these drinking water facility due care shall be taken so that these are easily accessible within a distance of 200m from the place of work for all workers at all location of work sites.

46.4.3 All such points shall be legible marked "Drinking Water" in a language understood by a majority of the workmen employed in such place and such point shall be situated within six metres of any washing places, urinals or latrines.

46.5 **Labour Accommodation**

46.5.1 **The contractor shall provide free of charges as near as possible, temporary living accommodation to all workers conforming to provisions of Section 34 of BOCWA. These accommodations shall have cooking place, bathing, washing and lavatory facilities.**

46.6 **Creches**

46.6.1 In every workplace where in more than 50 female workers are ordinarily employed, there shall be provided and maintained a suitable room for use of children under age of 6 yrs, conforming to the provisions of Section 35 of BOCWA.



PART – IV : ENVIRONMENTAL MANAGEMENT



47.0 Air Quality

- 47.1 The Contractor shall take all necessary precautions to minimise fugitive dust emissions from operations involving excavation, grading, and clearing of land and disposal of waste. He shall not allow emissions of fugitive dust from any transport, handling, construction or storage activity to remain visible in atmosphere beyond the property line of emission source for any prolonged period of time without notification to the Employer.
- 47.2 The Contractor shall use construction equipment designed and equipped to minimise or control air pollution. He shall maintain evidence of such design and equipment and make these available for inspection by Employer.
- 47.3 If after commencement of construction activity, Employer believes that the Contractor's equipment or methods of working are causing unacceptable air pollution impacts then these shall be inspected and remedial proposals shall be drawn up by the Contractor, submitted for review to the Employer and implemented.
- 47.4 In developing these remedial measures, the Contractor shall inspect and review all dust sources that may be contributing to air pollution. Remedial measures include use of additional/ alternative equipment by the Contractor or maintenance/modification of existing equipment of the Contractor.
In the event that approved remedial measures are not being implemented and serious impacts persist, the Employer may direct the Contractor to suspend work until the measures are implemented, as required under the Contract.
- 47.5 Contractor's transport vehicles and other equipment shall conform to emission standards fixed by Statutory Agencies of Government of India or the State Government from time to time. The Contractor shall carry out periodical checks and undertake remedial measures including replacement, if required, so as to operate within permissible norms.
- 47.6 The Contractor shall establish and maintain records of routine maintenance program for internal combustion engine powered vehicles and equipment used on this project. He shall keep records available for inspection by Employer.
- 47.7 The Contractor shall cover loads of dust generating materials like debris and soil being transported from construction sites. All trucks carrying loose material should be covered and loaded with sufficient free- board to avoid spills through the tail board or side boards.
- 47.8 The Contractor shall promptly transport all excavation disposal materials of whatever kind so as not to delay work on the project. Stockpiling of materials will only be allowed at sites designated by the Employer. The Contractor shall place excavation materials in the dumping/disposal areas designated in the plans as given in the specifications.
- 47.9 The temporary dumping areas shall be maintained by the Contractor at all times until the excavate is re-utilised for backfilling or as directed by Employer. Dust control activities shall continue even during any work stoppage.
- 47.10 The Contractor shall place material in a manner that will minimize dust production. Material shall be minimized each day and wetted, to minimize dust production. During dry weather, dust control methods must be used daily especially on windy, dry days to prevent any dust from blowing across the site perimeter.



- 47.11 The Contractor shall water down construction sites as required to suppress dust, during handling of excavation soil or debris or during demolition. The Contractor will make water sprinklers, water supply and water delivering equipment available at any time that it is required for dust control use. Dust screens will be used, as feasible when additional dust control measures are needed specially where the work is near sensitive receptors.
- 47.12 The Contractor shall provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from work sites such as construction depots and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.
- 47.13 The Contractor shall design and implement his blasting techniques so as to minimise dust, noise, vibration generation and prevention fly rock.
- 47.14 Blasting technique should be consistent not only with nature and quantity of rock to be blasted but also the location of blasting.
- 47.15 The contractor shall give preference to explosives with better environmental characteristics.
- 47.16 The Contractor shall protect structures, utilities, pavements roads and other facilities from disfiguration and damage as a result of his activities. Where this is not possible, the contractor shall restore the structures, utilities, pavements, roads and other facilities to their original or better, failing which the rectification/restoration work shall be carried out at the risk and cost of the contractor.
- 47.17 The Contractor shall submit to the Employer an Air Monitoring and Control Plan (AMCP) under contract specific Site Environmental Plan to guide construction activity insofar as it relates to monitoring, controlling and mitigating air pollution.

48.0 Water Quality

- 48.1 The Contractor shall comply with the Indian Government legislation and other State regulations in existence in Jaipur insofar as they relate to water pollution control and monitoring. A drainage system should be constructed at the commencement of the Works, to drain off all surface water from the work site into suitable drain outlet.
- 48.2 The Contractor shall provide adequate precautions to ensure that no spoil or debris of any kind is pushed, washed, falls or deposited on land adjacent to the site perimeter including public roads or existing stream courses and drains within or adjacent to the site. In the event of any spoil or debris from construction works being deposited or any silt washed down to any area, then all such spoil, debris or material and silt shall be immediately removed and the affected land and areas restored to their natural state by the Contractor to the satisfaction of the Employer.
- 48.3 Due to lowering of potable water supplies in Jaipur and subsequent contamination of ground water, the Contractor is not allowed to discharge water from the site without the approval of the Employer. The Contractor must comply with the requirements of the Central Ground Water Board for discharge of water arising from dewatering. Any water obtained from dewatering systems installed in the works must be either re-used for construction purposes and this water may subsequently be discharged to the drainage system or, if not re-used, recharged to the ground water at suitable aquifer levels. The Contractor must submit his proposals for approval of Employer, on his proposed locations of dewatering of excavation and collection of water for either construction re-use or recharge directly to



aquifers. The Contractor's recharge proposals must be sufficient for recharging of the quantity of water remaining after deduction of water re-used for construction. During dewatering, the contractor shall monitor ground water levels from wells to ensure that draw down levels do not exceed allowable limits. The Contractor will not be permitted to directly discharge, to the drainage system, unused ground water obtaining from the excavation without obtaining approval of Employer or the Agency controlling the system.

- 48.4 The Contractor shall ensure that earth, bentonite, chemicals and concrete agitator washings etc. are not deposited in the watercourses but are suitably collected and residue disposed off in a manner approved by local authorities.
- 48.5 All water and waste products (surface runoff and wastewater) arising on the site shall be collected and removed from the site via a suitable and properly designed temporary drainage system and disposed off at a location and in a manner that will cause neither pollution nor nuisance.
- 48.6 Any mud slurry from drilling, tunnelling, diaphragm wall construction or grouting etc. shall not be discharged into the drainage system unless treatment is carried out that will remove silt, mud particles, bentonite etc. The Contractor shall provide treatment facilities as necessary to prevent the discharge of contaminated ground water.
- 48.7 The Contractor shall discharge wastewater arising out of site office, canteen or toilet facilities constructed by him into sewers after obtaining prior approval of agency controlling the system. A wastewater drainage system shall be provided to drain wastewater into the sewerage system.
- 48.8 The bentonite mixing, treatment and handling system shall be established by the contractor giving due regard to its environmental impacts. The disposal of redundant bentonite shall be carefully considered whether in bulk or liquid form. The disposal location will be advised and agreed with the relevant authorities.
- 48.9 The Contractor shall take measures to prevent discharge of oil and grease during spillage from reaching drainage system or any water body. Oil removal / interceptors shall be provided to treat oil waste from workshop areas etc.
- 48.10 The Contractor shall apply to the appropriate authority for installing bore wells for water supply at site.

49.0 Archaeological and Historical Preservation

- 49.1 The contractor shall seek to accommodate archaeological and historical preservation concerns that may arise due to the construction of the project especially in close vicinity of such areas where such monuments may be located.
- 49.2 The contractor shall consult the Archaeological Survey of India (ASI). Other competent authorities and other parties, on the advise of the Employer, to identify and assess construction effects and seek ways to avoid, minimize or mitigate adverse effects on such monuments.
- 49.3 Adverse effects may include reasonably foreseeable effects caused by the construction that may occur later in time, be farther removed in distance or those that alter, howsoever temporarily, the significance of the structure.



50.0 Landscape and Greenery

- 50.1 As far as is reasonably practicable, the Contractor shall maintain ecological balance by preventing deforestation and defacing of natural landscape. In respect of ecological balance, the Contractor shall observe the following instructions.
- 50.2 The Contractor shall, so conduct his construction operations, as to prevent any avoidable destruction, scarring or defacing of natural surrounding in the vicinity of work.
- 50.3 Where destruction, scarring, damage or defacing may occur as a result of operations relating to Permanent or Temporary works, the same shall be repaired, replanted or otherwise corrected at Contractor's expense. All work areas shall be smoothed and graded in a manner to conform to natural appearance of the landscape as directed by the Employer.
- 50.4 A suggested list of trees/shrubs suitable for planting and landscaping is found in Employer's Project SHE Manual.

51.0 Felling of Trees

- 51.1 The contractor shall identify the number and type of trees that are required to be felled as a result of construction of works and facilities related to Jaipur Metro Project and inform the Employer.
- 51.2 All trees and shrubbery, which are not specifically required to be cleared or removed for construction purposes, shall be preserved and shall be protected from any damage that may be caused by Contractor's construction operations and equipment. The contractor shall not fell, remove or dispose of any tree or forest produce in any land handed over to him for the construction of works and facilities related to Jaipur Metro except with the previous permission obtained from the Forest Department.
- 51.3 The Employer shall arrange permission from the forest department for trees to be felled or transplanted. The Employer will permit the removal of trees or shrubs only after prior approval.
- 51.4 Special care shall be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavating, dumping, chemical damage or other operation and the Contractor shall adequately protect such trees by used of protective barriers or other methods approved by the Employer. Trees shall not be used for anchorage.

52.0 Fly Ash

- 52.1 The Employer may require the contractor to use fly ash as a percentage substitution of cement, in concrete for certain structures and works.
- 52.2 In all such uses of Fly Ash, the contractor shall maintain a detailed record of usage of Fly Ash. The contractor shall also collect related details and provide to the Employer.
- 52.3 The reporting details on consumption of Fly Ash are found in Employer's SHE Manual.



53.0 Waste

- 53.1 The contractor is required to develop, institute and maintain a Waste Management Programme (WMP) during the construction of the project for his works, which may include: -
- i) Identification of disposal sites.
 - ii) Identification of quantities to be excavated and disposed off.
 - iii) Identification of split between waste and inert material
 - iv) Identification of amounts intended to be stored temporarily on site location of such storage.
 - v) Identification of intended transport means and route.
 - vi) Obtaining permission, where required, for disposal.
- 53.2 Such a mechanism is intended to ensure that the designation of areas for the segregation and temporary storage of reusable and recyclable materials are incorporate into the WMP. The WMP should be prepared and submitted to the Engineer for approval.
- 53.3 The Contractor shall handle waste in a manner that ensures they are held securely without loss or leakage thus minimizing potential for pollution. The Contractor shall maintain and clean waste storage areas regularly.
- 53.4 The Contractor shall remove waste in a timely manner and disposed off at landfill sites after obtaining approval of Jaipur Municipal Corporation for its disposal.
- 53.5 Burning of wastes is prohibited. The Contractor shall not burn debris or vegetation or construction waste on the site but remove it in accordance with **50.1** above.
- 53.6 The Contractor shall make arrangement to dispose of metal scrap and other saleable waste to authorized dealer and make available to the Employer on request, records of such sales.

54.0 Hazardous Waste Management

- 54.1 If encountered or generated as a result of Contractor's activity, then waste classified as hazardous under the "Hazardous Wastes (Management & Handling) Rules, 1989, amendments 2000, 2003" shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.
- 54.2 Chemicals classified as hazardous chemicals under "Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 of Environment (Protection) Act, 1986 shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.
- 54.3 The contractor shall identify the nature and quantity of hazardous waste generated as a result of his activities and shall file a 'Request for Authorisation' with Rajasthan State Pollution Control Board along with a map showing the location of storage area.
- 54.4 Outside the storage area, the contractor shall place a 'display board', which will display quantity and nature of hazardous waste, on date. Hazardous Waste needs to be stored in a secure place



- 54.5 It shall be the responsibility of the contractor to ensure that hazardous wastes are stored, based on the composition, in a manner suitable for handling, storage and transport. The labelling and packaging is required to be easily visible and be able to withstand physical conditions and climatic factors.
- 54.6 The contractor shall approach only Authorised Recyclers of Hazardous Waste for disposal of Hazardous Waste, under intimation to the Employer.
- 54.7 Submittal of all environment related documents and records pertaining to monitoring and trend analysis on key parameters such as but not limited to consumption/efficient use of resources such as energy, water, material such as cement, fly ash, iron and steel, recycle/reuse of waste etc that shall have demonstrated continual improvement in the implementation of Environmental management System. Failure to do so the employer shall impose appropriate penalty as indicated under penalty clause.

55.0 Energy Management

- 55.1 The contractor shall use and maintain equipment so as to conserve energy and shall be able to produce demonstrable evidence of the same upon Employer's request.
- 55.2 Measures to conserve energy include but not limited to the following:
- i) Use of energy efficient motors and pumps
 - ii) Use of energy efficient lighting, which uses energy efficient luminaries
 - iii) Adequate and uniform illumination level at construction sites suitable for the task
 - iv) Proper size and length of cables and wires to match the rating of equipment
 - v) Use of energy efficient air conditioners
- 55.3 The contractor shall design site offices maximum daylight and minimum heat gain. The rooms shall be well insulated to enhance the efficiency of air conditioners and the use of solar films on windows may be used where feasible.



PART – V : PENALTY AND AWARDS



56.0 Charges to be recovered from contractor for unsafe act or condition

56.1 JMRC has built an image of safety conscious organisation meticulously over a period of three years. Any reportable accident (fatality / injury) results in loss of life and/or property damage. These accidents not only result in loss of life but also damage the reputation of JMRC. Most of the accidents are avoidable and caused preliminary due to contractors' negligence. Hence JMRC shall recover the cost of damages from the contractors for every reportable incident (fatality / injury).

56.2 In addition every JMRC work site is exposed to public scrutiny as the work is executed just on the right-of-way. Any unsafe act / unsafe condition observed by public further damages our reputation. Because of the non-voluntary compliance of contractors to the condition of contract on SHE and project SHE manual, JMRC has been forced to establish safety-enforcing organisation. The cost of established such organisation is to be recovered from contractors for all observed safety violations at sites.

56.3 The following table indicates the Safety, Health and Environment violation (unsafe act / unsafe condition) and charges to be recovered from contractors.

SL. NO.	TOPIC	UNSAFE ACT/UNSAFE CONDITION	DEDUCTIBLE AMOUNT
1.	SHE Policy & Plan	i) SHE policy a) non-compliance of clause 4.1 b) Inadequate coverage, not signed c) Not displayed at prominent locations	Rs.5,000 per single violation, compounded to a maximum of Rs.25,000 at any single instance.
		ii) SHE plan: a) Not as per Employers' content and coverage b) Delay in submission c) Not updated as per employer's instruction as per clause 4.4 d) Copies not provided to all required supervisors / engineers	Rs.1,00,000 per single violation, compounded to a maximum of Rs.2,00,000 at any single instance.
2.	SHE Organisation	i) Not complying to the minimum manpower requirements as mentioned in General Instruction JMRC/SHE/001 ii) Not filling up the vacancies created due to SHE personnel leaving the contractor within 14 days. iii) SHE organisation not provided with required Audio-visual and other equipments as per General Instruction JMRC/SHE/012 iv) Employing through outsourcing	i) Rs.1,00,000 per month for first month and Rs.2,00,000 for subsequent months ii) Rs.50,000 per month for first month and Rs.1,00,000 for subsequent months For items iii), iv), v) and vi) Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations



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		<p>agencies and SHE personal are not in the payroll of the main contractor</p> <p>v) Disobedience / Improper conduct of any SHE personnel.</p> <p>vi) Chief SHE Manager not reporting directly to CPM of contractor.</p>	
3.	SHE committee	<p>i) Failed to formulate or conduct SHE Committee meeting for any month</p> <p>ii) Contractor and Sub-contractor representatives not attending SHE Committee meetings</p> <p>iii) Failed to conduct Site inspection before conducting SHE Committee meeting</p> <p>iv) Failed to send SHE Committee Meeting minutes or Agenda to Employer in time</p> <p>v) Non-adherence of clause 7.7.1</p> <p>vi) Non-adherence of clause 7.9</p>	<p>i) Rs.1,00,000 for the first violation and Rs.5,00,000 for the subsequent violations</p> <p>ii) Rs.5,000 to the contractor of the member who had not attended the meeting for first violation and Rs.25,000 for subsequent violations.</p> <p>For item iii), iv), v) and vi) Rs.25,000 for first violation and Rs.50,000 for subsequent violations</p>
4.	ID card	<p>i) Non-adherence of clause 8.1, 8.2 and 8.3</p>	Rs.1,00,000 for first violation and Rs.2,00,000 for subsequent violations
5.	SHE Training	<p>i) Not complying to the requirements as mentioned in conditions of contract on SHE and project SHE manual with regard to:</p> <p>a) Induction training not given</p> <p>b) Supervisor/engineer/manager training not conducted as per clause 9.6</p> <p>c) Refresher training as per clause 9.7 and 9.11 not conducted</p> <p>d) Tool-box talk not conducted as per clause 9.8</p> <p>e) Skill development training not conducted as clause 9.9</p> <p>f) Daily Safety Oath not conducted as per clause 9.10</p> <p>g) Top management behaviour based SHE training conducted</p>	<p>For item 1 a) to g) Rs.50,000 for first violation on and Rs.1,00,000 for subsequent violations</p>
6.	SHE Inspection	<p>i) Not complying to the requirements as mentioned in conditions of contract on SHE and project SHE manual as per clause 10.0</p> <p>ii) Non compliance of clause 10.3.6</p>	Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations
7.	SHE audit	<p>Internal Audit: MARS</p> <p>i) Not conducted as per SHE Plan</p> <p>ii) Report not sent to Employer</p> <p>iii) Action not taken for any month</p>	<p>For item i) to iii) Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations.</p>



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		<p>External Audit</p> <p>iv) Not conducted as per SHE Plan</p> <p>v) Report not sent to employer</p> <p>vi) Action not taken for any quarter</p>	<p>For item iv) to vi)</p> <p>Rs.1,00,000 for first violation and Rs.2,00,000 for subsequent violations.</p>
8.	SHE Communication	<p>i) Important days to be observed for SHE awareness as furnished by employer not observed</p> <p>ii) Posters as furnished by Employer not printed and displayed</p>	<p>i) Rs.10,000 for first violation and Rs.50,000 for subsequent violations</p> <p>ii) 2,00,000 per contract</p>
9.	SHE Submittals	<p>i) Non compliance of clause 13.1</p> <p>ii) Non compliance of clause 13.2</p> <p>iii) Non compliance of clause 13.3</p>	<p>For item i)</p> <p>Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations</p> <p>For item ii) and iii)</p> <p>Rs.1,00,000 for first violation and Rs.2,00,000 for subsequent violations</p>
10.	Injury and Incidence reporting	<p>i) Fatal accidents</p> <p>ii) Injury accident</p> <p>iii) Abnormal delay in reporting accidents or wilful suppression of information about any accidents / dangerous occurrence as per clause 14.1.4</p> <p>iv) Delay in informing about any accidents / dangerous incidents.</p> <p>v) Non-compliance of the clause 14.4</p>	<p>i. Rs.5,00,000 for first fatality and Rs.10,00,000 for every subsequent fatality.</p> <p>ii. Rs.1,00,000 for first grievously injured person and Rs.2,00,000 for every subsequent grievously injured person (Grievous Injury as defined by Workmen Compensation Act)</p> <p>iii. Rs.1,00,000 for first violation and Rs.2,00,000 for subsequent violations</p> <p>For items iv) and v)</p> <p>Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations</p>
11.	Emergency preparedness Plan	Non-compliance of the clause 15.1,15.2, 15.3, 15.4, 15.5 and 15.6	Rs.1,00,000 for non-compliance of any of the clauses
12.	Housekeeping	<p>i) Housekeeping maintenance register not properly maintained up to date</p> <p>ii) Surrounding areas of drinking water tanks / taps not hygienically cleaned / maintained</p> <p>iii) Office, stores, toilet / urinals not properly cleaned and maintained.</p> <p>iv) Required dustbins at appropriate places not provided / not cleaned.</p> <p>v) Stairways, gangways, passageways blocked.</p>	Rs.10,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance



		<ul style="list-style-type: none"> vi) Lumber with protruding nails left as such vii) Openings unprotected viii) Excavated earth not removed within a reasonable time. ix) Truck carrying excavated earth not covered / tyres not cleaned. x) Vehicles / equipments parked / placed on roads obstructing free flow of traffic xi) Unused surplus cables / steel scraps lying scattered xii) Wooden scraps, empty wooden cable drums lying scattered xiii) Water stagnation leading to mosquito breeding 	
13.	Working at Height / Ladders and Scaffolds	<ul style="list-style-type: none"> i) Not using or anchoring Safety Belt ii) Not using Safety Net iii) Absence of life line or anchorage point to anchor safety belt iv) Non-compliance of clause 18.17 v) Using Bamboo ladders vi) Painting of ladders vii) Improper usage (less than 1m extension above landing point, not maintaining 1:4 ratio) viii) Aluminium ladders without base rubber bush ix) Usage of broken / weak ladders x) Usage of re-bar welded ladders xi) Improper guardrail, toe board, barriers and other means of collective protection xii) Improper working platform xiii) Working at unprotected fragile surface xiv) Working at unprotected edges 	Rs.10,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
14.	Lifting appliances and gear	<ul style="list-style-type: none"> i) Non availability of fitness certificate as per clause 21.3 ii) Documents not displayed on the machine or not available with the operator as per clause 21.4 iii) Maximum Safe Working Load not written on the machine as per clause 21.5 iv) Non-compliance of 21.6 v) Non-compliance of 21.7 vi) Automatic safe load indicator not provided or not in working condition as per clause 21.8 vii) Age of the operator less than 21 years or without any licence and non-compliance of other item as per clause 21.9 	Rs.50,000 per single violation Compounded to a maximum of Rs.5,00,000 at any single instance



		<ul style="list-style-type: none"> viii) Non-compliance of 21.10 ix) Non-compliance of any of the items mentioned regarding rigging requirements as per clause 21.11 x) Failure to submit method statement in case of all critical lifting xi) Person riding on crane. xii) Creating more noise and smoke xiii) Absence of portable fire extinguisher in driver cabin xiv) Fail to guard hoist platform xv) No fencing of hoist rope movement area xvi) Hoist platform not in the horizontal position 	
15.	Launching operation	Non-adherence of any of the provisions mentioned in clause 22.2	Rs. 50,000 for first violation and Rs.1,00,000 for subsequent violations .
16.	Site Electrical safety	<ul style="list-style-type: none"> i) Non-compliance of clause 26.1.1 ii) Non-compliance of clause 26.2.4, 26.2.5 iii) Non-compliance of clause 26.3.1 iv) Non-compliance of clause 26.7, 26.8 and 26.9.1 v) Non-compliance of clause 26.10 and 26.13 vi) Non-compliance of clause 28.3.2 vii) Exposed electric lines (fermentative damage) and circuits in the workplace. viii) Inserting of bare wires into the socket ix) Improper grounding for the electrical appliances x) Electrical cables running on the ground xi) Non-compliance clause 27.0 	Rs.10,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
17.	Hand tools and Power tools	<ul style="list-style-type: none"> i) Non-compliance of clause 28.0 	Rs.10,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
18.	Gas Cutting	<ul style="list-style-type: none"> ii) Wrong colour coding of cylinder. iii) Cylinders not stored in upright position. iv) Flash back arrester, non-return valve and regulator not present or not in working condition. v) Fail to put cylinders in a cylinder trolley. vi) Damaged hose. vii) Using domestic LPG cylinders viii) Fail to store cylinder 6.6m away from fire prone materials ix) Fail to use hose clamps x) Fire extinguisher not placed in the vicinity during operation 	Rs.10,000 per single violation Compounded to a maximum of Rs.50,000 at any single instance



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19.	Welding	<ul style="list-style-type: none"> i) Voltmeter and Ammeter not working ii) Improper grounding and return path. iii) Damaged welding cable iv) Bare openings in the cable. v) Non-availability of separate switch in the transformer vi) Non-availability of main switch control to switch off power to the welding unit. vii) Usage of reinforcement rod as return conductor viii) Damaged holder ix) Fire extinguisher not placed in the vicinity during operation 	Rs.10,000 per single violation Compounded to a maximum of Rs.50,000 at any single instance
20.	Fire precaution	<ul style="list-style-type: none"> i) Smoking and open flames in fire prone area ii) Using more than 24V portable electrical appliances in the fire prone area iii) Not proper ventilation in cylinder storage area. iv) Absence of fire extinguishers v) Fire extinguishers not refilled once in a year. vi) Fire extinguisher placed in a not easily accessible location 	Rs.5,000 per single violation Compounded to a maximum of Rs.25,000 at any single instance.
21.	Excavation, Tunnelling and confined space	<ul style="list-style-type: none"> i) Non-compliance of clause 34.1.1 ii) Non-compliance of clause 34.2.3 iii) Non-compliance of clause 34.3 	For any item from i) and ii) Rs.10,000 per single violation Compounded to a maximum of Rs.50,000 at any single instance. For item iii) Rs.10,000 per first violation and Rs.50,000 for subsequent violations
22.	Work permit system	<ul style="list-style-type: none"> i) Non-compliance of clause 35.2 ii) Non-compliance of clause 21.11.9 	For item i) and ii) Rs.50,000 per first violation and Rs.1,00,000 for subsequent violations
23.	Traffic Management	<ul style="list-style-type: none"> i) Non-compliance of clause 36.4.1 ii) Non-compliance of clause 36.8.3 iii) Non-compliance of clause 36.9.2 iv) Non-compliance of clause 36.9.3 v) Non-compliance of clause 36.9.7 vi) Non-compliance of clause 36.9.8 	Rs.1,00,000 per first violation and Rs.2,00,000 for subsequent violations



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		a) Barricades i) Not Cleaned ii) Not in alignment iii) Not numbered iv) Not painted v) Red lights / reflectors not working vi) Damages not repaired vii) Not secured properly viii) Barricade inspector not employed ix) Protruding parts / portions repaired x) Barricades maintaining register not properly maintained up to date	Rs.25,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
		b) Contractor Vehicles i) Over loading of vehicles ii) Unfit drivers or operators iii) Unlicensed vehicles iv) Absence of traffic marshals v) Absence of reversing alarm vi) Absence of fog light (at winter) vii) Power / hand brakes not in working condition.	Rs.25,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
		c) Splashing of Bentonite on roads / non-cleaning of tyres of dumpers and transit mixers i) Mishandling of bentonite like splashing of bentonite outside specified width of barricading ii) Non-cleaning of tyres of dumpers and transit mixers before leaving the site and thereby creating a traffic safety hazard to road users.	For item i) and ii) a) Rs.1,00,000 on first observation. b) Rs. 2,00,000 on second observation c) Rs. 3,00,000 on third and subsequent observations
24.	Batching plant / Casting yard	Non-adherence of any of the provisions mentioned in clause 38.0.	Rs. 10,000 for single violation compounded to a maximum of Rs.1,00,000 at any single instant.
25.	PPE	i) Not having ii) Not wearing (or) using and kept it elsewhere iii) Using damaged one iv) Using wrong type v) Using wrong colour helmet or helmet without logo vi) Using for other operation (e.g. Using safety helmet for storing materials or carrying water from one place to other) vii) Not conforming to BIS standard	From item i) to vi). Rs.200 per single violation For item vii) Rs.10,000 for first violation and Rs.50,000 for subsequent violations For item viii) Rs.50,000 for first violation and Rs.1,00,000 for subsequent violations



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		viii) Non-compliance of clause 39.6, 39.7 and 39.8	
26.	Occupational Health	i) Fail to conduct Medical examination to workers ii) Absence of ambulance van & room iii) Workers not having ID card iv) Inadequate number of toilets v) Toilets not cleaned properly vi) Absence of water facilities for toilets and washing places vii) Toilet placed more than 500m from the work site viii) Absence of drinking water ix) Absence of first-aid person in work site. x) Absence or inadequacy of first-aid box. xi) Misuse of first-aid box. xii) First-aid box not satisfy the minimum Indian standard. xiii) Smoking inside the construction site xiv) Drink and drive or work xv) Excessive noise and vibration xvi) Canteen not provided xvii) Food stuff not served on no loss no profit basis xviii) Creche not provided xix) Accommodation not provided as per BOCWA xx) Fumigation / insecticides not sprayed to prevent Mosquito breeding xxi) Non-compliance of clause 44.1 and 44.2	Rs.10,000 per single violation Compounded to a maximum of Rs.1,00,000 at any single instance
27.	Labour Welfare measures	i) Non adherence of Labour welfare provisions of BOCWA ii) Fail to register establishment and display the registration certificate at workplace iii) Absence of workers register and records iv) Absence of muster roll and wages register v) Fail to display an abstract of BOCWA and BOCWR	Rs.10,000 per single violation Compounded to a maximum of Rs.50,000 at any single instance
28.	Environmental Management	i) Tyre wash facility not provided ii) Spillage from vehicles not arrest iii) Air monitoring not practiced iv) Noise monitoring not practiced v) The values of air monitoring and noise monitoring not with in acceptable limits vi) Dust control measures at sites not	Rs.10,000 per single violation Compounded to a maximum of Rs.50,000 at any single instance



		practiced	
		vii) Improper disposal of debris / residues	

56.4 **Without limiting to the unsafe acts and or conditions mentioned above in clause 56.3 the Employer shall have the right to deduct charges for any other unsafe act and or condition depending upon the gravity of the situation on a case-to-case basis. The charges shall be in comparison with that of the similar offence indicated in clause 56.3.**

57.0 Stoppage of work

57.1 The Employer shall have the right to stop the work at his sole discretion, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and / or property, and / or equipments. In such cases, the contractor shall be informed in writing about the nature of hazards and possible injury / accident.

57.2 The contractor shall not proceed with the work until he has complied with each direction to the satisfaction of Employer

57.3 The Contractor shall not be entitled for any damages / compensation for stoppage of work, due to safety reasons and the period of such stoppage of work shall not be taken as an extension of time for Completion of the Facilities and will not be the ground for waiver of levy of liquidated damages.

58.0 Awards

The following categories will be considered for awards as per the scheme in practice of Employer

- i) For every safe million man hour working without any reportable incidents
- ii) Zero fatality contracts
- iii) 100% adherence to voluntary reporting of all accidents throughout the currency of contract
- iv) Safest project team of the year.
- v) Best SHE team of the year.
- vi) Safest Contractor of the year.



APPENDIX



	JAIPUR METRO RAIL CORPORATION LTD.
APPENDIX NO.: 1	

Memorandum of Understanding between Jaipur Metro Rail Corporation (JMRC) and the Contractor for safe execution of contract work

This Memorandum of Understanding is made and executed by and between Jaipur Metro Rail Corporation Ltd. (JMRC), a Company registered under the Companies Act 1956 and having its registered office at Khanij Bhawan, Udyog Bhawan Premises, Tilak Nagar, C-Scheme, Jaipur-302005 or their authorized representative(s), hereinafter referred to as "EMPLOYER" (which expression shall wherever the context so requires or admits be deemed to mean and include its successors in business and assigns) of the one party
AND

M/s _____ having its registered office at _____ hereinafter referred to as the "CONTRACTOR" (which expression shall wherever the context so requires or admits be deemed to mean and include its successors in business and assigns) of the other party

WITNESSETH THAT

WHEREAS the EMPLOYER gives highest importance to the occupational safety, health and environment during execution of work, seeks cooperation from the CONTRACTOR in this endeavour.

Thus, this Memorandum of Understanding is for promoting the safety, health and environment aspects required to be followed at workplace/site and will be applicable to any site job to be done by the CONTRACTOR
AND

WHEREAS the CONTRACTOR has read all the terms and conditions of the EMPLOYER and whereas the CONTRACTOR has studied the following documents:

- (a) Tender Documents, including Notice Inviting Tender, General Conditions, Special Conditions,
- (b) Conditions of Contract on Safety, Health and Environment and Project Safety, Health and Environment Manual.
- (c) Building and Other Construction Workers (Regulations of Employment and Conditions of Service) Act 1996, Central Rules 1998 and subsequent Rajasthan Government Rules 2009, Building and Other Construction Workers Welfare Cess Act 1996 and Rules 1998 and Rajasthan Building and Other Construction Workers' Welfare Board Rules and
- (d) Indian Electricity Act 2003 and Rules 1956.
- (e) Corresponding International / Bureau of Indian Standard Codes.

The amendments to any of the above rules and any other rules & regulations or procedures, circulars, notices & advices laid down by the EMPLOYER from time to time.

Now it is hereby AGREED AND DECLARED by and between the EMPLOYER and the CONTRACTOR as follows:

Clause - I The CONTRACTOR shall abide by the terms and conditions stipulated in Condition of Contract on Safety, Health & Environment and Project Safety, Health



Safety, Health and Environment (SHE) Manual

& Environment Manual.

- Clause - II The CONTRACTOR shall undertake full responsibility for safe execution of job at work place/site and safety of his personnel and adjoining road users during work.
- Clause - III Without giving any prior notice, the EMPLOYER shall from time to time be entitled to add/or amend any or all terms and conditions with a view to improving safety and occupational health of personnel and safety of work, with immediate effect and the same shall be binding on the CONTRACTOR. The contractor agrees to implement all such amendments, which shall be laid down by the EMPLOYER.
- Clause - IV Besides following the guidelines, safety rules and regulations, safety codes given in various safety procedures/documents mentioned above, the CONTRACTOR shall also prepare detailed method statement which includes job safety analysis wherever there are complicated and hazardous/high risk working involved and get it approved from Employer before execution of work.
- Clause - V Any negligence or violation in implementing any of the provision of the conditions of contract on Safety, Health & Environment and JMRC project Safety, Health & Environment Manual shall be viewed seriously and the contractor is liable to compensate the employer for the loss of reputation. The cost of damage shall be fixed on case-to-case basis.

In witness thereof the Parties hereto by representatives duly authorised have executed this Memorandum of Understanding on _____ day of _____ 20____.

Signed on
For and on behalf of JMRC

Signed on
For and on behalf of (Contractor)

Signature:
Name:
Title:

Signature:
Name:
Title:



	JAIPUR METRO RAIL CORPORATION LTD.
APPENDIX NO.: 2	

Safety, Welfare and Occupational Health requirements as per BOCW Act 1996 and Rules 1998 and Rajasthan BOCW Rules 2009.

(This list has been prepared in chronological order with primary importance to Section of Act and secondary importance to Rules)

- S -** Refers relevant Sections in BOCWA
R - Refers relevant Rules in BOCWR
C - Refers relevant Chapter No. in BOCWR

Sl. No.	1. Items	Relevant Sections / Rules in BOCWA and BOCWR and RBOCWR
2.	Registration of establishment	S – 7, R – 23 to 27
3.	Display of registration certification at workplace	R – 26 (5)
4.	Hours of work	S – 28 R – 234 to 237
5.	Register of overtime	S – 28; S – 29 R – 241(1) Form XXII
6.	Weekly rest and payment at rest	R – 235
7.	Night shift	R – 236
8.	Maintenance of workers registers and records	S – 30 R – 238
9.	Notice of commencement and completion	S – 46 R – 239
10.	Register of persons employed as building workers	R – 240
11.	Muster roll and wages register	R – 241(1) (a); Form XVI and XVII
12.	Payment of wages	R – 248
13.	Display of notice of wages regarding	R – 249
14.	Register of damage or loss	R – 241(1)(a); Form XIX, XX, XXI
15.	Issue of wages book	R – 241(2)(a); Form XXIII
16.	Service certificate for each workers	R – 241(2)(b); Form XXIV
17.	Display an abstract of BOCWA and BOCWR	R – 241(5)
18.	Annual return	R – 242; Form XXV
19.	Drinking water	S – 32
20.	Latrines and Urinals	S – 33 R - 243
21.	Accommodation	S – 34
22.	Creches	S – 35
23.	First-aid boxes	S – 36 R – 231 and Schedule III
24.	Canteens	S – 37 R – 244
25.	Food stuff and other items served in the canteens	R – 245
26.	Supply of tea and snacks in work place	R – 246
27.	Food charges on no loss no profit basis	R - 247
28.	Delhi BOCW welfare Board Rules	R – 250 to 296



29.	Safety committee	S – 38 R – 208
30.	Safety officer	S – 38 R – 209 and Schedule VII
31.	Reporting of accidents and dangerous occurrences	S – 39, R – 210
32.	Procedure for inquiry in to the causes of accidents	R – 211
33.	Responsibility of employer	S - 44 R – 5
34.	Responsibility of Architects, Project engineer and Designers	R – 6
35.	Responsibility of workmen	R – 8
36.	Responsibility for payment of wages and compensation	S – 45
37.	Penalties and Procedures	S – 47; S – 55
38.	Excessive noise, vibration etc	R – 34
39.	Fire Protection	R – 35
40.	Emergency action plan	R – 36
41.	Fencing of motors	R – 37
42.	Lifting of carrying of excessive weight	R – 38
43.	Health, Safety and Environmental Policy	R – 39
44.	Dangerous and Harmful Environment	R – 40
45.	Overhead protection	R – 41
46.	Slipping, Tripping, Cutting, Drowning and Falling Hazards	R – 42
47.	Dust, Gases, Fumes, etc	R – 43
48.	Corrosive substance	R – 49
49.	Eye Protection	R – 45
50.	Head Protection and other protection apparel	R – 46; R – 54
51.	Electrical Hazards	R – 47
52.	Vehicular traffic	R – 48
53.	Stability of structure	R – 49
54.	Illumination	R – 50; R – 124
55.	Stacking of materials	R – 51
56.	Disposal of debris	R – 52
57.	Numbering and marking of floors	R – 53
58.	Lifting appliances and gears	C – VII; R – 55 to 81
59.	Runways and Ramps	C – VIII; R – 82 to 85
60.	Working on or adjacent to water	C – IX; R – 86 & 87
61.	Transport and earthmoving equipments	C – X; R – 88 to 95
62.	Concrete work	C – XI; R – 96 to 107
63.	Demolition	C – XII; R – 108 to 118
64.	Excavation and Tunnelling works	C – XIII; R – 119 to 168
65.	Ventilation	R – 153
66.	Construction, repair and maintenance of step roof	C – XIV; R – 169 to 171
67.	Ladders and Step ladders	C – XV; R – 172 to 174
68.	Catch platform and hoardings, chutes, safety belts and nets	C – XVI; R – 175 to 180
69.	Structural frame and formworks	C – XVII; R – 181 to 185
70.	Stacking and unstacking	C – XVIII; R – 186 & 187
71.	Scaffold	C – XIX; R – 188 to 205
72.	Cofferdams and Caissons	C – XX; R – 206 to 211
73.	Explosives	C – XXI; R – 212 & 213
74.	Piling	C – XXII; R – 214 to 222
75.	Medical Examination for building and other construction worker, Crane operator an Transport vehicle drivers	R – 81; R – 223(a)(iii) and Schedule XII



Safety, Health and Environment (SHE) Manual

76.	Medical examination for occupational health hazards	R – 233(a)(iv)
77.	Charging of workers for Medical Examination	R – 223(b)
78.	Occupational health centres and Medical officers	R – 225 and Schedule X & XI
79.	Ambulance van & room	R – 226 & 227 and Schedule IV & V
80.	Stretchers	R – 228
81.	Occupational health service for building workers	R – 229
82.	Medical examination for occupational health hazards	R – 223(a)(iv)
83.	Emergency care services and emergency treatment	R – 232
84.	Panel of experts and agencies	Central Rule 250 Rajasthan Rule 277
85.	Power of inspectors	Central rule 251 Rajasthan rule 278



	JAIPUR METRO RAIL CORPORATION LTD.
APPENDIX NO.: 3	


CONTENT OF SHE PLAN	
Contract No	
Contractor Name	
Project Name	

1	Project Highlights <ul style="list-style-type: none">i. Title of the contentii. Contractor Numberiii. Brief scope of workiv. Location map/ key planv. Period of the project
2	SHE Policy
3	Site Organisation Chart Chart indicating reporting of SHE personnel
4	Roles & Responsibility Individual responsibility of the <ul style="list-style-type: none">i. Project Managerii. Construction Manageriii. Construction Supervisorsiv. SHE Committee Membersv. SHE Inchargevi. Site Engineersvii. First Line Supervisorsviii. Sub-contractors
5	SHE Committee <ul style="list-style-type: none">i. Details - Chairman, Members, Secretary and Employer's representative,ii. Procedures for effective conduct of meeting
6	SHE Training
7	Subcontractor Evaluation, Selection and Control
8	SHE Inspection
9	SHE Audit
10	Accident Investigation And Reporting Procedures



11	Occupational Health Measures
12	Labour Welfare Measures
13	Risk assessment and mitigation procedures
14	Safe Work Procedures <ul style="list-style-type: none"> i. Work at Height ii. Structural Steel Erection iii. Launching of segments iv. Floor, Wall Openings and Stairways v. Welding, Cutting and Bracing vi. Lifting appliances vii. Work Permit Systems viii. Electrical Equipments ix. Mechanical Equipments x. Excavation xi. Fire Prevention xii. Hazardous Chemicals and Solvents xiii. Ionising Radiation xiv. Lighting xv. Abrasive Blasting
15	Work Permit System
16	List of standard job specific PPEs to be used in the site
17	Maintenance of Regime for construction Equipment and Machinery
18	Traffic management
19	Housekeeping
20	Environmental Management
21	Emergency Management
22	Visitors and Security arrangement



	JAIPUR METRO RAIL CORPORATION LTD.
APPENDIX NO.: 4	

WORKPLACE POLICY ON HIV/AIDS PREVENTION & CONTROL FOR WORKMEN ENGAGED BY CONTRACTORS

“Being mobile in and of itself is not a risk factor for HIV infection. It is the situations encountered and the behaviours possibly engaged in during mobility or migration that increase vulnerability and risk regarding HIV / AIDS.”

UNAIDS, Technical update on ‘Population, Mobility and AIDS’, February 2001, p.5

Jaipur Metro Rail Corporation (JMRC) recognizes HIV / AIDS as a developmental challenge and realizes the need to respond to it by implementing regular HIV / AIDS prevention programmes and creating a non-discriminatory work environment for HIV infected workmen engaged by contractors. For the purpose of making conscientious, sensitive and compassionate decision in addressing the realities of HIV / AIDS, JMRC has established these guidelines based on ILO code of practice on HIV / AIDS.

- ▶ Creating awareness through professional agency using IEC (Information, Education and Communication) package specially designed for migrant workers.
- ▶ Institutional capacity building by training the project implementation team, Safety, Health & Environment (SHE) Managers, establishing linkages for efficient diagnosis and treatment of the affected workers, effective monitoring of implementation and documentation for further learning.
- ▶ Establishing peer educators by selecting them in consultation with contractors and training them through professional agencies so that they become focal point for any information, education and awareness campaigns among the workmen throughout the contract period.
- ▶ Promotion of social marketing of condoms through Rajasthan State Aids Control Society (RSACS).



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/001	

MINIMUM MANPOWER REQUIREMENTS OF SHE ORGANIZATION BASED ON CONTRACT VALUE

	1	2	3	4	5	6
Awarded Contract value (in Cr.)	Chief SHE Manager	Senior SHE Manager	Junior SHE Manager	Safety Steward	Senior SHE (Electrical) Engineer	Junior SHE (Electrical) Engineer
Upto 2	-	-	1	Refer Note 1	-	1
Upto 10	-	1	Refer Note 1		1	Refer Note 2
Upto 25	1	Refer Note 1			1	
Upto 100	1				1	
Upto 250	1				1	
More than 250	1				1	

	7	8	9	10	11	12	13
Awarded Contract value (in Cr.)	*Junior SHE (Fire) Manager / **Senior SHE (Fire) Manager	Occupational Health officer with Necessary Nursing Assistants (Refer Note3)	Environmental Manager	Senior SHE (Traffic) Engineer (Refer Note4)	Barricade Maintenance Squad (Refer Note4)	House Keeping Squad	Labour Welfare Officer
Upto 2	-	-	-	-	Refer Note 5	Refer Note 6	-
Upto 10	-	1 (PT)	1	1			1
Upto 25	1*	1 (PT)	1	1			1
Upto 100	1*	1 (FT)	1	1			1
Upto 250	1**	2(FT)	1	1			1 with support staff
More than 250	2**	2(FT)	1 with support staff	1			1 with support staff

Note 1: Adequate, qualified and trained SHE Professionals with required support staff to be deployed at each worksite at each shift.

Note 2: Adequate, qualified and trained Electrical Engineers / supervisors to be deployed at each worksite at each shift.



Safety, Health and Environment (SHE) Manual

Note 3: (PT) means Part-Time and (FT) means Full-time.

Note 4: Senior SHE (Traffic) Engineer Post and Barricade Manager (including the staff) Posts are applicable to contracts where the work has to be executed either below or over the right-of-way like Viaduct, Tunnel Contracts wherein erection and maintenance of barricades are paramount important.

Note 5: One Barricade Manager supported by required supervisors and workmen

Note 6: One Housekeeping Manager supported by required supervisors and workmen



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/002	

MINIMUM QUALIFICATION AND EXPERIENCE FOR (SHE) SAFETY, ELECTRICAL, ENVIRONMENTAL, TRAFFIC ENGG. AND OCCUPATIONAL HEALTH PROFESSIONALS

Sl. No	Designation	Qualification	Experience (in years)
1	Chief SHE Manager	<p>The Chief SHE Manager shall have qualified in any of the following degree/diploma:</p> <ul style="list-style-type: none"> i) Post Graduate Diploma in Industrial Safety & Environmental Management (PGDISEM) from National Institute of Industrial Engineering, Mumbai ii) M.E. in Industrial Safety from NIT, Trichy, Tamil Nadu iii) M.E. in Industrial Safety from Mepco Schlenk Engineering College, Sivakasi, Tamil Nadu iv) B.E. in Fire and Safety Engg. From Cochin University of Science and Engg. Cochin, Kerala v) B.E. with advanced Safety Management Diploma from CLI / RLI Mumbai / Chennai / Kolkata and Kanpur. vi) B.E / B.Arch., with one year Full Time advanced Safety diploma from NICMAR, Hyderabad. vii) B.E/B.Tech with any other equivalent State and Central Govt. recognized full time Degree / Diploma in Safety. viii) International qualifications like CSP (Certified Safety Professional), NEBOSH, MIOSH, MSISO etc. 	2 {for all category except (iv) and 5yrs for category (iv)}
2	Senior SHE Manager (Refer Note 3)	<p>As stated in Sl. No:1 and in addition the following categories:</p> <ul style="list-style-type: none"> i) B.Sc.(Physics/Chemistry/Maths) with one year Full Time advanced Safety diploma from NICMAR, Hyderabad ii) B.Sc. / Diploma in Engg. with advanced Safety Management Diploma from CLI / RLI / Mumbai / Chennai / Kolkata and Kanpur. iii) B.Sc. (Physics/Chemistry/Maths) with One year Full Time diploma in Safety Engineering offered by West Bengal State Technical Education Departments and similar courses by other states. iv) Any Graduate or diploma holder with 7 years of work experience in full fledged SHE department of any Public Sector / Leading Private Sector / MNC / with prior approval of employer on a case to case basis 	2 {for category (i), (ii) and (iii) only}
3	Junior SHE Manager (Refer Note 3)	<ul style="list-style-type: none"> i) Degree in Science / Diploma in Engineering with Govt. recognized safety diplomas from Correspondence 	2 (for category (i) only)



Safety, Health and Environment (SHE) Manual

		course of NICMAR, Annamalai University, National and State Productivity Councils, Other State Technical Education Boards etc. ii) Any Graduate or diploma holder with 5 years of work experience in full fledged SHE department of any Public Sector / Leading Private Sector / MNC / with prior approval of employer on a case to case basis	
4	Safety Steward (Refer Note 3)	Any basic qualification with any SHE related certificate courses.	2
5	Senior SHE (Electrical) Manager	Degree in Electrical Engineering + Govt. recognized Electrical Licence holder	2
6	Junior SHE (Electrical) Manager	Diploma in Electrical Engineering + Govt. recognized Electrical Licence holder	1
7	Senior SHE (Fire) Manager	i) B.E. (Fire) from National Fire Service College, Nagpur ii) B.E (Fire & Safety) from Cochin University iii) Graduate with any Govt. recognized diploma in Fire Safety with 5 years of experience	2 (for category (i) and (ii) only)
8	Junior SHE (Fire) Manager	Any Diploma holder with any Govt. recognized diploma in Industrial Fire Safety.	1
9	Occupational Health Officer	MBBS with Govt. recognized degree/diploma in Industrial/ occupational health	1
10	Environment Manager	Govt. recognized PG Degree / PG Diploma / Degree in Environmental Engineering / Science	2
11	Senior SHE (Traffic) Engineer	Govt. recognized PG Degree / Degree / Diploma in Traffic/Transportation Engineering or Planning	1
12.	House Keeping Squad -Manager	Any Diploma in Engineering	1
13	Barricade Manager	Any Diploma in Engineering	1
14	Labour Welfare Officer	Any Degree with Govt. Recognized Degree / Diploma / P G Diploma in Labour Welfare related fields like Law, Personnel / Industrial Relations etc.	2

Note 1: In some extraordinary cases where the candidate had earlier worked in JMRC Projects they can be considered for the following posts:

- i) Senior SHE Manager
- ii) Junior SHE Manager
- iii) Safety Steward

depending upon the qualification and no. of years of experience on a case to case basis even if they do not possess the prescribed qualification as listed above.

Note 2: In all other cases other than listed under note 3 (i), (ii) and (iii) irrespective their earlier experience with JMRC projects the candidates shall qualify as specified above.



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/003	

MINIMUM REQUIREMENTS OF SHE MONITORING AND AUDIO-VISUAL EQUIPMENTS

- For the purpose of minimum requirements of Audio-visual and Other equipment the contracts are categorized into the following groups:

Contract Value (Initial awarded value of contract)	Group
Upto 25 Cr	A
Upto 100 Cr	B
Upto 250 Cr	C
More than 250 Cr	D

- Every contractor falling into the above groups shall provide the following minimum required audio visual aids for conducting weekly review, monthly safety committee and other post review meeting of all fatal and major incidences effectively. These audio-visual equipments are a must for conducting periodical in-house safety presentations in the training programmes.
- In addition to the above portable hand held digital sound level meter (SLM) and portable hand held digital lux meter are also to be provided.


Sl.No	SHE monitoring and Audio-Visual Equipment details	SHE monitoring and Audio-Visual equipment required for			
		Group A Contract	Group B Contract	Group C Contract	Group D Contract
1.	Portable hand held Digital Sound Level Meter (SLM)	1	1	1	1
2.	Portable hand held Digital Lux Meter	1	1	1	1
3.	Laptop Computer with standard configuration including multi media facilities	1	1	1	1
4.	Colour Printer	1	1	1	1
5.	Computer projector with screen	-	1	1	1
6.	Overhead projector	1			
7.	35mm Camera (For taking accident investigation photos in which case the images can not be easily altered)	1	1	1	1



Safety, Health and Environment (SHE) Manual

8.	Digital camera with flash of minimum 4 mega pixel and video facility	1	1	1	2
9.	Digital still camera with flash of minimum 4 mega pixel	1	2	4	6
10.	Portable loudspeaker (for tool-box talk and emergency purpose)	1	1	2	6
11.	Communication facility like mobile phone, walky-talky etc	For all supervisors and managers/engineers working in Safety, Health & Environment			
12.	Accident investigation Kit containing the following:	1	1	1	2
a)	Chalk piece for marking				
b)	Measuring tape for measuring <ul style="list-style-type: none"> Flexible tape – 2m length Metal Foot long scale and Metal tape – 30m 				
c)	Equipment tags				
d)	Multipurpose Flash light				
e)	Barrier tape of 20m length				
f)	Accident investigation Forms and checklists				
g)	Enough Paper for witness recording and other noting				
h)	Emergency Phone Numbers list				



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction: JMRC/SHE/GI/004	

Training of Contractor's Employees/Staff/Worker's

Contractor shall provide a training/workshop on safety, health & environment (SHE) to all its workers/staff/employees/subcontractors of at least 2 weeks (96 hrs) at the time of induction. Before posting of any his worker's/staff/employees/subcontractors, the contractor shall give a certificate that the said person had undergone the requisite SHE training. Non compliance of the above will invoke penalties as per the condition of contract on SHE, of Tender Document.

The training shall cover following aspects:-

1. Hazard Identification Procedure

Hazards on site:

- Falls
- Earthing work
- Electricity
- Machinery
- Handling materials
- Transport
- Site housekeeping
- Fire

2. Personal Protective Equipment

- What is available?
- How to obtain it?
- Correct use and care.

3. Health

- Site welfare facilities
- Potential health hazards
- First Aid/CPR


4. Duties of the contractor

- Brief outline of the responsibilities of the Contractor by law
- Details of Contractor's accident prevention policy
- JMRC's SHE manual
- Building and other Constructions Welfare Law

5. Employee's Duties

- Brief outline of responsibilities of employee under law
- Explanation of how new employees fit into the Contractor's plan for accident prevention. (induction and orientation).



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/005	

ID Card Format

(85 mm x 55mm)

Front side of ID Card:

Name & Address of Main/Sub Contractor	
LOGO of Main/Sub Contractor Company	Location Jaipur Metro Rail Project
Name: Designation: Blood Group: Valid from: Valid up to:	Photo
Contractor's Authorised Signatory with seal	

Backside of ID Card:

Employee Address: _____ _____ _____
<div>1. This card is the property of "XX" (Main / Sub / Labour Contractor) and must be returned on demand and on transfer / cancellation of employment. 2 A charge will be levied for replacement of the card due to loss or theft 3 If found please return to</div>
Main contractors' Address



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/006	

SHE Training details for Managers and Supervisors

1. The Law and Safety	2. Policy and Administration
Statutory requirement Appropriate regulations Duties of employer and employee	Effect of incentive on accident prevention Human relations Consultation Safety Officer: duties, aims, objectives
3. Safety and the Supervisor	4. Principles of Accident Prevention
Safety and efficient production go together Accidents affect morale and public relations	Attitudes of management, supervision and operations Methods of achieving safe operations Accident and injury causes
5. Site Inspection	6. Human Behavior
The role of management Hazard Identification Procedure Records results Follow-up procedures Feedback	Motivating agencies Individual behavior Environmental effects Techniques of persuasion
7. Site housekeeping	8. Health
Site organization Relationship of site housekeeping to accident occurrence Site access Equipment storage Material stacking Materials handling	Medical examination Hazard to health on site Sanitation and welfare Protective clothing First Aid/CPR
9. Personal Protective Equipment	10. Electricity
Eye, face, hands, feet and legs Respiratory protective equipment Protection against ionizing radiation	Appreciation of electrical hazards Power tools Arc welding Low voltage system Lighting and power system on sites ELCB, RRCB, Grounding/Ground fault circuit interrupters (GFCIs)
11. Oxygen and Acetylene Equipment	12. Equipment
Cylinder storage and maintenance Condition and maintenance of valves, regulators, and gauges Condition and maintenance of hoses and fittings Pressures	Accidents related to moving parts of machinery Appreciation of principles of guarding Importance of regular maintenance



3. Transportation	14. Excavations
Transport to and from site Hazard connected with site transport Competent drivers Dumpers Tipping trucks Movement near excavations	Method of shoring Precautions while shoring Precautions at edge of excavations Removal of shoring Sheet steel piling
15. Working platforms, Ladders, and Scaffolding	16. Cranes and other Lifting Machines
Hazards connected with the use of ladders Maintenance and inspection Type of scaffold Overloading Work on roofs Fragile material Openings in walls and floors Use of safety belts and nets	Licensing, certification and training required for operation of cranes Slings methods Signaling Access to crane(s) Maintenance and examination Ground conditions Hazards and accident prevention methods connected with the use of different types of cranes/heavy equipment Crane Lift Plan for all lifts
17. Lifting Tackle	18. Fire Prevention and Control
Slings - single and multi-legged Safe working loads (SWLs) Safety hooks and eyebolts Cause of failure Maintenance and examination	Principle causes determining fire Understanding fire chemistry Fire fighting equipment Fire fighting training
19. Communications	
Effective methods of communication (particular interest to non-English speaking workers) Method and preparation of reports Safety committees Safety meeting	



JAIPUR METRO RAIL CORPORATION LTD.

General Instruction : JMRC/SHE/GI/007

SHE Training Matrix

Types of training	Management																				Supervisor										Specific																			
	SHE Orientation	SHE Leadership	SHE Plan	SHE Improvement Plan	Management of Change	SHE Audit & Inspection	SHE Emergency Response & Preparedness	Incident/Accident Investigation & Reporting	SHE Communication	SHE Promotion & Incentives	Traffic Management	Hazard Identification & Risk Analysis	Permit to work system	Confined space entry	scaffolding	Waste Management	Environment Monitoring	Labour welfare measures	Behavioral Based Safety Management (BBSM)	Job/Task Safety Analysis (USA)	Safety Training Observation Programme (STOP)	Industrial First Aid & CPR	Incident / Accident Investigation & Reporting	Fire fighting	Confined Space Testing & Certification	Scaffold Erection & Inspection	Rigging	Wire Rope Inspection	Crane Inspection	Electrical/Mechanical Isolation	Permit to Work System	Confined Space Working	Explosive Handling & Control	Heavy Lifting Operation	Radiography (X-Ray)	HAZMAT Handling & Control	Welding, Cutting & Bracing	Power Actuated Hand Tool	Electrical/Mechanical Isolation	Roofing Work	Steel erection work	Scaffold Erection/Dismantling	False-work Erection / Dismantling	Painting in Confined Area						
Project Manager	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•																										
Sr. Construction Managers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•					•																					
Quality Manager	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•																										
Planning engineer	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•																										
Construction Managers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•																										
Construction Supervisors	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•																										
Construction Foreman	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•																										
Machinery Operators	•	•									•																																							
Material Handlers	•	•					•				•	•			•								•																											
Station Building Workers	•																																																	
Steel workers	•	•					•						•		•																																			
Mechanical workers	•	•					•						•		•																																			
Other Civil workers	•						•						•		•																																			
Electrical workers	•	•					•						•		•																																			
Radiographers	•						•						•		•																																			
Transportation Drivers	•						•				•				•																																			
Security Officers	•	•					•	•			•	•			•																																			
Clerical Staff	•	•					•				•	•			•																																			
Medical Doctor	•	•	•				•	•			•				•				•																															
Sr. SHE Managers		•					•				•	•			•				•			•	•																											
Jr. SHE Managers		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
SHE Supervisors		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•



Safety, Health and Environment (SHE) Manual

DAYS TO BE OBSERVED FOR CREATING SHE AWARENESS

	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/008	

1 st Monday to Sunday of January	Road Safety Week (Subjected to confirmation from Ministry of Road Transport, Govt. of India every year.)
16 th February	Kyoto Protocol Day
March	Red Cross Month
May 1 to 7	Emergency Preparedness Week
4 th March	National Safety Day
7 th April	World Health Day
14 th April	Fire Safety Day
April 18 to 22	Earth Week
20 th April	Earth Day
20 th April	Noise Awareness Day
28 th April	ILO World Day for Safety and Health at Work Day
5 th June	World Environmental Day
12 th June	World Day against Child Labours
9 th July	Occupational Health Day
17 th October	World Trauma Day
1 st December	World AIDS Day



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/009	

Minimum Requirements of SHE Communication Posters / Signage / Video

- For the purpose of Minimum requirements of SHE Communication Posters / Signages / Video the contracts are categorized into the following groups:

Contract Value (Initial awarded value of contract)	Group
Upto 25 Cr	A
Upto 100 Cr	B
Upto 250 Cr	C
More than 250 Cr	D

- Every contractor falling into the above groups shall prepare a SHE Communication Plan as a part of site specific SHE Plan and shall include the following minimum requirement of Posters / Signages / Video as applicable. In case readymade posters are available in any of the category from National Safety Council, Loss Prevention Association of India or any other safety related organisations they may procure the same and display it. In case the same is not available then the contractors' shall make necessary arrangements to get the posters designed and printed on their own.

All the above are to be detailed in the Site SHE Plan and get an approval from the Employer before displaying the posters.

Table No.: 1 - Minimum No. of Posters

Sl.No	SHE Poster Title	Minimum No. of concepts in each title	No. of Posters / Signage / Video			
			Group A Contract	Group B Contract	Group C Contract	Group D Contract
1.	Safety Culture	5	Each 10	Each 50	Each 75	Each 100
2.	Daily Safety Oath	1 English & 1 Hindi	Each 100	Each 200	Each 500	Each 1000
3.	Mandatory PPE Usage					
a)	Signages to display the messages like PPE ZONE, NO PPE ZONE, HARD HAT AREA etc.	2 types of sizes made up of metal sheet to be mounted at different locations	Each 25	Each 50	Each 75	Each 200
b)	Helmet	5	Each 25	Each 50	Each 75	Each 200



Safety, Health and Environment (SHE) Manual

c)	Shoe	5	Each 25	Each 50	Each 75	Each 200
d)	Goggles & Ear Protection	5	Each 25	Each 50	Each 75	Each 200
e)	Full Body Harness	5	Each 25	Each 50	Each 75	Each 200
f)	Hi-Vi Jacket	5	Each 25	Each 50	Each 75	Each 200
4.	Emergency Management Plan	5	Each 25	Each 50	Each 75	Each 200
5.	Working at Heights	10	Each 25	Each 50	Each 75	Each 200
a)	Ladder, Stairway, Scaffold - Signages to display the messages like SAFE, UNSAFE, FIT FOR USE, AVOID USE etc.	5 types of sizes made up of metal sheet to be mounted at different locations	Each 25	Each 50	Each 75	Each 200
6.	Site Electricity	5	Each 25	Each 50	Each 75	Each 200
7.	Crane Safety	5	Each 25	Each 50	Each 75	Each 200
8.	Slings	5	Each 25	Each 50	Each 75	Each 200
9.	Rigging Procedures	5	Each 25	Each 50	Each 75	Each 200
10.	Excavation	5	Each 25	Each 50	Each 75	Each 200
11.	Occupational Health (Mosquito Control, HIV/AIDS awareness, Dust Control, Noise Control, No Smoking/Spitting, etc.)	10	Each 25	Each 50	Each 75	Each 200
12.	First – Aid	3	Each 25	Each 50	Each 75	Each 200
13.	Labour Welfare Measures (Payment of Minimum Wages, Avoidance of Child labour, Signing in the Muster Roll, In case of accidents-what to do? etc	5	Each 25	Each 50	Each 75	Each 200
14.	Importance of “Safety Handbook”	1	25	50	75	200
15.	Traffic Safety (Speed limit, safe crossing and working within barricaded area etc.)	5	Each 25	Each 50	Each 75	Each 200
16.	Environmental Monitoring (Spillage of Muck, hazardous material, Improper drainage, water spray for dust containment etc.)	5	Each 25	Each 50	Each 75	Each 200
17.	Video in Hindi on PPE usage – 15 minutes duration	1	-	-	-	1



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Note 1: Items mentioned under 17 is **video**. Items under 3 (a) and 5 (a) are **metal signage boards** and all other items are **posters**.

Table No.: 2 – Size of Posters / Signages

Sl.No	Item	Size
1.	Posters – Standard	17"x22" –135 GSM 4 Colour Printing
2.	Posters – Special (Wherever required)	17"x22" card laminated FA Poster
3.	Posters - Mega size (Wherever required)	32"x40" Flex FA Poster
4.	First-Aid Booklet	6"x4"
5.	Safety Handbook	6"x4"
6.	Signages	Small : 12"x6" Big : 24"x12"
7.	Road Traffic Sign Boards	Strictly as per Indian Road Congress (IRC) specifications

Table No.: 3 – Safety Signage Colour (as per IS 9457)

Sl.No	Type of signage	Colour
1	Mandatory	Blue
2	Danger	Yellow
3	Prohibitory	Red
4	Safe conditions	Green



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction : JMRC/SHE/GI/010	

Experts / Agencies for SHE Services

Sl. No.	Organisation	Services
1.	Bureau Veritas India Pvt. Ltd., B-21 & 22, First Floor, Sector-16, NOIDA-201 301 (U.P.) Phone: 0120 – 2515055, Fax: 0120 - 2515248 E-mail: enp.delhi@in.bureauveritas.com	<ul style="list-style-type: none"> • External SHE Audit • SHE Management / Technical Training
2.	Central Labour Institute Post box no: 17851 N.S.Monkikar Marg Sion , Mumbai- 400 022 Tel.: 022- 4092203, Fax: 022 – 4071986 E-mail: cli@dgfasli.nic.in	<ul style="list-style-type: none"> • SHE Management / Technical Training
3.	Construction Industry Development Council 801, 8 th Floor, Hemkunt Chambers, 89, Nehru Place,, New Delhi – 110 019	<ul style="list-style-type: none"> • SHE Management / Technical Training
4.	Delhi Productivity Council 1E/10, Swami Ramtirath Nagar New Delhi – 110 055 Tel.: 23522835	<ul style="list-style-type: none"> • SHE Management / Technical Training
5.	Det Norske Veritas AS, 203, Savitri Sadan 1, 11 Preet Vihar Community Centre, New Delhi-110 092 Phone: 011-2253 1502/2253/1503, 2242 7688/2253 1278 Fax: 011-2253 0247 Website: www.dnv.com	<ul style="list-style-type: none"> • External SHE Audit • SHE Management / Technical Training
6.	Dr. A. V. Baliga Memorial trust Link House Bagadur Shah Zafar Marg Press Area, New Delhi – 110 002 Phone: 011 – 23311119	<ul style="list-style-type: none"> • HIV / AIDS awareness



7.	DuPont Safety Resources, E.I. DuPont India Private Limited, Arihant Nitco Park 6 th Floor, 90, Dr. Radhakrishnan Salai, Mylapore, Chennai-600 004 Phone: 044-2847 2800, 2847 3752 Fax: 044-2847 3800 Mobile: 9381201040 Website: in.dupont.com	<ul style="list-style-type: none"> • SHE Management Training
8.	EQMS INDIA PVT. LTD. E-49, 1 st Floor, Dazzle House, Jawahar Park, Main Vikas Marg, Laxmi Nagar, Delhi-110 092 Phone: 91-11-220 17639/2204 4754 Fax: 91-91 2201 5150 E-mail: eqms@eqmsindia.org Website: www.eqmsindia.com	<ul style="list-style-type: none"> • ISO Certification • SHE Management / Technical Training
9.	Green Cross Consultants 59, 7 th Cross, 1 st Floor, Jai Bharath Nagar, Banglore-560 033 Phone: 080-2549 6782 E-mail: etgrangan@yahoo.com	<ul style="list-style-type: none"> • SHE Management / Technical Training
10.	HSRTC, PENTASAFE, 201, 2 nd Floor, Town Centre, Andheri Kurla Road, Marol, Andheri (East), Mumbai-400 059 Phone: 022-2850 2210/20/50 Fax: 022-2850 2260 E-mail: training@penta-safe.com Website: www.penta-safe.com	<ul style="list-style-type: none"> • SHE Practical Field Training for Height Safety
11.	Institute of Driving Training & Research, Wazirabad Road, Adjoining Loni Road flyover. New Delhi – 110 094 Phone: 011 – 22813474, 22815833 Fax: 011 - 22811131	<ul style="list-style-type: none"> • SHE Technical Training for Vehicle Drivers.
12.	Institute for Research, Development & Training of Construction Trades & Management, An Educational Institute, Society and Trust, 1 st Floor, UVCE Alumni Association Building, K.R. Circle, Banglore-560 001 Phone: 080-22294291/22243257 Fax: 080-22243257 E-mail: ubrco@vsnl.com Website: www.instructindia.org	<ul style="list-style-type: none"> • SHE Technical /Field Training



13.	International Engineering Company K – 10, South Extension, Part – 2, New Delhi – 110 049 Phone: 011 – 26254761, 26258130 Mobile: 9312260130 E-mail: ashok@intenco.net	<ul style="list-style-type: none"> • Crane and Lifting appliances and Gears Certification • SHE Practical Field Training for Crane Safety
14.	L & T Eutectic 32, Sivaji Marg New Delhi – 110 015 Phone: 011 - 51419538, 51419539 Fax: 011 - 51419600 Website: www.Inteutecticwelding.com	<ul style="list-style-type: none"> • SHE Practical Field Training for Welding Safety
15.	Loss Prevention Association of India Ltd. Warden House, Sir P.M. Road, Mumbai – 400 001 Website: www.lpaidia.org	<ul style="list-style-type: none"> • SHE Management / Technical Training
16.	MFA Crucial Moments Healthcare Pvt. Ltd., 42, Okhla Industrial Estate, Phase – II New Delhi – 110 020 Phone: 011 – 55624000 Fax: 011 – 55624010 E-mail: contact@crucialmoments.net	<ul style="list-style-type: none"> • First-aid Training
17.	Modicare Foundation 4 Community Centre, New Friends Colony, New Delhi – 110 065 Phone: 011 – 5167235059 Fax: 011 – 26915469 E-mail: nivedita@modi.com , nivedita@gmail.com Website: www.modicarefoundation.org	<ul style="list-style-type: none"> • HIV / AIDS awareness
18.	National Safety Council HQ and Institute Building 98A, Sector 15, industrial Area C.B.D Belapur, Navi Mumbai – 400614 Phone: 27579924	<ul style="list-style-type: none"> • SHE Management / Technical Training
19.	NICMAR (National Institute of Construction Management and Research) 910,9 th Floor, Hemkunt Chambers, 89, Nehru Place, New Delhi – 110 019 Phone: 011 – 51618415, 51618417, 51618418 Fax: 011 – 51618416	<ul style="list-style-type: none"> • SHE Management / Technical Training



20.	Quality Growth Services Pvt. Ltd. H-13, Kirti Nagar, New Delhi – 110 015 Fax: 011 – 25431737 / 25438598 / 25918332 E-mail: qgs@qgspl.com Website: www.qgspl.com	<ul style="list-style-type: none"> • ISO Certification
21.	Safety Engineers Association / Safety Educational Trust – India 2/257, First Floor, Dr. Ambedkar Nagar, Manapakkam, Chennai – 600 116 Phone: 044 – 22523461 E-mail: safetrustindia@rediffmail.com	<ul style="list-style-type: none"> • SHE Management / Technical Training
22.	SHE Management Consultancy & Support Services, 145 A, Pocket-VI, (DDA Flats), Kondli Gharoli, Mayur Vihar-II, Delhi-110 096 Fax: 011-2262 5015 Mobile: 9811153873 E-mail: r_k_p@vsnl.net	<ul style="list-style-type: none"> • SHE Management / Technical Training
23.	St. Johns' Ambulance Red Cross Road New Delhi – 110 001	<ul style="list-style-type: none"> • First-aid Training
24.	Vexil Business Process Services Pvt. Ltd. 208, A/4, Savitri Nagar, New Delhi – 110 017 Mobile: 9350232714, 98102832201, 9350232716 E-mail: info@vexilbps.com Website: www.vexilbps.com	<ul style="list-style-type: none"> • Emergency Preparedness Mock drill • SHE Management / Technical Training
25.	Welding Research Institute Bharat Heavy Electricals Ltd. (BHEL) Trichirappalli, Tamil Nadu – 620 014 Phone: 0431 – 2577029, 2577283 Fax: 0431 – 2520770 E-mail: wri@bheltry.co.in	<ul style="list-style-type: none"> • SHE Practical Field Training for Welding Safety
26.	Dr Cris Research Centre for Occupational Health & Safety 306, Guru Arjuna Dev Bhawan Ranjit Nagar Complex, New Delhi-08 Ph: 9810040406 Fax: 011-25702929 Email: team@drcri.com www.drcri.com	<ul style="list-style-type: none"> • Ambulance • Communication Material • First Aid Training • HIV/AIDS Awareness • ID Card • Medical Facilities • SHE training




	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction: JMRC/SHE/GI/011	

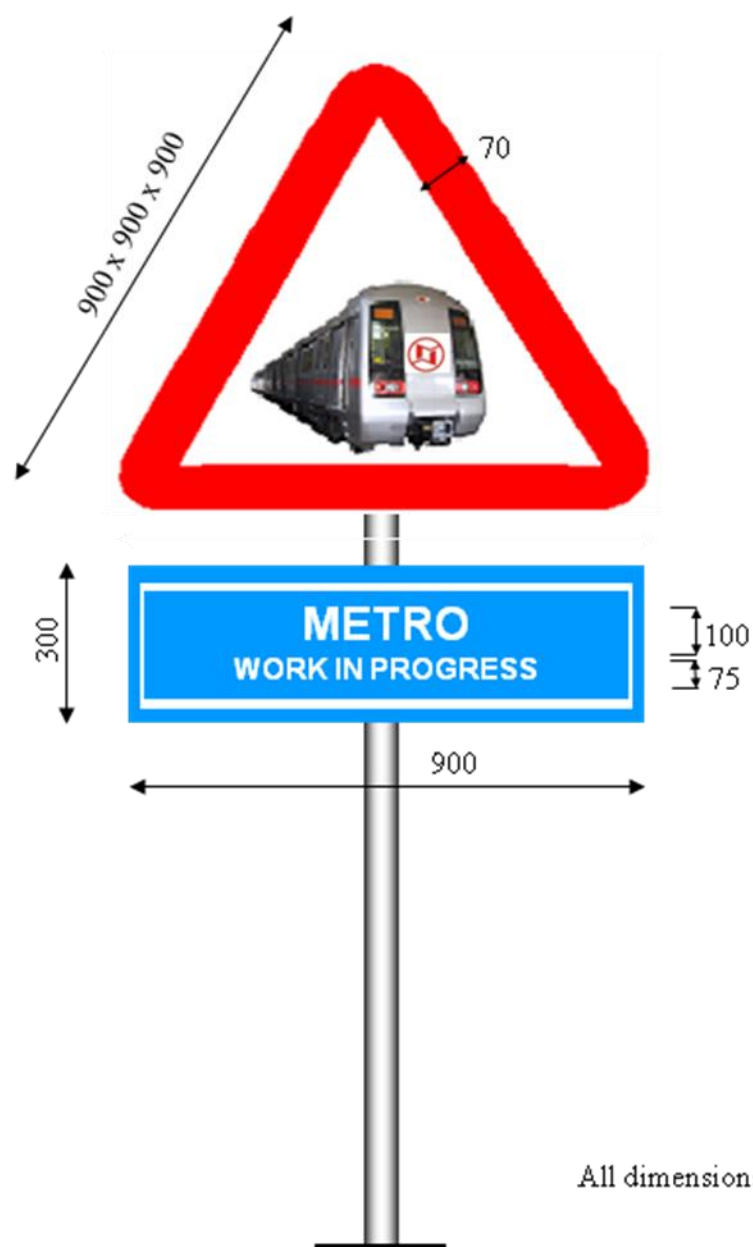
Minimum Lighting Requirements

S.N.	A. Facility or Function	Luminance – lx (lm/ft ²)
B. 1.	Administrative areas (offices, drafting and meeting rooms, etc.)	540 (50)
C. 2.	D. Construction areas <ul style="list-style-type: none"> - general indoor - general outdoor - tunnel and general underground work areas (minimum 110 lux required at tunnel and shaft heading during drilling, mucking and scaling) 	55 (5) 33 (3) 55 (5)
E. 3.	F. Access ways <ul style="list-style-type: none"> - exit ways, walkways, ladders, stairs 	110 (10)
4.	G. Maintenance / Operating areas / shops <ul style="list-style-type: none"> - vehicle maintenance shop - carpentry shop - outdoors field maintenance area - refueling area, outdoors - shops, fine details work - shops, medium detail work - welding shop 	325 (30) 110 (10) 55 (5) 55 (5) 540 (50) 325 (30) 325 (30)
5.	Mechanical/electrical equipment rooms	110 (10)
6.	Hoists, Elevators, freight and passenger	215 (20)
7.	H. Warehouses and storage rooms/area <ul style="list-style-type: none"> - indoor stockroom, active/bulk storage - indoor rack storage - outdoor storage 	110 (10) 270 (25) 33 (3)
8.	Health Centers and First aid stations and infirmaries	325 (30)
9.	Toilets, wash and dressing rooms	110 (10)
10.	Work areas – general (not listed above)	325 (30)
11.	Parking areas	33 (3)
12.	Visitor areas	215 (20)
13.	Laboratories	540 (50)



	JAIPUR METRO RAIL CORPORATION LTD.
General Instruction: JMRC/SHE/GI/012	

SIGNAGE





	JAIPUR METRO RAIL CORPORATION LTD.
FORM No. : SF/001	

FORMATION OF SITE SHE COMMITTEE	
Contract No	
Contractor Name	
Contract Title	

<u>CIRCULAR</u>	
<u>Committee</u> The following SHE Committee is constituted with immediate effect: Chairman: Members: 1) 2) 3) 4) 5) Secretary:	
<u>Periodicity</u> The committee will meet at least once in a month on the day (specify date)	
<u>Agenda</u> Secretary will circulate agenda of the meeting at least two days in advance of the schedule date of the meeting.	
<u>Circulation</u> Gist of the meeting will be minuted in the standard format and circulated to the following under the signature of the secretary 1. Chairman 2. Members 3. JMRC Representatives 5. Others concerned	
Date: CHAIRMAN	Signed By: -----



	JAIPUR METRO RAIL CORPORATION LTD.
FORM No. : SF/002	

MINUTES OF SHE COMMITTEE MEETING			
Contract No.			
Contractor Name			
Contract Title			
Meeting No.		Date of Meeting	
Location of Meeting			

MEMBERS PRESENT	INVITEES	MEMBERS ABSENT



Safety, Health and Environment (SHE) Manual

REPORT SENT TO					
No. of Copies	Name / Dept.	No. of Copies	Name / Dept.	No. of Copies	Name / Dept.
Prepared by: _____ Location: _____ Date: _____					

MINUTES OF SHE MEETING				
Item No.	Description of Discussion	Action By	Target	Remarks
1	Complaints received from Clients and corrective and preventive action			
2	Review of MOM of previous meeting			
3	NCR's / Observation from third party			
4	First - Aid cases / Reportable accident cases			
5	Future jobs and specific requirement			
6	Status of implementation of Safety plan			
7	Sub-contractor performance			



Safety, Health and Environment (SHE) Manual

8	Analysis of first-aid cases			
9	Need for any specific system / training / PPE's / resources			
10	Observation of SHE committee during last walk down			

Next SHE Meeting is scheduled on:

Date:	Chief SHE Manager (Signature & Name)
Date:	Project Manager (Signature & Name)



**Procurement of Plant
Design, Supply and Installation
JAIPUR METRO RAIL CORPORATION LIMITED
BIDDING DOCUMENT
for
Procurement
of
NCB No.-JP/EW/1B/E2**

DESIGN, DETAIL ENGINEERING, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 25 KV AC TRACTION (RIGID OHE), 33 KV AUXILIARY SUB STATIONS (ASS), ASSOCIATED CABLING AND SCADA SYSTEMS FOR UNDERGROUND CORRIDORS OF JAIPUR MASS RAPID TRANSPORT SYSTEM PROJECT PHASE-1B

PART-III CONDITIONS OF CONTRACT AND CONTRACT FORMS

Section 7 – General Conditions of Contract (GCC)

Section 8 – Special Conditions of Contract (SCC)

Section 9 – Contract Forms (COF)

JAIPUR METRO RAIL CORPORATION LTD.

**Khanij Bhawan, Tilak Marg,
C- Scheme, Jaipur (Rajasthan) PIN-302005
Country: India**

Section 7 - General Conditions of Contract

These General Conditions of Contract (GCC) are based on the Model Form of International Contract for Process Plant Construction published by the Engineering Advancement Association of Japan (ENAA). The Multilateral Development Banks (MDBs) participating in the procurement harmonization process gratefully acknowledge the contribution of ENAA to the advancement of good contracting practices by its borrowers. The GCC contain general clauses to be applied on all contracts. The GCC in this section, read in conjunction with the Special Conditions of Contract in Section 8 and other documents listed therein, should be a complete document expressing all the rights and obligations of the contracting parties. The General Conditions herein shall not be altered.

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General Conditions of Contract

A. Contract and Interpretation

1. Definitions

1.1 The following words and expressions shall have the meanings hereby assigned them:

“Contract” means the Contract Agreement entered into between the Employer and the Contractor, together with the Contract Documents referred to therein; they shall constitute the Contract, and the term “the Contract” shall in all such documents be construed accordingly.

“Contract Documents” means the documents listed in Article 1.1 (Contract Documents) of the Contract Agreement (including any amendments thereto).

“GCC” means the General Conditions of Contract.

“SCC” means the Special Conditions of Contract.

“day” means calendar day.

“year” means 365 days.

“month” means calendar month.

“Party” means the Employer or the Contractor, as the context requires.

“Employer” means the person named as such in the SCC and includes the legal successors or permitted assigns of the Employer.

“Project Manager” means the person appointed by the Employer in the manner provided in GCC Subclause 17.1 (Project Manager) hereof and named as such in the SCC to perform the duties delegated by the Employer.

“Contractor” means the person(s) named as Contractor in the Contract Agreement, and includes the legal successors or permitted assigns of the Contractor.

“Contractor’s Representative” means any person nominated by the Contractor and approved by the Employer in the manner provided in GCC Subclause 17.2 (Contractor’s Representative and Construction Manager) hereof to perform the duties delegated by the Contractor.

“Construction Manager” means the person appointed by the Contractor’s Representative in the manner provided in GCC Subclause 17.2.4.

“Subcontractor,” including manufacturers, means any person to whom execution of any part of the Facilities, including preparation of any design or supply of any Plant, is sub-contracted directly or indirectly by the Contractor, and includes its legal successors or permitted assigns.

“Dispute Board” means the person or persons named as such in the SCC appointed by agreement between the Employer and the Contractor to make a decision on or to settle any dispute or difference between the Employer and the Contractor referred to him or her by the parties pursuant to GCC Subclause 45.1 (Dispute Board) hereof.

“The Bank” means the financing institution named in the SCC.

“Contract Price” means the sum specified in Article 2.1 (Contract Price) of the Contract Agreement, subject to such additions and adjustments thereto or deductions therefrom, as may be made pursuant to the Contract.

“Facilities” means the Plant to be supplied and installed, as well as all the Installation Services to be carried out by the Contractor under the Contract.

“Plant” means permanent plant, equipment, machinery, apparatus, articles and things of all kinds to be provided and incorporated in the Facilities by the Contractor under the Contract (including the spare parts to be supplied by the Contractor under GCC Subclause 7.3 hereof), but does not include Contractor’s Equipment.

“Installation Services” means all those services ancillary to the supply of the Plant for the Facilities, to be provided by the Contractor under the Contract, such as transportation and provision of marine or other similar insurance, inspection, expediting, site preparation works (including the provision and use of Contractor’s Equipment and the supply of all construction materials required), installation, testing, precommissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc. as the case may require.

“Contractor’s Equipment” means all facilities, equipment, machinery, tools, apparatus, appliances, or things of every kind required in or for installation, completion and maintenance of Facilities that are to be provided by the Contractor, but does not include Plant, or other things intended to form or forming part of the Facilities.

“Country of Origin” means the countries and territories eligible under the rules of the Bank as further elaborated in the SCC.

“Site” means the land and other places upon which the Facilities are to be installed, and such other land or places as may be specified in the Contract as forming part of the Site.

“Effective Date” means the date of fulfillment of all conditions stated in Article 3 (Effective Date) of the Contract Agreement, upon which the period until the Time for Completion shall be counted from.

“Time for Completion” means the time within which Completion of the Facilities as a whole (or of a part of the Facilities where a separate Time for Completion of such part has been prescribed) is to be attained, as referred to in GCC Clause 8 and in accordance with the relevant provisions of the Contract.

“Completion” means that the Facilities (or a specific part thereof where specific parts are specified in the Contract) have been completed operationally and structurally and put in a tight and clean condition, that all work in respect of Precommissioning of the Facilities or such specific part thereof has been completed, and that the Facilities or specific part thereof are ready for Commissioning as provided in GCC Clause 24 (Completion) hereof.

“Precommissioning” means the testing, checking and other requirements specified in the Employer’s Requirements that are to be carried out by the Contractor in preparation for Commissioning as provided in GCC Clause 24 (Completion) hereof.

“Commissioning” means operation of the Facilities or any part thereof by the Contractor following Completion, which operation is to be carried out by the Contractor as provided in GCC Subclause 25.1 (Commissioning) hereof, for the purpose of carrying out Guarantee Test(s).

“Guarantee Test(s)” means the test(s) specified in the Employer’s Requirements to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees specified in the Appendix (Functional Guarantees) to the Contract Agreement in accordance with the provisions of GCC Subclause 25.2 (Guarantee Test) hereof.

“Operational Acceptance” means the acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor’s fulfillment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions of GCC Clause 28 (Functional Guarantees) hereof and shall include deemed acceptance in accordance with GCC Clause 25 (Commissioning and Operational Acceptance) hereof.

“Defect Liability Period” means the period of validity of the warranties given by the Contractor commencing at Completion of the Facilities or a part thereof, during which the Contractor is responsible for defects with respect to the Facilities (or the relevant part thereof) as provided in GCC Clause 27 (Defect Liability) hereof.

- | | |
|------------------------------|--|
| 2. Contract Documents | 2.1 Subject to Article 1.2 (Order of Precedence) of the Contract Agreement, all documents forming part of the Contract (and all parts thereof) are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole. |
| 3. Interpretation | 3.1 In the Contract, except where the context requires otherwise, <ul style="list-style-type: none"> (a) words indicating one gender include all genders; (b) words indicating the singular also include the plural and words indicating the plural also include the singular; (c) provisions including the word “agree,” “agreed,” or “agreement” require the agreement to be record in writing; |

- (d) the word “tender” is synonymous with “bid,” “tenderer” with “Bidder,” and “tender documents” with “Bidding Documents;” and
- (e) “written” or “in writing” means handwritten, typewritten, printed or electronically made, and resulting in a permanent record.

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

3.2 Incoterms

Unless inconsistent with any provision of the Contract, the meaning of any trade term and the rights and obligations of parties thereunder shall be as prescribed by Incoterms.

“Incoterms” means international rules for interpreting trade terms published by the International Chamber of Commerce (latest edition), 38 Cours Albert 1^{er}, 75008 Paris, France.

3.3 Entire Agreement

Subject to GCC Subclause 16.4 hereof, the Contract constitutes the entire agreement between the Employer and Contractor with respect to the subject matter of Contract and supersedes all communications, negotiations, and agreements (whether written or oral) of parties with respect thereto made prior to the date of Contract.

3.4 Amendment

No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party hereto.

3.5 Independent Contractor

The Contractor shall be an independent contractor performing the Contract. The Contract does not create any agency, partnership, joint venture, or other joint relationship between the parties hereto. Subject to the provisions of the Contract, the Contractor shall be solely responsible for the manner in which the Contract is performed. All employees, representatives, or Subcontractors engaged by the Contractor in connection with the performance of the Contract shall be under the complete control of the Contractor and shall not be deemed to be employees of the Employer, and nothing contained in the Contract or in any subcontract awarded by the Contractor shall be construed to create any contractual relationship between any such employees, representatives, or Subcontractors and the Employer.

3.6 Non-Waiver

3.6.1 Subject to GCC Subclause 3.6.2 below, no relaxation, forbearance, delay, or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect, or restrict the rights of that party under the Contract, nor shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

3.6.2 Any waiver of a party’s rights, powers, or remedies under the

Contract must be in writing, must be dated, and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.

3.7 Severability

If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity, or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

3.8 Country of Origin

"Origin" means the place where the plant and component parts thereof are mined, grown, produced, or manufactured, and from which the services are provided. Plant components are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that is substantially in its basic characteristics or in purpose or utility from its components.

4. Communications

4.1 Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests, and discharges, these communications shall be

- (a) in writing and delivered against receipt; and
- (b) delivered, sent, or transmitted to the address for the recipient's communications as stated in the Contract Agreement.

When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Project Manager, a copy shall be sent to the Project Manager or the other Party, as the case may be.

5. Law and Language

5.1 The Contract shall be governed by and interpreted in accordance with laws of the country specified in the SCC.

5.2 The ruling language of the Contract shall be that stated in the SCC.

5.3 The language for communications shall be the ruling language unless otherwise stated in the SCC.

6. Fraud and Corruption

6.1 ADB's Anticorruption Policy requires Borrowers (including beneficiaries of ADB-financed activity), as well as Bidders, Suppliers, and Contractors under ADB-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, ADB

- (a) defines, for the purposes of this provision, the terms set forth below as follows:
 - (i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;
 - (ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party

to obtain a financial or other benefit or to avoid an obligation;

- (iii) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
 - (iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party;
 - (v) "obstructive practice" means (a) deliberately destroying, falsifying, altering, or concealing of evidence material to an ADB investigation; (b) making false statements to investigators in order to materially impede an ADB investigation; (c) failing to comply with requests to provide information, documents, or records in connection with an Office of Anticorruption and Integrity (OAI) investigation; (d) threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or (e) materially impeding ADB's contractual rights of audit or access to information; and
 - (vi) "integrity violation" is any act which violates ADB's Anticorruption Policy, including (i) to (v) above and the following: abuse, conflict of interest, violations of ADB sanctions, retaliation against whistleblowers or witnesses, and other violations of ADB's Anticorruption Policy, including failure to adhere to the highest ethical standard.
- (b) will reject a proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the Contract;
 - (c) will cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the Borrower or of a beneficiary of ADB-financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations during the procurement or the execution of that contract, without the Borrower having taken timely and appropriate action satisfactory to ADB to remedy the situation;
 - (d) will impose remedial actions on a firm or an individual, at any time, in accordance with ADB's Anticorruption Policy and Integrity Principles and Guidelines (both as amended from time to time), including declaring ineligible, either indefinitely or for a

stated period of time, to participate¹ in ADB-financed, administered, or supported activities or to benefit from an ADB-financed, administered, or supported contract, financially or otherwise, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations; and

- (e) will have the right to require suppliers and contractors to permit ADB or its representative to inspect their accounts and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by ADB.

B. Subject Matter of Contract

7. Scope of Facilities

- 7.1 Unless otherwise expressly limited in the Employer's Requirements, the Contractor's obligations cover the provision of all Plant and the performance of all Installation Services required for the design, the manufacture (including procurement, quality assurance, construction, installation, associated civil works, pre-commissioning and delivery) of the Plant and the installation, completion, and commissioning of the Facilities in accordance with the plans, procedures, specifications, drawings, codes, and any other documents as specified in the section Employer's Requirements. Such specifications include, but are not limited to, the provision of supervision and engineering services; the supply of labour, materials, equipment, spare parts (as specified in GCC Subclause 7.3 below) and accessories; Contractor's Equipment; construction utilities and supplies; temporary materials, structures, and facilities; transportation (including, without limitation, unloading and hauling to, from and at the Site); and storage, except for those supplies, works, and services that will be provided or performed by the Employer, as set forth in the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement.
- 7.2 The Contractor shall, unless specifically excluded in the Contract, perform all such work and/or supply all such items and materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining Completion of the Facilities as if such work and/or items and materials were expressly mentioned in the Contract.
- 7.3 In addition to the supply of Mandatory Spare Parts included in the Contract, the Contractor agrees to supply spare parts required for the operation and maintenance of the Facilities for the period specified in the SCC and the provisions, if any, specified in the SCC. However, the identity, specifications, and quantities of such spare parts and the terms and conditions relating to the supply thereof are to be agreed between the Employer and the Contractor, and the price of such spare parts shall be that given in Price Schedule No. 6, which shall be added

¹ Whether as a Contractor, Subcontractor, Consultant, Manufacturer or Supplier, or Service Provider; or in any other capacity (different names are used depending on the particular Bidding Document).

to the Contract Price. The price of such spare parts shall include the purchase price therefore and other costs and expenses (including the Contractor's fees) relating to the supply of spare parts.

8. Time for Commencement and Completion

- 8.1 The Contractor shall commence work on the Facilities within the period specified in the SCC and without prejudice to GCC Subclause 26.2 hereof, the Contractor shall thereafter proceed with the Facilities in accordance with the time schedule specified in the Appendix 4 (Time Schedule) to the Contract Agreement.
- 8.2 The Contractor shall attain Completion of the Facilities or of a part where a separate time for Completion of such part is specified in the Contract, within the time stated in the SCC or within such extended time to which the Contractor shall be entitled under GCC Clause 40 hereof.

9. Contractor's Responsibilities

- 9.1 The Contractor shall design, manufacture, including associated purchases and/or subcontracting, install, and complete the Facilities in accordance with the Contract. When completed, the Facilities should be fit for the purposes for which they are intended as defined in the Contract.
- 9.2 The Contractor confirms that it has entered into this Contract on the basis of a proper examination of the data relating to the Facilities, including any data as to boring tests provided by the Employer, and on the basis of information that the Contractor could have obtained from a visual inspection of the Site if access thereto was available and of other data readily available to it relating to the Facilities as of the date 28 days prior to bid submission. The Contractor acknowledges that any failure to acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Facilities.
- 9.3 The Contractor shall acquire and pay for all permits, approvals, and/or licenses from all local, state, or national government authorities or public service undertakings in the country where the Site is located, which such authorities or undertakings require the Contractor to obtain in its name and which are necessary for the performance of the Contract, including, without limitation, visas for the Contractor's and Subcontractor's personnel and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals, and/or licenses that are not the responsibility of the Employer under GCC Subclause 10.3 hereof and that are necessary for the performance of the Contract.
- 9.4 The Contractor shall comply with all laws in force in the country where the Facilities are to be implemented. The laws will include all local, state, national, or other laws that affect the performance of the Contract and bind upon the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any and all liabilities, damages, claims, fines, penalties, and expenses of whatever nature arising or resulting from the violation of such laws by the Contractor or its personnel, including the Subcontractors and their personnel, but without prejudice to GCC Subclause 10.1 hereof.
- 9.5 Any plant and services that will be incorporated in or be required for the Facilities and other supplies shall have their origin as specified under GCC Clause 1 (Country of Origin). Any Subcontractors retained

by the Contractor shall be from a country as specified in GCC Clause 1 (Country of Origin).

9.6 The Contractor shall permit ADB to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by ADB, if so required by ADB.

9.7 If the Contractor is a joint venture or consortium of two or more persons, all such persons shall be jointly and severally bound to the Employer for the fulfillment of the provisions of the Contract and shall designate one of such persons to act as a leader with authority to bind the joint venture or consortium. The composition or the constitution of the joint venture or consortium shall not be altered without the prior consent of the Employer.

9.8 Protection of the Environment

(a) The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise, and other results of his operations.

(b) The Contractor shall ensure that emissions, surface discharges, and effluent from the Contractor's activities shall not exceed the values stated in the Specification or prescribed by applicable Laws.

10. Employer's Responsibilities

10.1 All information and/or data to be supplied by the Employer as described in the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement shall be deemed to be accurate, except when the Employer expressly states otherwise.

10.2 The Employer shall be responsible for acquiring and providing legal and physical possession of the Site and access thereto, and for providing possession of and access to all other areas reasonably required for the proper execution of the Contract, including all requisite rights of way, as specified in the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement. The Employer shall give full possession of and accord all rights of access thereto on or before the date(s) specified in that Appendix.

10.3 The Employer shall acquire and pay for all permits, approvals, and/or licenses from all local, state, or national government authorities, or public service undertakings in the country where the Site is located which (a) such authorities or undertakings require the Employer to obtain in the Employer's name, (b) are necessary for the execution of the Contract, including those required for the performance by both the Contractor and the Employer of their respective obligations under the Contract, and (c) are specified in the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement.

10.4 If requested by the Contractor, the Employer shall use its best endeavors to assist the Contractor in obtaining in a timely and expeditious manner all permits, approvals, and/or licenses necessary

for the execution of the Contract from all local, state, or national government authorities, or public service undertakings that such authorities or undertakings require the Contractor or Subcontractors or the personnel of the Contractor or Subcontractors, as the case may be, to obtain.

- 10.5 Unless otherwise specified in the Contract or agreed upon by the Employer and the Contractor, the Employer shall provide sufficient, properly qualified operating and maintenance personnel; shall supply and make available all raw materials, utilities, lubricants, chemicals, catalysts, other materials and facilities; and shall perform all work and services of whatsoever nature, including those required by the Contractor to properly carry out Pre-commissioning, Commissioning, and Guarantee Tests, all in accordance with the provisions of the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement at or before the time specified in the program furnished by the Contractor under GCC Subclause 18.2 hereof and in the manner thereupon specified or as otherwise agreed upon by the Employer and the Contractor.
- 10.6 The Employer shall be responsible for the continued operation of the Facilities after Completion, in accordance with GCC Subclause 24.8, and shall be responsible for facilitating the Guarantee Test(s) for the Facilities, in accordance with GCC Subclause 25.2.
- 10.7 All costs and expenses involved in the performance of the obligations under this GCC Clause 10 shall be the responsibility of the Employer, except those incurred by the Contractor with respect to the performance of Guarantee Tests, in accordance with GCC Subclause 25.2.
- 10.8 In the event that the Employer shall be in breach of any of his obligations imposed by the Contract, then the additional cost reasonably incurred by the Contractor in consequence thereof shall be added to the Contract Price.

C. Payment

11. Contract Price

- 11.1 The Contract Price shall be as specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement.
- 11.2 Unless an adjustment clause is provided for in the SCC, the Contract Price shall be a firm lump sum not subject to any alteration, except in the event of a Change in the Facilities or as otherwise provided in the Contract.
- 11.3 Subject to GCC Subclauses 9.2, 10.1, and 35 hereof, the Contractor shall be deemed to have satisfied itself as to the correctness and sufficiency of the Contract Price, which shall, except as otherwise provided for in the Contract, cover all its obligations under the Contract.

12. Terms of Payment

- 12.1 The Contract Price shall be paid as specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement and in the Appendix (Terms and Procedures of Payment) to the Contract

Agreement, which also outlines the procedures to be followed in making application for and processing payments.

- 12.2 No payment made by the Employer herein shall be deemed to constitute acceptance by the Employer of the Facilities or any part(s) thereof.
- 12.3 In the event that the Employer fails to make any payment by its respective due date or within the period set forth in the Contract, the Employer shall pay to the Contractor interest on the amount of such delayed payment at the rate(s) shown in the Appendix (Terms and Procedures of Payment) to the Contract Agreement for the period of delay until payment has been made in full, whether before or after judgment or arbitration award.
- 12.4 The currency or currencies in which payments are made to the Contractor under this Contract shall be specified in the Appendix (Terms and Procedures of Payment) to the Contract Agreement, subject to the general principle that payments will be made in the currency or currencies in which the Contract Price has been stated in the Contractor's bid.

13. Securities

13.1 Issuance of Securities

The Contractor shall provide the securities specified below in favor of the Employer at the times, and in the amount, manner, and form specified below.

13.2 Advance Payment Security

13.2.1 The Contractor shall, within 28 days of the notification of contract award, provide a security in an amount equal to the advance payment calculated in accordance with the Appendix (Terms and Procedures of Payment) to the Contract Agreement, and in the same currency or currencies.

13.2.2 The security shall be in the form provided in the Bidding Documents or in another form acceptable to the Employer. The amount of the security shall be reduced in proportion to the value of the Facilities executed by and paid to the Contractor from time to time, and shall automatically become null and void when the full amount of the advance payment has been recovered by the Employer. The security shall be returned to the Contractor immediately after its expiration.

13.3 Performance Security

13.3.1 The Contractor shall, within 28 days of the notification of contract award, provide a security for the due performance of the Contract in the amount specified in the SCC.

13.3.2 The security shall be denominated in the currency or currencies of the Contract, or in a freely convertible currency acceptable to the Employer, and shall be in one of the forms of bank guarantees provided in the Bidding Documents, as stipulated by the Employer in the SCC, or in another form acceptable to the Employer.

13.3.3 Unless otherwise specified in the SCC, the security shall be reduced by half on the date of the Operational Acceptance. The Security shall become null and void, or shall be reduced

pro rata to the Contract Price of a part of the Facilities for which a separate Time for Completion is provided, 540 days after Completion of the Facilities or 365 days after Operational Acceptance of the Facilities, whichever occurs first; provided, however, that if the Defects Liability Period has been extended on any part of the Facilities pursuant to GCC Subclause 27.8 hereof, the Contractor shall issue an additional security in an amount proportionate to the Contract Price of that part. The security shall be returned to the Contractor immediately after its expiration, provided, however, that if the Contractor, pursuant to GCC Subclause 27.10, is liable for an extended defect liability obligation, the performance security shall be extended for the period and up to the amount specified in the SCC.

14. Taxes and Duties

- 14.1 Except as otherwise specifically provided in the Contract, the Contractor shall bear and pay all taxes, duties, levies, and charges assessed on the Contractor, its Subcontractors, or their employees by all municipal, state, or national government authorities in connection with the Facilities in and outside of the country where the Site is located.
- 14.2 Notwithstanding GCC Subclause 14.1 above, the Employer shall bear and promptly pay all customs and import duties as well as other local taxes like, e.g., a value-added tax (VAT), imposed by the law of the country where the Site is located on the Plant specified in Price Schedule No. 1 and that are to be incorporated into the Facilities.
- 14.3 If any tax exemptions, reductions, allowances, or privileges may be available to the Contractor in the country where the Site is located, the Employer shall use its best endeavors to enable the Contractor to benefit from any such tax savings to the maximum allowable extent.
- 14.4 For the purpose of the Contract, it is agreed that the Contract Price specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement is based on the taxes, duties, levies, and charges prevailing at the date 28 days prior to the date of bid submission in the country where the Site is located (hereinafter called "Tax" in this GCC Subclause 14.4). If any rates of Tax are increased or decreased, a new Tax is introduced, an existing Tax is abolished, or any change in interpretation or application of any Tax occurs in the course of the performance of Contract, which was or will be assessed on the Contractor, Subcontractors, or their employees in connection with performance of the Contract, an equitable adjustment of the Contract Price shall be made to fully take into account any such change by addition to the Contract Price or deduction therefrom, as the case may be, in accordance with GCC Clause 36 hereof.

D. Intellectual Property

15. License/Use of Technical Information

- 15.1 For the operation and maintenance of the Plant, the Contractor hereby grants a non-exclusive and nontransferable license (without the right to sublicense) to the Employer under the patents, utility models, or other industrial property rights owned by the Contractor or by a third

party from whom the Contractor has received the right to grant licenses thereunder, and shall also grant to the Employer a nonexclusive and nontransferable right (without the right to sublicense) to use the know-how and other technical information disclosed to the Employer under the Contract. Nothing contained herein shall be construed as transferring ownership of any patent, utility model, trademark, design, copyright, know-how, or other intellectual property right from the Contractor or any third party to the Employer.

- 15.2 The copyright in all drawings, documents, and other materials containing data and information furnished to the Employer by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the Employer directly or through the Contractor by any third party, including suppliers of materials, the copyright in such materials shall remain vested in such third party.

16. Confidential Information

- 16.1 The Employer and the Contractor shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during, or following termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data, and other information it receives from the Employer to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this GCC Clause 16.
- 16.2 The Employer shall not use such documents, data, and other information received from the Contractor for any purpose other than the operation and maintenance of the Facilities. Similarly, the Contractor shall not use such documents, data, and other information received from the Employer for any purpose other than the design, procurement of Plant, construction, or such other work and services as are required for the performance of the Contract.
- 16.3 The obligation of a party under GCC Subclauses 16.1 and 16.2 above, however, shall not apply to that information, which
- (a) now or hereafter enters the public domain through no fault of that party;
 - (b) can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party hereto; and
 - (c) otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.
- 16.4 The above provisions of this GCC Clause 16 shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Facilities or any part thereof.

- 16.5 The provisions of this GCC Clause 16 shall survive termination, for whatever reason, of the Contract.

E. Execution of the Facilities

17. Representatives 17.1 Project Manager

If the Project Manager is not named in the Contract, then within 14 days of the Effective Date, the Employer shall appoint and notify the Contractor in writing of the name of the Project Manager. The Employer may from time to time appoint some other person as the Project Manager in place of the person previously so appointed, and shall give notice of the name of such other person to the Contractor without delay. No such appointment shall be made at such a time or in such a manner as to impede the progress of work on the Facilities. Such appointment shall only take effect upon receipt of such notice by the Contractor. The Project Manager shall represent and act for the Employer at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals, and all other communications under the Contract shall be given by the Project Manager, except as herein otherwise provided.

All notices, instructions, information, and other communications given by the Contractor to the Employer under the Contract shall be given to the Project Manager, except as herein otherwise provided.

17.2 Contractor's Representative and Construction Manager

17.2.1 If the Contractor's Representative is not named in the Contract, then within 14 days of the Effective Date, the Contractor shall appoint the Contractor's Representative and shall request the Employer in writing to approve the person so appointed. If the Employer makes no objection to the appointment within 14 days, the Contractor's Representative shall be deemed to have been approved. If the Employer objects to the appointment within 14 days giving the reason therefor, then the Contractor shall appoint a replacement within 14 days of such objection, and the foregoing provisions of this GCC Subclause 17.2.1 shall apply thereto.

17.2.2 The Contractor's Representative shall represent and act for the Contractor at all times during the performance of the Contract and shall give to the Project Manager all the Contractor's notices, instructions, information, and all other communications under the Contract.

All notices, instructions, information, and all other communications given by the Employer or the Project Manager to the Contractor under the Contract shall be given to the Contractor's Representative or, in its absence, its deputy, except as herein otherwise provided.

The Contractor shall not revoke the appointment of the Contractor's Representative without the Employer's prior written consent, which shall not be unreasonably withheld. If the Employer consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the

procedure set out in GCC Subclause 17.2.1.

17.2.3 The Contractor's Representative may, subject to the approval of the Employer which shall not be unreasonably withheld, at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's Representative, and shall specify the powers, functions, and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to the Employer and the Project Manager.

Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with this GCC Subclause 17.2.3 shall be deemed to be an act or exercise by the Contractor's Representative.

17.2.4 From the commencement of installation of the Facilities at the Site until Completion, the Contractor's Representative shall appoint a suitable person as the Construction Manager. The Construction Manager shall supervise all work done at the Site by the Contractor and shall be present at the Site throughout normal working hours except when on leave, sick, or absent for reasons connected with the proper performance of the Contract. Whenever the Construction Manager is absent from the Site, the Contractor's Representative or the Construction Manager shall appoint a suitable person to act as the Construction Manager's deputy.

17.2.5 The Employer may by notice to the Contractor object to any representative or person employed by the Contractor in the execution of the Contract who, in the reasonable opinion of the Employer, may behave inappropriately, may be incompetent or negligent, or may commit a serious breach of the Site regulations provided under GCC Subclause 22.4. The Employer shall provide evidence of the same, whereupon the Contractor shall remove such person from the Facilities.

17.2.6 If any representative or person employed by the Contractor is removed in accordance with GCC Subclause 17.2.5, the Contractor shall, where required, promptly appoint a replacement.

18. Work Program

18.1 Contractor's Organization

The Contractor shall supply to the Employer and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities within 21 days of the Effective Date. The chart shall include the identities of the key personnel, and the curricula vitae of such key personnel to be employed shall be supplied together with the chart. The Contractor shall promptly inform the Employer and the Project Manager in writing of any revision or alteration of such an organization chart.

18.2 Program of Performance

Within 28 days after the Effective Date, the Contractor shall submit to the Project Manager a detailed program of performance of the Contract, made in a form acceptable to the Project Manager and showing the sequence in which it proposes to design, manufacture,

transport, assemble, install, and pre-commission the Facilities, as well as the date by which the Contractor reasonably requires that the Employer shall have fulfilled its obligations under the Contract so as to enable the Contractor to execute the Contract in accordance with the program and to achieve Completion, Commissioning, and Acceptance of the Facilities in accordance with the Contract. The program so submitted by the Contractor shall accord with the Time Schedule included in the Appendix (Time Schedule) to the Contract Agreement and any other dates and periods specified in the Contract. The Contractor shall update and revise the program as and when appropriate or when required by the Project Manager, but without modification in the Times for Completion given in the SCC and any extension granted in accordance with GCC Clause 40, and shall submit all such revisions to the Project Manager.

18.3 Progress Report

The Contractor shall monitor progress of all the activities specified in the program referred to in GCC Subclause 18.2 above, and supply a progress report to the Project Manager every month.

The progress report shall be in a form acceptable to the Project Manager and shall indicate: (a) percentage completion achieved compared with the planned percentage completion for each activity; and (b) where any activity is behind the program, giving comments and likely consequences and stating the corrective action being taken.

18.4 Progress of Performance

If at any time the Contractor's actual progress falls behind the program referred to in GCC Subclause 18.2, or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Employer or the Project Manager, prepare and submit to the Project Manager a revised program, taking into account the prevailing circumstances, and shall notify the Project Manager of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion under GCC Subclause 8.2, any extension thereof entitled under GCC Subclause 40.1, or any extended period as may otherwise be agreed upon between the Employer and the Contractor.

18.5 Procedures

The Contract shall be executed in accordance with the Contract Documents including the procedures given in the Forms and Procedures of the Employer's Requirements.

The Contractor may execute the Contract in accordance with its own standard project execution plans and procedures to the extent that they do not conflict with the provisions contained in the Contract.

19.Subcontracting

- 19.1 The Appendix 5 (List of Major Items of Plant and Services and List of Approved Subcontractors) to the Contract Agreement specifies major items of plant and services and a list of approved Subcontractors against each item, including manufacturers. Insofar as no Subcontractors are listed against any such item, the Contractor shall prepare a list of Subcontractors for such item for inclusion in such list. The Contractor may from time to time propose any addition to or deletion from any such list. The Contractor shall submit any such list or any modification thereto to the Employer for its approval in sufficient

time so as not to impede the progress of work on the Facilities. Such approval by the Employer for any of the Subcontractors shall not relieve the Contractor from any of its obligations, duties, or responsibilities under the Contract.

- 19.2 The Contractor shall select and employ its Subcontractors for such major items from those listed in the lists referred to in GCC Subclause 19.1.
- 19.3 For items or parts of the Facilities not specified in the Appendix (List of Major Items of Plant and Services and List of Approved Subcontractors for Major Items) to the Contract Agreement, the Contractor may employ such Subcontractors as it may select, at its discretion.
- 19.4 Each subcontract shall include provisions which would entitle the Employer to require the sub-contract to be assigned to the Employer under GCC 19.5 (if and when applicable), or in event of termination by the Employer under GCC 42.2.
- 19.5 If a Sub-contractor's obligations extend beyond the expiry date of the relevant Defects Liability Period and the Project Manager, prior to that date, instructs the Contractor to assign the benefits of such obligations to the Employer, then the Contractor shall do so.

20. Design and Engineering

20.1 Specifications and Drawings

20.1.1 The Contractor shall execute the basic and detailed design and the engineering work in compliance with the provisions of the Contract, or where not so specified, in accordance with good engineering practice.

The Contractor shall be responsible for any discrepancies, errors, or omissions in the specifications, drawings, and other technical documents that it has prepared, whether such specifications, drawings, and other documents have been approved by the Project Manager or not, provided that such discrepancies, errors, or omissions are not because of inaccurate information furnished in writing to the Contractor by or on behalf of the Employer.

20.1.2 The Contractor shall be entitled to disclaim responsibility for any design, data, drawing, specification, or other document, or any modification thereof provided or designated by or on behalf of the Employer, by giving a notice of such disclaimer to the Project Manager.

20.2 Codes and Standards

Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date 28 days prior to date of bid submission shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied subject to approval by the Employer and shall be treated in accordance with GCC Clause 39.

20.3 Approval/Review of Technical Documents by Project Manager

20.3.1 The Contractor shall prepare or cause its Subcontractors to prepare, and furnish to the Project Manager the documents listed in the Appendix (List of Documents for Approval or Review) to the Contract Agreement for its approval or review as

specified and in accordance with the requirements of GCC Subclause 18.2 (Program of Performance).

Any part of the Facilities covered by or related to the documents to be approved by the Project Manager shall be executed only after the Project Manager's approval thereof.

GCC Subclauses 20.3.2 through 20.3.7 shall apply to those documents requiring the Project Manager's approval, but not to those furnished to the Project Manager for its review only.

20.3.2 Within 14 days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Subclause 20.3.1, the Project Manager shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in writing of its disapproval thereof and the reasons therefor and the modifications that the Project Manager proposes.

If the Project Manager fails to take such action within the said 14 days, then the said document shall be deemed to have been approved by the Project Manager.

20.3.3 The Project Manager shall not disapprove any document, except on the grounds that the document does not comply with the Contract or that it is contrary to good engineering practice. If the Project Manager disapproves a document, he shall specify the reasons for his decision.

20.3.4 If the Project Manager disapproves the document, the Contractor shall modify the document and resubmit it for the Project Manager's approval in accordance with GCC Subclause 20.3.2. If the Project Manager approves the document subject to modification(s), the Contractor shall make the required modification(s), whereupon the document shall be deemed to have been approved.

20.3.5 If any dispute or difference occurs between the Employer and the Contractor in connection with or arising out of the disapproval by the Project Manager of any document and/or any modification(s) thereto that cannot be settled between the parties within a reasonable period, then such dispute or difference may be referred to a Dispute Board for determination in accordance with GCC Subclause 45.3 hereof. If such dispute or difference is referred to a Dispute Board, the Project Manager shall give instructions as to whether and, if so, how, performance of the Contract is to proceed. The Contractor shall proceed with the Contract in accordance with the Project Manager's instructions, provided that if the Dispute Board upholds the Contractor's view on the dispute and if the Employer has not given notice under Subclause 45.3 hereof, then the Contractor shall be reimbursed by the Employer for any additional costs incurred by reason of such instructions and shall be relieved of such responsibility or liability in connection with the dispute and the execution of the instructions as the Dispute Board shall decide, and the Time for Completion shall

be extended accordingly.

20.3.6 The Project Manager's approval, with or without modification of the document furnished by the Contractor, shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract except to the extent that any subsequent failure results from modifications required by the Project Manager.

20.3.7 The Contractor shall not depart from any approved document unless the Contractor has first submitted to the Project Manager an amended document and obtained the Project Manager's approval thereof, pursuant to the provisions of this GCC Subclause 20.3.

If the Project Manager requests any change in any already approved document and/or in any document based thereon, the provisions of GCC Clause 39 shall apply to such request.

21. Procurement

21.1 Materials

Subject to GCC Subclause 14.2, the Contractor shall procure and transport all materials in an expeditious and orderly manner to the Site.

21.2 Employer-Supplied Materials

If the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement provides that the Employer shall furnish any specific items to the Contractor, the following provisions shall apply:

21.2.1 The Employer shall, at its own risk and expense, transport each item to the place on or near the Site as agreed upon by the parties and make such item available to the Contractor at the time specified in the program furnished by the Contractor, pursuant to GCC Subclause 18.2, unless otherwise mutually agreed.

21.2.2 Upon receipt of such item, the Contractor shall inspect the same visually and notify the Project Manager of any detected shortage, defect, or default. The Employer shall immediately remedy any shortage, defect, or default, or the Contractor shall, if practicable and possible, at the request of the Employer, remedy such shortage, defect, or default at the Employer's cost and expense. After inspection, such item shall fall under the care, custody, and control of the Contractor. The provision of this GCC Subclause 21.2.2 shall apply to any item supplied to remedy any such shortage or default or to substitute for any defective item, or shall apply to defective items that have been repaired.

21.2.3 The foregoing responsibilities of the Contractor and its obligations of care, custody, and control shall not relieve the Employer of liability for any undetected shortage, defect, or default, nor place the Contractor under any liability for any such shortage, defect or default whether under GCC Clause 27 or under any other provision of Contract.

21.3 Transportation

21.3.1 The Contractor shall at its own risk and expense transport all the materials and the Contractor's Equipment to the Site by the mode of transport that the Contractor judges most suitable

under all the circumstances.

21.3.2 Unless otherwise provided in the Contract, the Contractor shall be entitled to select any safe mode of transport operated by any person to carry the materials and the Contractor's Equipment.

21.3.3 Upon dispatch of each shipment of materials and the Contractor's Equipment, the Contractor shall notify the Employer by telex, cable, facsimile, or electronic means, of the description of the materials and of the Contractor's Equipment, the point and means of dispatch, and the estimated time and point of arrival in the country where the Site is located, if applicable, and at the Site. The Contractor shall furnish the Employer with relevant shipping documents to be agreed upon between the parties.

21.3.4 The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of the materials and the Contractor's Equipment to the Site. The Employer shall use its best endeavors in a timely and expeditious manner to assist the Contractor in obtaining such approvals, if requested by the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any claim for damage to roads, bridges, or any other traffic facilities that may be caused by the transport of the materials and the Contractor's Equipment to the Site.

21.4 Customs Clearance

The Contractor shall, at its own expense, handle all imported materials and Contractor's Equipment at the point(s) of import and shall handle any formalities for customs clearance, subject to the Employer's obligations under GCC Subclause 14.2, provided that if applicable laws or regulations require any application or act to be made by or in the name of the Employer, the Employer shall take all necessary steps to comply with such laws or regulations. In the event of delays in customs clearance that are not the fault of the Contractor, the Contractor shall be entitled to an extension in the Time for Completion, pursuant to GCC Clause 40.

22. Installation

22.1 Setting Out/Supervision

22.1.1 Benchmark

- (a) The Contractor shall be responsible for the true and proper setting-out of the Facilities in relation to bench marks, reference marks, and lines provided to it in writing by or on behalf of the Employer.
- (b) If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level, or alignment of the Facilities, the Contractor shall forthwith notify the Project Manager of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the Project Manager. If such error is based on incorrect data provided in writing by or on behalf of the Employer, the expense of rectifying the same shall be

borne by the Employer.

22.1.2 Contractor's Supervision

The Contractor shall give or provide all necessary superintendence during the installation of the Facilities, and the Construction Manager or its deputy shall be constantly on the Site to provide full-time superintendence of the installation. The Contractor shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the work at hand.

22.2 Labour

22.2.1 Engagement of Staff and Labour

- (a) Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and Labour, local or otherwise, and for their payment, housing, feeding, and transport.
- (b) The Contractor shall provide and employ on the Site in the installation of the Facilities such skilled, semi-skilled, and unskilled Labour as is necessary for the proper and timely execution of the Contract. The Contractor is encouraged to use local Labour that has the necessary skills.
- (c) The Contractor shall be responsible for obtaining all necessary permit(s) and/or visa(s) from the appropriate authorities for the entry of all Labour and personnel to be employed on the Site into the country where the Site is located. The Employer will, if requested by the Contractor, use his best endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or government permission required for bringing in the Contractor's personnel.
- (d) The Contractor shall at its own expense provide the means of repatriation to all of its and its Subcontractor's personnel employed on the Contract at the Site to the place where they were recruited or to their domicile. It shall also provide suitable temporary maintenance of all such persons from the cessation of their employment on the Contract to the date programmed for their departure. In the event that the Contractor defaults in providing such means of transportation and temporary maintenance, the Employer may provide the same to such personnel and recover the cost of doing so from the Contractor.

22.2.2 Persons in the Service of Employer

The Contractor shall not recruit, or attempt to recruit, staff and Labour from amongst the Employer's Personnel.

22.2.3 Labour Laws

- (a) The Contractor shall comply with all the relevant Labour

Laws applicable to the Contractor's Personnel, including Laws relating to their employment, health, safety, welfare, immigration, and emigration, and shall allow them all their legal rights.

- (b) The Contractor shall at all times during the progress of the Contract use its best endeavors to prevent any unlawful, riotous, or disorderly conduct or behavior by or amongst its employees and the Labour of its Subcontractors.
- (c) The Contractor shall, in all dealings with its Labour and the Labour of its Subcontractors currently employed on or connected with the Contract, pay due regard to all recognized festivals, official holidays, religious, or other customs and all local laws and regulations pertaining to the employment of Labour.

22.2.4 Rates of Wages and Conditions of Labour

- (a) The Contractor shall pay rates of wages, and observe conditions of Labour, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor.
- (b) The Contractor shall inform the Contractor's Personnel about their liability to pay personal income taxes in the Country in respect of such of their salaries, wages, and allowances as are chargeable under the Laws for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws.

22.2.5 Working Hours

- (a) No work shall be carried out on the Site on locally recognized days of rest, or outside the normal working hours stated in the SCC, unless
 - (i) otherwise stated in the Contract;
 - (ii) the Project Manager gives consent; or
 - (iii) the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Project Manager.
- (b) If and when the Contractor considers it necessary to carry out work at night or on public holidays so as to meet the Time for Completion and requests the Project Manager's consent thereto, the Project Manager shall not unreasonably withhold such consent.
- (c) This Subclause shall not apply to any work which is customarily carried out by rotary or double shifts.

22.2.6 Facilities for Staff and Labour

- (a) Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Specification.
- (b) The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.

22.2.7 Health and Safety

- (a) The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay, and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.
- (b) The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the performance of the Contract, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.
- (c) The Contractor shall send to the Project Manager, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety, and welfare of persons, and damage to property, as the Project Manager may reasonably require.

22.2.8 Funeral Arrangements

In the event of the death of any of the Contractor's personnel or accompanying members of their families, the Contractor shall be responsible for making the appropriate arrangements for their return or burial, unless otherwise specified in the SCC.

22.2.9 Records of Contractor's Personnel

The Contractor shall keep accurate records of the Contractor's personnel, including the number of each class of Contractor's Personnel on the Site and the names, ages, gender, hours worked, and wages paid to all workers. These records shall be summarized on a monthly basis in a form approved by the Project Manager and shall be available for inspection by the Project Manager until the Contractor has completed all work.

22.2.10 Supply of Foodstuff

The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Specification at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.

22.2.11 Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.

22.2.12 Measures against Insect and Pest Nuisance

The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce their danger to health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.

22.2.13 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give barter, or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift barter, or disposal by Contractor's Personnel.

22.2.14 Arms and Ammunition

The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.

22.2.15 Prohibition of All Forms of Forced or Compulsory Labour

The contractor shall not employ "forced or compulsory Labour" in any form. "Forced or compulsory Labour" consists of all work or service, not voluntarily performed, that is extracted from an individual under threat of force or penalty.

22.2.16 Prohibition of Harmful Child Labour

The Contractor shall not employ any child to perform any work that is economically exploitative, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.

22.3 Contractor's Equipment

22.3.1 All Contractor's Equipment brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Contractor shall not remove the same from the Site without the Project Manager's consent that such Contractor's Equipment is no longer required for the execution of the Contract.

22.3.2 Unless otherwise specified in the Contract, upon completion of the Facilities, the Contractor shall remove from the Site all Equipment brought by the Contractor onto the Site and any surplus materials remaining thereon.

- 22.3.3 The Employer will, if requested, use its best endeavors to assist the Contractor in obtaining any local, state or national government permission required by the Contractor for the export of the Contractor's Equipment imported by the Contractor for use in the execution of the Contract that is no longer required for the execution of the Contract.

22.4 Site Regulations and Safety

The Employer and the Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Contractor shall prepare and submit to the Employer, with a copy to the Project Manager, proposed Site regulations for the Employer's approval, which approval shall not be unreasonably withheld.

Such Site regulations shall include, but shall not be limited to, rules in respect of security, safety of the Facilities, gate control, sanitation, medical care, and fire prevention.

22.5 Opportunities for Other Contractors

- 22.5.1 The Contractor shall, upon written request from the Employer or the Project Manager, give all reasonable opportunities for carrying out the work to any other contractors employed by the Employer on or near the Site.
- 22.5.2 If the Contractor, upon written request from the Employer or the Project Manager, makes available to other contractors any roads or ways the maintenance for which the Contractor is responsible, permits the use by such other contractors of the Contractor's Equipment, or provides any other service of whatsoever nature for such other contractors, the Employer shall fully compensate the Contractor for any loss or damage caused or occasioned by such other contractors in respect of any such use or service, and shall pay to the Contractor reasonable remuneration for the use of such equipment or the provision of such services.
- 22.5.3 The Contractor shall also so arrange to perform its work as to minimize, to the extent possible, interference with the work of other contractors. The Project Manager shall determine the resolution of any difference or conflict that may arise between the Contractor and other contractors and the workers of the Employer in regard to their work.
- 22.5.4 The Contractor shall notify the Project Manager promptly of any defects in the other Contractors' work that come to its notice, and that could affect the Contractor's work. The Project Manager shall determine the corrective measures, if any, required to rectify the situation after inspection of the Facilities. Decisions made by the Project Manager shall be binding on the Contractor.

22.6 Emergency Work

If, by reason of an emergency arising in connection with and during the execution of the Contract, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Facilities, the

Contractor shall immediately carry out such work.

If the Contractor is unable or unwilling to do such work immediately, the Employer may do or cause such work to be done as the Employer may determine is necessary in order to prevent damage to the Facilities. In such event the Employer shall, as soon as practicable after the occurrence of any such emergency, notify the Contractor in writing of such emergency, the work done and the reasons therefor. If the work done or caused to be done by the Employer is work that the Contractor was liable to do at its own expense under the Contract, the reasonable costs incurred by the Employer in connection therewith shall be paid by the Contractor to the Employer. Otherwise, the cost of such remedial work shall be borne by the Employer.

22.7 Site Clearance

22.7.1 Site Clearance in Course of Performance

In the course of carrying out the Contract, the Contractor shall keep the Site reasonably free from all unnecessary obstruction, store, or remove any surplus materials, clear away any wreckage, rubbish, or temporary works from the Site, and remove any Contractor's Equipment no longer required for execution of the Contract.

22.7.2 Clearance of Site after Completion

After Completion of all parts of the Facilities, the Contractor shall clear away and remove all wreckage, rubbish, and debris of any kind from the Site, and shall leave the Site and Facilities in a clean and safe condition.

22.8 Watching and Lighting

The Contractor shall provide and maintain at its own expense all lighting, fencing, and watching when and where necessary for the proper execution and the protection of the Facilities, or for the safety of the owners and occupiers of adjacent property and for the safety of the public.

23. Test and Inspection

- 23.1 The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the Plant and any part of the Facilities as are specified in the Contract.
- 23.2 The Employer and the Project Manager or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Employer shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.
- 23.3 Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice of such test and/or inspection and of the place and time thereof to the Project Manager. The Contractor shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Employer and the Project Manager or their designated representatives to attend the test and/or inspection.

- 23.4 The Contractor shall provide the Project Manager with a certified report of the results of any such test and/or inspection.

If the Employer or Project Manager or their designated representatives fails to attend the test and/or inspection, or if it is agreed between the parties that such persons shall not do so, then the Contractor may proceed with the test and/or inspection in the absence of such persons, and may provide the Project Manager with a certified report of the results thereof.

- 23.5 The Project Manager may require the Contractor to carry out any test and/or inspection not required by the Contract, provided that the Contractor's reasonable costs and expenses incurred in the carrying out of such test and/or inspection shall be added to the Contract Price. Further, if such test and/or inspection impedes the progress of work on the Facilities and/or the Contractor's performance of its other obligations under the Contract, due allowance will be made in respect of the Time for Completion and the other obligations so affected.

- 23.6 If any Plant or any part of the Facilities fails to pass any test and/or inspection, the Contractor shall either rectify or replace such Plant or part of the Facilities and shall repeat the test and/or inspection upon giving a notice under GCC Subclause 23.3.

- 23.7 If any dispute or difference of opinion shall arise between the parties in connection with or arising out of the test and/or inspection of the Plant or part of the Facilities that cannot be settled between the parties within a reasonable period of time, it may be referred to a Dispute Board for determination in accordance with GCC Subclause 45.3.

- 23.8 The Contractor shall afford the Employer and the Project Manager, at the Employer's expense, access at any reasonable time to any place where the Plant are being manufactured or the Facilities are being installed, in order to inspect the progress and the manner of manufacture or installation, provided that the Project Manager shall give the Contractor a reasonable prior notice.

- 23.9 The Contractor agrees that neither the execution of a test and/or inspection of Plant or any part of the Facilities, nor the attendance by the Employer or the Project Manager, nor the issue of any test certificate pursuant to GCC Subclause 23.4, shall release the Contractor from any other responsibilities under the Contract.

- 23.10 No part of the Facilities or foundations shall be covered up on the Site without the Contractor carrying out any test and/or inspection required under the Contract. The Contractor shall give a reasonable notice to the Project Manager whenever any such parts of the Facilities or foundations are ready or about to be ready for test and/or inspection; such test and/or inspection and notice thereof shall be subject to the requirements of the Contract.

- 23.11 The Contractor shall uncover any part of the Facilities or foundations, or shall make openings in or through the same as the Project Manager may from time to time require at the Site, and shall reinstate and make good such part or parts.

If any parts of the Facilities or foundations have been covered up at the Site after compliance with the requirement of GCC Subclause 23.10 and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating, and making good the same shall be borne by the Employer, and the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been delayed or impeded in the performance of any of its obligations under the Contract.

24. Completion of the Facilities

24.1 As soon as the Facilities or any part thereof has, in the opinion of the Contractor, been completed operationally and structurally and put in a tight and clean condition as specified in the Employer's Requirements, excluding minor items not materially affecting the operation or safety of the Facilities, the Contractor shall so notify the Employer in writing.

24.2 Within 7 days after receipt of the notice from the Contractor under GCC Subclause 24.1, the Employer shall supply the operating and maintenance personnel specified in the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement for Pre-commissioning of the Facilities or any part thereof.

Pursuant to the Appendix (Scope of Works and Supply by the Employer) to the Contract Agreement, the Employer shall also provide, within the said 7-day period, the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services, and other matters required for Pre-commissioning of the Facilities or any part thereof.

24.3 As soon as reasonably practicable after the operating and maintenance personnel have been supplied by the Employer and the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services, and other matters have been provided by the Employer in accordance with GCC Subclause 24.2, the Contractor shall commence Pre-commissioning of the Facilities or the relevant part thereof in preparation for Commissioning, subject to GCC Subclause 25.5.

24.4 As soon as all works in respect of Pre-commissioning are completed and, in the opinion of the Contractor, the Facilities or any part thereof is ready for Commissioning, the Contractor shall so notify the Project Manager in writing.

24.5 The Project Manager shall, within 14 days after receipt of the Contractor's notice under GCC Subclause 24.4, either issue a Completion Certificate in the form specified in the Employer's Requirements (Forms and Procedures), stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's notice under GCC Subclause 24.4, or notify the Contractor in writing of any defects and/or deficiencies.

If the Project Manager notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such defects and/or deficiencies, and shall repeat the procedure described in GCC Subclause 24.4.

If the Project Manager is satisfied that the Facilities or that part thereof have reached Completion, the Project Manager shall, within 7 days after receipt of the Contractor's repeated notice, issue a Completion Certificate stating that the Facilities or that part thereof have reached

Completion as of the date of the Contractor's repeated notice.

If the Project Manager is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within 7 days after receipt of the Contractor's repeated notice, and the above procedure shall be repeated.

24.6 If the Project Manager fails to issue the Completion Certificate and fails to inform the Contractor of any defects and/or deficiencies within 14 days after receipt of the Contractor's notice under GCC Subclause 24.4 or within 7 days after receipt of the Contractor's repeated notice under GCC Subclause 24.5, or if the Employer makes use of the Facilities or part thereof, then the Facilities or that part thereof shall be deemed to have reached Completion as of the date of the Contractor's notice or repeated notice, or as of the Employer's use of the Facilities, as the case may be.

24.7 As soon as possible after Completion, the Contractor shall complete all outstanding minor items so that the Facilities are fully in accordance with the requirements of the Contract, failing which the Employer will undertake such completion and deduct the costs thereof from any monies owing to the Contractor.

24.8 Upon Completion, the Employer shall be responsible for the care and custody of the Facilities or the relevant part thereof, together with the risk of loss or damage thereto, and shall thereafter take over the Facilities or the relevant part thereof.

**25. Commissioning
and Operational
Acceptance**

25.1 Commissioning

25.1.1 Commissioning of the Facilities or any part thereof shall be commenced by the Contractor immediately after issue of the Completion Certificate by the Project Manager, pursuant to GCC Subclause 24.5, or immediately after the date of the deemed Completion, under GCC Subclause 24.6.

25.1.2 The Employer shall supply the operating and maintenance personnel and all raw materials, utilities, lubricants, chemicals, catalysts, facilities, services, and other matters required for Commissioning.

25.1.3 In accordance with the requirements of the Contract, the Contractor's and Project Manager's advisory personnel shall attend the Commissioning, including the Guarantee Test, and shall advise and assist the Employer.

25.2 Guarantee Test

25.2.1 Subject to GCC Subclause 25.5, the Guarantee Test and repeats thereof shall be conducted by the Contractor during Commissioning of the Facilities or the relevant part thereof to ascertain whether the Facilities or the relevant part can attain the Functional Guarantees specified in the Appendix (Functional Guarantees) to the Contract Agreement. The Employer shall promptly provide the Contractor with such information as the Contractor may reasonably require in relation to the conduct and

results of the Guarantee Test and any repeats thereof.

25.2.2 If for reasons not attributable to the Contractor, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period from the date of Completion specified in the SCC or any other period agreed upon by the Employer and the Contractor, the Contractor shall be deemed to have fulfilled its obligations with respect to the Functional Guarantees, and GCC Subclauses 28.2 and 28.3 shall not apply.

25.3 Operational Acceptance

25.3.1 Subject to GCC Subclause 25.4 below, Operational Acceptance shall occur in respect of the Facilities or any part thereof when

- (a) the Guarantee Test has been successfully completed and the Functional Guarantees are met; or
- (b) the Guarantee Test has not been successfully completed or has not been carried out for reasons not attributable to the Contractor within the period from the date of Completion specified in the SCC, or any other agreed upon period as specified in GCC Subclause 25.2.2 above; or
- (c) the Contractor has paid the liquidated damages specified in GCC Subclause 28.3 hereof; and
- (d) any minor items mentioned in GCC Subclause 24.7 hereof relevant to the Facilities or that part thereof have been completed.

25.3.2 At any time after any of the events set out in GCC Subclause 25.3.1 have occurred, the Contractor may give a notice to the Project Manager requesting the issue of an Operational Acceptance Certificate in the form provided in the Employer's Requirements (Forms and Procedures) in respect of the Facilities or the part thereof specified in such notice as of the date of such notice.

25.3.3 The Project Manager shall, after consultation with the Employer, and within 7 days after receipt of the Contractor's notice, issue an Operational Acceptance Certificate.

25.3.4 If within 7 days after receipt of the Contractor's notice, the Project Manager fails to issue the Operational Acceptance Certificate or fails to inform the Contractor in writing of the justifiable reasons why the Project Manager has not issued the Operational Acceptance Certificate, the Facilities or the relevant part thereof shall be deemed to have been accepted as of the date of the Contractor's said notice.

25.4 Partial Acceptance

25.4.1 If the Contract specifies that Completion and Commissioning shall be carried out in respect of parts of the Facilities, the provisions relating to Completion and Commissioning including the Guarantee Test shall apply to each such part of the Facilities individually, and the Operational Acceptance Certificate shall be

issued accordingly for each such part of the Facilities.

25.4.2 If a part of the Facilities comprises facilities such as buildings, for which no Commissioning or Guarantee Test is required, then the Project Manager shall issue the Operational Acceptance Certificate for such facility when it attains Completion, provided that the Contractor shall thereafter complete any outstanding minor items that are listed in the Operational Acceptance Certificate.

25.5 Delayed Pre-Commissioning and/or Guarantee Test

25.5.1 In the event that the Contractor is unable to proceed with the Pre-commissioning of the Facilities pursuant to Subclause 24.3, or with the Guarantee Test pursuant to Subclause 25.2, for reasons attributable to the Employer either on account of non availability of other facilities under the responsibilities of other contractor(s), or for reasons beyond the Employer's control, the provisions leading to "deemed" completion of activities such as Completion, pursuant to GCC Subclause 24.6, and Operational Acceptance, pursuant to GCC Subclause 25.3.4, and Contractor's obligations regarding Defect Liability Period, pursuant to GCC Subclause 27.2, Functional Guarantee, pursuant to GCC Clause 28, and Care of Facilities, pursuant to GCC Clause 32, and GCC Clause 41.1, Suspension, shall not apply. In this case, the following provisions shall apply.

25.5.2 When the Contractor is notified by the Project Manager that he will be unable to proceed with the activities and obligations pursuant to above Subclause 25.5.1, the Contractor shall be entitled to the following:

- (a) the Time of Completion shall be extended for the period of suspension without imposition of liquidated damages pursuant to GCC Subclause 26.2;
- (b) payments due to the Contractor in accordance with the provision specified in the Appendix (Terms and Procedures of Payment) to the Contract Agreement, which would not have been payable in normal circumstances due to noncompletion of the subject activities, shall be released to the Contractor against submission of a security in the form of a bank guarantee of equivalent amount acceptable to the Employer, and which shall become null and void when the Contractor will have complied with its obligations regarding those payments, subject to the provision of Subclause 25.5.3 below;
- (c) the expenses towards the above security and extension of other securities under the contract, of which validity needs to be extended, shall be reimbursed to the Contractor by the Employer;
- (d) the additional charges towards the care of the Facilities pursuant to GCC Subclause 32.1 shall be reimbursed to

the Contractor by the Employer for the period between the notification mentioned above and the notification mentioned in Subclause 25.5.4 below. The provision of GCC Subclause 33.2 shall apply to the Facilities during the same period.

25.5.3 In the event that the period of suspension under above Subclause 25.5.1 actually exceeds 180 days, the Employer and Contractor shall mutually agree to any additional compensation payable to the Contractor.

25.5.4 When the Contractor is notified by the Project Manager that the plant is ready for Pre-commissioning, the Contractor shall proceed without delay in performing all the specified activities and obligations under the contract.

F. Guarantees and Liabilities

26. Completion Time Guarantee

26.1 The Contractor guarantees that it shall attain Completion of the Facilities (or a part for which a separate time for completion is specified) within the Time for Completion specified in the SCC pursuant to GCC Subclause 8.2, or within such extended time to which the Contractor shall be entitled under GCC Clause 40 hereof.

26.2 If the Contractor fails to attain Completion of the Facilities or any part thereof within the Time for Completion or any extension thereof under GCC Clause 40, the Contractor shall pay to the Employer liquidated damages in the amount specified in the SCC as a percentage rate of the Contract Price or the relevant part thereof. The aggregate amount of such liquidated damages shall in no event exceed the amount specified as "Maximum" in the SCC as a percentage rate of the Contract Price. Once the "Maximum" is reached, the Employer may consider termination of the Contract, pursuant to GCC Subclause 42.2.2.

Such payment shall completely satisfy the Contractor's obligation to attain Completion of the Facilities or the relevant part thereof within the Time for Completion or any extension thereof under GCC Clause 40. The Contractor shall have no further liability whatsoever to the Employer in respect thereof.

However, the payment of liquidated damages shall not in any way relieve the Contractor from any of its obligations to complete the Facilities or from any other obligations and liabilities of the Contractor under the Contract.

Save for liquidated damages payable under this GCC Subclause 26.2, the failure by the Contractor to attain any milestone or other act, matter or thing by any date specified in the Appendix (Time Schedule) to the Contract Agreement and/or other program of work prepared pursuant to GCC Subclause 18.2 shall not render the Contractor liable for any loss or damage thereby suffered by the Employer.

- 26.3 If the Contractor attains Completion of the Facilities or any part thereof before the Time for Completion or any extension thereof under GCC Clause 40, the Employer shall pay to the Contractor a bonus in the amount specified in the SCC. The aggregate amount of such bonus shall in no event exceed the amount specified as "Maximum" in the SCC.

27. Defect Liability

- 27.1 The Contractor warrants that the Facilities or any part thereof shall be free from defects in the design, engineering, materials, and workmanship of the Plant supplied and of the work executed.

- 27.2 The Defect Liability Period shall be 540 days from the date of Completion of the Facilities (or any part thereof) or 1 year from the date of Operational Acceptance of the Facilities (or any part thereof), whichever first occurs, unless specified otherwise in the SCC pursuant to GCC Subclause 27.10.

If during the Defect Liability Period any defect should be found in the design, engineering, materials, and workmanship of the Plant supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace, or otherwise make good as the Contractor shall determine at its discretion, such defect as well as any damage to the Facilities caused by such defect. The Contractor shall not be responsible for the repair, replacement, or making good of any defect or of any damage to the Facilities arising out of or resulting from any of the following causes:

- (a) improper operation or maintenance of the Facilities by the Employer,
- (b) operation of the Facilities outside specifications provided in the Contract, or
- (c) normal wear and tear.

- 27.3 The Contractor's obligations under this GCC Clause 27 shall not apply to:

- (a) any materials that are supplied by the Employer under GCC Subclause 21.2, are normally consumed in operation, or have a normal life shorter than the Defect Liability Period stated herein;
- (b) any designs, specifications or other data designed, supplied, or specified by or on behalf of the Employer or any matters for which the Contractor has disclaimed responsibility herein; or
- (c) any other materials supplied or any other work executed by or on behalf of the Employer, except for the work executed by the Employer under GCC Subclause 27.7.

- 27.4 The Employer shall give the Contractor a notice stating the nature of any such defect together with all available evidence thereof, promptly following the discovery thereof. The Employer shall afford all reasonable opportunity for the Contractor to inspect any such defect.

- 27.5 The Employer shall afford the Contractor all necessary access to the Facilities and the Site to enable the Contractor to perform its

obligations under this GCC Clause 27.

The Contractor may, with the consent of the Employer, remove from the Site any Plant or any part of the Facilities that are defective if the nature of the defect, and/or any damage to the Facilities caused by the defect, is such that repairs cannot be expeditiously carried out at the Site.

- 27.6 If the repair, replacement or making good is of such a character that it may affect the efficiency of the Facilities or any part thereof, the Employer may give to the Contractor a notice requiring that tests of the defective part of the Facilities shall be made by the Contractor immediately upon completion of such remedial work, whereupon the Contractor shall carry out such tests.

If such part fails the tests, the Contractor shall carry out further repair, replacement or making good, as the case may be, until that part of the Facilities passes such tests. The tests shall be agreed upon by the Employer and the Contractor.

- 27.7 If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be less than 15 days), the Employer may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Employer in connection therewith shall be paid to the Employer by the Contractor or may be deducted by the Employer from any monies due the Contractor or claimed under the Performance Security.

- 27.8 If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defect Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Employer because of any of the aforesaid reasons.

- 27.9 Except as provided in GCC Clauses 27 and 33, the Contractor shall be under no liability whatsoever and howsoever arising, and whether under the Contract or at law, in respect of defects in the Facilities or any part thereof, the Plant, design, or engineering, or work executed that appear after Completion of the Facilities or any part thereof, except where such defects are the result of the gross negligence, fraud, criminal, or willful action of the Contractor.

- 27.10 In addition, any such component of the Facilities and during the period of time as may be specified in the SCC shall be subject to an extended Defect Liability Period. Such obligation of the Contractor shall be in addition to the Defect Liability Period specified under GCC Subclause 27.2.

28. Functional Guarantees

- 28.1 The Contractor guarantees that during the Guarantee Test, the Facilities and all parts thereof shall attain the Functional Guarantees specified in the Appendix (Functional Guarantees) to the Contract Agreement, subject to, and upon the conditions therein specified.
- 28.2 If, for reasons attributable to the Contractor, the minimum level of the Functional Guarantees specified in the Appendix (Functional

Guarantees) to the Contract Agreement are not met either in whole or in part, the Contractor shall at its cost and expense make such changes, modifications, and/or additions to the Plant or any part thereof as may be necessary to meet at least the minimum level of such Guarantees. The Contractor shall notify the Employer upon completion of the necessary changes, modifications, and/or additions, and shall request the Employer to repeat the Guarantee Test until the minimum level of the Guarantees has been met. If the Contractor eventually fails to meet the minimum level of Functional Guarantees, the Employer may consider termination of the Contract, pursuant to GCC Subclause 42.2.2.

- 28.3 If, for reasons attributable to the Contractor, the Functional Guarantees specified in the Appendix (Functional Guarantees) to the Contract Agreement are not attained either in whole or in part, but the minimum level of the Functional Guarantees specified in the said Appendix to the Contract Agreement is met, the Contractor shall, at the Contractor's option, either
- (a) make such changes, modifications, and/or additions to the Facilities or any part thereof that are necessary to attain the Functional Guarantees at its cost and expense, and shall request the Employer to repeat the Guarantee Test or
 - (b) pay liquidated damages to the Employer in respect of the failure to meet the Functional Guarantees in accordance with the provisions in the Appendix (Functional Guarantees) to the Contract Agreement.
- 28.4 The payment of liquidated damages under GCC Subclause 28.3, up to the limitation of liability specified in the Appendix (Functional Guarantees) to the Contract Agreement, shall completely satisfy the Contractor's guarantees under GCC Subclause 28.3, and the Contractor shall have no further liability whatsoever to the Employer in respect thereof. Upon the payment of such liquidated damages by the Contractor, the Project Manager shall issue the Operational Acceptance Certificate for the Facilities or any part thereof in respect of which the liquidated damages have been so paid.

29. Patent Indemnity

- 29.1 The Contractor shall, subject to the Employer's compliance with GCC Subclause 29.2, indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions, or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Employer may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright, or other intellectual property right registered or otherwise existing at the date of the Contract by reason of (a) the installation of the Facilities by the Contractor or the use of the Facilities in the country where the Site is located, and (b) the sale of the products produced by the Facilities in any country.

Such indemnity shall not cover any use of the Facilities or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, any infringement resulting from the use of the Facilities or any part thereof, or any products produced thereby in association or combination with any other equipment, plant, or materials not supplied by the Contractor, pursuant to the Contract

Agreement.

- 29.2 If any proceedings are brought or any claim is made against the Employer arising out of the matters referred to in GCC Subclause 29.1, the Employer shall promptly give the Contractor a notice thereof, and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

If the Contractor fails to notify the Employer within 28 days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the 28-day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim.

The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.

- 29.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers, and Subcontractors from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Contractor may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright, or other intellectual property right registered or otherwise existing at the date of the Contract arising out of or in connection with any design, data, drawing, specification, or other documents or materials provided or designed by or on behalf of the Employer.

30. Limitation of Liability

- 30.1 Except in cases of criminal negligence or willful misconduct,
- (a) the Contractor shall not be liable to the Employer, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to the Employer, and
 - (b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed a multiple of the Contract Price specified in the SCC or, if a multiple is not so specified, the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.

G. Risk Distribution

31. Transfer of Ownership

- 31.1 Ownership of the Plant (including spare parts) to be imported into the country where the Site is located shall be transferred to the Employer upon loading on to the mode of transport to be used to convey the

Plant from the country of origin to that country.

- 31.2 Ownership of the Plant (including spare parts) procured in the country where the Site is located shall be transferred to the Employer when the Plant are brought on to the Site.
- 31.3 Ownership of the Contractor's Equipment used by the Contractor and its Subcontractors in connection with the Contract shall remain with the Contractor or its Subcontractors.
- 31.4 Ownership of any Plant in excess of the requirements for the Facilities shall revert to the Contractor upon Completion of the Facilities or at such earlier time when the Employer and the Contractor agree that the Plant in question are no longer required for the Facilities.
- 31.5 Notwithstanding the transfer of ownership of the Plant, the responsibility for care and custody thereof together with the risk of loss or damage thereto shall remain with the Contractor pursuant to GCC Clause 32 (Care of Facilities) hereof until Completion of the Facilities or the part thereof in which such Plant are incorporated.

32. Care of Facilities

- 32.1 The Contractor shall be responsible for the care and custody of the Facilities or any part thereof until the date of Completion of the Facilities pursuant to GCC Clause 24 or, where the Contract provides for Completion of the Facilities in parts, until the date of Completion of the relevant part, and shall make good at its own cost any loss or damage that may occur to the Facilities or the relevant part thereof from any cause whatsoever during such period. The Contractor shall also be responsible for any loss or damage to the Facilities caused by the Contractor or its Subcontractors in the course of any work carried out, pursuant to GCC Clause 27. Notwithstanding the foregoing, the Contractor shall not be liable for any loss or damage to the Facilities or that part thereof caused by reason of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Subclauses 32.2 and 38.1.
- 32.2 If any loss or damage occurs to the Facilities or any part thereof or to the Contractor's temporary facilities by reason of
 - (a) insofar as they relate to the country where the Site is located, nuclear reaction, nuclear radiation, radioactive contamination, pressure wave caused by aircraft or other aerial objects, or any other occurrences that an experienced contractor could not reasonably foresee, or if reasonably foreseeable could not reasonably make provision for or insure against, insofar as such risks are not normally insurable on the insurance market and are mentioned in the general exclusions of the policy of insurance, including War Risks and Political Risks, taken out under GCC Clause 34 hereof; or
 - (b) any use or occupation by the Employer or any third party other than a Subcontractor, authorized by the Employer of any part of the Facilities; or
 - (c) any use of or reliance upon any design, data, or specification provided or designated by or on behalf of the Employer, or any such matter for which the Contractor has disclaimed

responsibility herein,

the Employer shall pay to the Contractor all sums payable in respect of the Facilities executed, notwithstanding that the same be lost, destroyed, or damaged, and will pay to the Contractor the replacement value of all temporary facilities and all parts thereof lost, destroyed, or damaged. If the Employer requests the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Contractor shall make good the same at the cost of the Employer in accordance with GCC Clause 39. If the Employer does not request the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Employer shall either request a change in accordance with GCC Clause 39, excluding the performance of that part of the Facilities thereby lost, destroyed or damaged, or, where the loss or damage affects a substantial part of the Facilities, the Employer shall terminate the Contract pursuant to GCC Subclause 42.1 hereof.

32.3 The Contractor shall be liable for any loss of or damage to any Contractor's Equipment, or any other property of the Contractor used or intended to be used for purposes of the Facilities, except (i) as mentioned in GCC Subclause 32.2 with respect to the Contractor's temporary facilities, and (ii) where such loss or damage arises by reason of any of the matters specified in GCC Subclauses 32.2 (b) and (c) and 38.1.

32.4 With respect to any loss or damage caused to the Facilities or any part thereof or to the Contractor's Equipment by reason of any of the matters specified in GCC Subclause 38.1, the provisions of GCC Subclause 38.3 shall apply.

**33. Loss of or
Damage to
Property;
Accident or Injury
to Workers;
Indemnification**

33.1 Subject to GCC Subclause 33.3, the Contractor shall indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions, or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, in respect of the death or injury of any person or loss of or damage to any property other than the Facilities whether accepted or not, arising in connection with the supply and installation of the Facilities and by reason of the negligence of the Contractor or its Subcontractors, or their employees, officers, or agents, except any injury, death, or property damage caused by the negligence of the Employer, its contractors, employees, officers, or agents.

33.2 If any proceedings are brought or any claim is made against the Employer that might subject the Contractor to liability under GCC Subclause 33.1, the Employer shall promptly give the Contractor a notice thereof and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

If the Contractor fails to notify the Employer within 28 days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the 28-day period, the Employer shall make no admission that may be

prejudicial to the defense of any such proceedings or claim.

The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.

- 33.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers, and Subcontractors from any liability for loss of or damage to property of the Employer, other than the Facilities not yet taken over, that is caused by fire, explosion, or any other perils, in excess of the amount recoverable from insurances procured under GCC Clause 34, provided that such fire, explosion, or other perils were not caused by any act or failure of the Contractor.
- 33.4 The party entitled to the benefit of an indemnity under this GCC Clause 33 shall take all reasonable measures to mitigate any loss or damage which has occurred. If the party fails to take such measures, the other party's liabilities shall be correspondingly reduced.

34. Insurance

- 34.1 To the extent specified in the Appendix (Insurance Requirements) to the Contract Agreement, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified in the said Appendix. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, who should not unreasonably withhold such approval.
- (a) Cargo Insurance During Transport
Covering loss or damage occurring while in transit from the Contractor's or Subcontractor's works or stores until arrival at the Site, to the Plant (including spare parts therefor) and to the Contractor's Equipment.
- (b) Installation All Risks Insurance
Covering physical loss or damage to the Facilities at the Site, occurring prior to Completion of the Facilities, with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the Defect Liability Period while the Contractor is on the Site for the purpose of performing its obligations during the Defect Liability Period.
- (c) Third Party Liability Insurance
Covering bodily injury or death suffered by third parties including the Employer's personnel, and loss of or damage to property occurring in connection with the supply and installation of the Facilities.
- (d) Automobile Liability Insurance
Covering use of all vehicles used by the Contractor or its Subcontractors, whether or not owned by them, in connection with the execution of the Contract.

(e) Workers' Compensation

In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.

(f) Employer's Liability

In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.

(g) Other Insurances

Such other insurances as may be specifically agreed upon by the parties hereto as listed in the Appendix (Insurance Requirements) to the Contract Agreement.

34.2 The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Subclause 34.1, except for the Third Party Liability, Workers' Compensation, and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Subclause 34.1 except for the Cargo Insurance During Transport, Workers' Compensation, and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

34.3 The Contractor shall, in accordance with the provisions of the Appendix (Insurance Requirements) to the Contract Agreement, deliver to the Employer certificates of insurance or copies of the insurance policies as evidence that the required policies are in full force and effect. The certificates shall provide that no less than 21 days' notice shall be given to the Employer by insurers prior to cancellation or material modification of a policy.

34.4 The Contractor shall ensure that, where applicable, its Subcontractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Subcontractors are covered by the policies taken out by the Contractor.

34.5 The Employer shall at its expense take out and maintain in effect during the performance of the Contract those insurances specified in the Appendix (Insurance Requirements) to the Contract Agreement, in the sums and with the deductibles and other conditions specified in the said Appendix. The Contractor and the Contractor's Subcontractors shall be named as co-insureds under all such policies. All insurers' rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies. The Employer shall deliver to the Contractor satisfactory evidence that the required insurances are in full force and effect. The policies shall provide that not less than 21 days' notice shall be given to the Contractor by all insurers prior to any cancellation or material modification of the policies. If so requested by the Contractor, the Employer shall provide copies of the policies taken out by the Employer under this GCC Subclause 34.5.

- 34.6 If the Contractor fails to take out and/or maintain in effect the insurances referred to in GCC Subclause 34.1, the Employer may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Contractor under the Contract any premium that the Employer shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Contractor. If the Employer fails to take out and/or maintain in effect the insurances referred to in GCC 34.5, the Contractor may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Employer under the Contract any premium that the Contractor shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Employer. If the Contractor fails to or is unable to take out and maintain in effect any such insurances, the Contractor shall nevertheless have no liability or responsibility towards the Employer, and the Contractor shall have full recourse against the Employer for any and all liabilities of the Employer herein.
- 34.7 Unless otherwise provided in the Contract, the Contractor shall prepare and conduct all and any claims made under the policies effected by it pursuant to this GCC Clause 34, and all monies payable by any insurers shall be paid to the Contractor. The Employer shall give to the Contractor all such reasonable assistance as may be required by the Contractor. With respect to insurance claims in which the Employer's interest is involved, the Contractor shall not give any release or make any compromise with the insurer without the prior written consent of the Employer. With respect to insurance claims in which the Contractor's interest is involved, the Employer shall not give any release or make any compromise with the insurer without the prior written consent of the Contractor.

**35. Unforeseen
Conditions**

- 35.1 If, during the execution of the Contract, the Contractor shall encounter on the Site any physical conditions other than climatic conditions, or artificial obstructions that could not have been reasonably foreseen prior to the date of the Contract Agreement by an experienced contractor on the basis of reasonable examination of the data relating to the Facilities including any data as to boring tests, provided by the Employer, and on the basis of information that it could have obtained from a visual inspection of the Site if access thereto was available, or other data readily available to it relating to the Facilities, and if the Contractor determines that it will in consequence of such conditions or obstructions incur additional cost and expense or require additional time to perform its obligations under the Contract that would not have been required if such physical conditions or artificial obstructions had not been encountered, the Contractor shall promptly, and before performing additional work or using additional Plant or Contractor's Equipment, notify the Project Manager in writing of
- (a) the physical conditions or artificial obstructions on the Site that could not have been reasonably foreseen;
 - (b) the additional work and/or Plant and/or Contractor's Equipment required, including the steps which the Contractor will or proposes to take to overcome such conditions or obstructions;
 - (c) the extent of the anticipated delay; and

- (d) the additional cost and expense that the Contractor is likely to incur.

On receiving any notice from the Contractor under this GCC Subclause 35.1, the Project Manager shall promptly consult with the Employer and Contractor and decide upon the actions to be taken to overcome the physical conditions or artificial obstructions encountered. Following such consultations, the Project Manager shall instruct the Contractor, with a copy to the Employer, of the actions to be taken.

35.2 Any reasonable additional cost and expense incurred by the Contractor in following the instructions from the Project Manager to overcome such physical conditions or artificial obstructions referred to in GCC Subclause 35.1 shall be paid by the Employer to the Contractor as an addition to the Contract Price.

35.3 If the Contractor is delayed or impeded in the performance of the Contract because of any such physical conditions or artificial obstructions referred to in GCC Subclause 35.1, the Time for Completion shall be extended in accordance with GCC Clause 40.

36. Change in Laws and Regulations

36.1 If, after the date 28 days prior to the date of Bid submission, in the country where the Site is located, any law, regulation, ordinance, order or by-law having the force of law is enacted, promulgated, abrogated, or changed, which shall be deemed to include any change in interpretation or application by the competent authorities, that subsequently affects the costs and expenses of the Contractor and/or the Time for Completion, the Contract Price shall be correspondingly increased or decreased, and/or the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been affected in the performance of any of its obligations under the Contract. Notwithstanding the foregoing, such additional or reduced costs shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable, in accordance with the SCC, pursuant to GCC Subclause 11.2.

37. Force Majeure

37.1 "Force Majeure" shall mean any event beyond the reasonable control of the Employer or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected, and shall include, without limitation, the following:

- (a) war, hostilities, or warlike operations whether a state of war be declared or not, invasion, act of foreign enemy and civil war;
- (b) rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion, and terrorist acts;
- (c) confiscation, nationalization, mobilization, commandeering or requisition by or under the order of any government or de jure or de facto authority or ruler or any other act or failure to act of any local state or national government authority;
- (d) strike, sabotage, lockout, embargo, import restriction, port congestion, lack of usual means of public transportation and communication, industrial dispute, shipwreck, shortage or

- restriction of power supply, epidemics, quarantine, and plague;
- (e) earthquake, landslide, volcanic activity, fire, flood or inundation, tidal wave, typhoon or cyclone, hurricane, storm, lightning, or other inclement weather condition, nuclear, and pressure waves or other natural or physical disaster; and
 - (f) shortage of Labour, materials, or utilities where caused by circumstances that are themselves Force Majeure.
- 37.2 If either party is prevented, hindered, or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within 14 days after the occurrence of such event.
- 37.3 The party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such party's performance is prevented, hindered, or delayed. The Time for Completion shall be extended in accordance with GCC Clause 40.
- 37.4 The party or parties affected by the event of Force Majeure shall use reasonable efforts to mitigate the effect thereof upon its or their performance of the Contract and to fulfill its or their obligations under the Contract, but without prejudice to either party's right to terminate the Contract under GCC Subclauses 37.6 and 38.5.
- 37.5 No delay or nonperformance by either party hereto caused by the occurrence of any event of Force Majeure shall
- (a) constitute a default or breach of the Contract; or
 - (b) give rise to any claim for damages or additional cost or expense occasioned thereby, subject to GCC Subclauses 32.2, 38.3 and 38.4
- if and to the extent that such delay or nonperformance is caused by the occurrence of an event of Force Majeure.
- 37.6 If the performance of the Contract is substantially prevented, hindered, or delayed for a single period of more than 60 days or an aggregate period of more than 120 days on account of one or more events of Force Majeure during the currency of the Contract, the parties will attempt to develop a mutually satisfactory solution, failing which either party may terminate the Contract by giving a notice to the other, but without prejudice to either party's right to terminate the Contract under GCC Subclause 38.5.
- 37.7 In the event of termination pursuant to GCC Subclause 37.6, the rights and obligations of the Employer and the Contractor shall be as specified in GCC Subclauses 42.1.2 and 42.1.3.
- 37.8 Notwithstanding GCC Subclause 37.5, Force Majeure shall not apply to any obligation of the Employer to make payments to the Contractor herein.

38. War Risks

38.1 "War Risks" shall mean any event specified in paragraphs (a) and (b) of GCC Subclause 37.1 and any explosion or impact of any mine, bomb, shell, grenade, or other projectile, missile, munitions or explosive of war, occurring or existing in or near the country (or countries) where the Site is located.

38.2 Notwithstanding anything contained in the Contract, the Contractor shall have no liability whatsoever for or with respect to

- (a) destruction of or damage to Facilities, Plant, or any part thereof;
- (b) destruction of or damage to property of the Employer or any third party; or
- (c) injury or loss of life

if such destruction, damage, injury or loss of life is caused by any war risks, and the Employer shall indemnify and hold the Contractor harmless from and against any and all claims, liabilities, actions, lawsuits, damages, costs, charges, or expenses arising in consequence of or in connection with the same.

38.3 If the Facilities or any Plant or Contractor's Equipment or any other property of the Contractor used or intended to be used for the purposes of the Facilities shall sustain destruction or damage by reason of any war risks, the Employer shall pay the Contractor for

- (a) any part of the Facilities or the Plant so destroyed or damaged to the extent not already paid for by the Employer and so far as may be required by the Employer, and as may be necessary for completion of the Facilities;
- (b) replacing or making good any Contractor's Equipment or other property of the Contractor so destroyed or damaged; and
- (c) replacing or making good any such destruction or damage to the Facilities or the Plant or any part thereof.

If the Employer does not require the Contractor to replace or make good any such destruction or damage to the Facilities, the Employer shall either request a change in accordance with GCC Clause 39, excluding the performance of that part of the Facilities thereby destroyed or damaged or, where the loss, destruction, or damage affects a substantial part of the Facilities, shall terminate the Contract, pursuant to GCC Subclause 42.1.

If the Employer requires the Contractor to replace or make good on any such destruction or damage to the Facilities, the Time for Completion shall be extended in accordance with GCC 40.

38.4 Notwithstanding anything contained in the Contract, the Employer shall pay the Contractor for any increased costs or incidentals to the execution of the Contract that are in any way attributable to, consequent on, resulting from, or in any way connected with any war risks, provided that the Contractor shall as soon as practicable notify the Employer in writing of any such increased cost.

38.5 If during the performance of the Contract any war risks shall occur that

financially or otherwise materially affect the execution of the Contract by the Contractor, the Contractor shall use its reasonable efforts to execute the Contract with due and proper consideration given to the safety of its and its Subcontractors' personnel engaged in the work on the Facilities, provided, however, that if the execution of the work on the Facilities becomes impossible or is substantially prevented for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of any war risks, the parties will attempt to develop a mutually satisfactory solution, failing which either party may terminate the Contract by giving a notice to the other.

- 38.6 In the event of termination pursuant to GCC Subclauses 38.3 or 38.5, the rights and obligations of the Employer and the Contractor shall be specified in GCC Subclauses 42.1.2 and 42.1.3.

H. Change in Contract Elements

39. Change in the Facilities

39.1 Introducing a Change

39.1.1 Subject to GCC Subclauses 39.2.5 and 39.2.7, the Employer shall have the right to propose, and subsequently require, that the Project Manager order the Contractor from time to time during the performance of the Contract to make any change, modification, addition, or deletion to, in or from the Facilities hereinafter called "Change," provided that such Change falls within the general scope of the Facilities and does not constitute unrelated work and that it is technically practicable, taking into account both the state of advancement of the Facilities and the technical compatibility of the Change envisaged with the nature of the Facilities as specified in the Contract.

39.1.2 The Contractor may from time to time during its performance of the Contract propose to the Employer with a copy to the Project Manager, any Change that the Contractor considers necessary or desirable to improve the quality, efficiency, or safety of the Facilities. The Employer may at its discretion approve or reject any Change proposed by the Contractor, provided that the Employer shall approve any Change proposed by the Contractor to ensure the safety of the Facilities.

39.1.3 Notwithstanding GCC Subclauses 39.1.1 and 39.1.2, no change made necessary because of any default of the Contractor in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any adjustment of the Contract Price or the Time for Completion.

39.1.4 The procedure on how to proceed with and execute Changes is specified in GCC Subclauses 39.2 and 39.3, and further details and forms are provided in the Employer's Requirements (Forms and Procedures).

39.2 Changes Originating from Employer

39.2.1 If the Employer proposes a Change pursuant to GCC Subclause 39.1.1, it shall send to the Contractor a "Request for Change

Proposal,” requiring the Contractor to prepare and furnish to the Project Manager as soon as reasonably practicable a “Change Proposal,” which shall include the following:

- (a) brief description of the Change,
- (b) effect on the Time for Completion,
- (c) estimated cost of the Change,
- (d) effect on Functional Guarantees (if any),
- (e) effect on the Facilities, and
- (f) effect on any other provisions of the Contract.

39.2.2 Prior to preparing and submitting the “Change Proposal,” the Contractor shall submit to the Project Manager an “Estimate for Change Proposal,” which shall be an estimate of the cost of preparing and submitting the Change Proposal.

Upon receipt of the Contractor’s Estimate for Change Proposal, the Employer shall do one of the following:

- (a) accept the Contractor’s estimate with instructions to the Contractor to proceed with the preparation of the Change Proposal,
- (b) advise the Contractor of any part of its Estimate for Change Proposal that is unacceptable and request the Contractor to review its estimate
- (c) advise the Contractor that the Employer does not intend to proceed with the Change.

39.2.3 Upon receipt of the Employer’s instruction to proceed under GCC Subclause 39.2.2 (a), the Contractor shall, with proper expedition, proceed with the preparation of the Change Proposal, in accordance with GCC Subclause 39.2.1.

39.2.4 The pricing of any Change shall, as far as practicable, be calculated in accordance with the rates and prices included in the Contract. If such rates and prices are inequitable, the parties thereto shall agree on specific rates for the valuation of the Change.

39.2.5 If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 39 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Contract Agreement by more than 15%, the Contractor may give a written notice of objection thereto prior to furnishing the Change Proposal as aforesaid. If the Employer accepts the Contractor’s objection, the Employer shall withdraw the proposed Change and shall

notify the Contractor in writing thereof.

The Contractor's failure to so object shall neither affect its right to object to any subsequent requested Changes or Change Orders herein, nor affect its right to take into account, when making such subsequent objection, the percentage increase or decrease in the Contract Price that any Change not objected to by the Contractor represents.

- 39.2.6 Upon receipt of the Change Proposal, the Employer and the Contractor shall mutually agree upon all matters therein contained. Within 14 days after such agreement, the Employer shall, if it intends to proceed with the Change, issue the Contractor with a Change Order.

If the Employer is unable to reach a decision within 14 days, it shall notify the Contractor with details of when the Contractor can expect a decision.

If the Employer decides not to proceed with the Change for whatever reason, it shall, within the said period of 14 days, notify the Contractor accordingly. Under such circumstances, the Contractor shall be entitled to reimbursement of all costs reasonably incurred by it in the preparation of the Change Proposal, provided that these do not exceed the amount given by the Contractor in its Estimate for Change Proposal submitted in accordance with GCC Subclause 39.2.2.

- 39.2.7 If the Employer and the Contractor cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Completion, or any other matters identified in the Change Proposal, the Employer may nevertheless instruct the Contractor to proceed with the Change by issue of a "Pending Agreement Change Order."

Upon receipt of a Pending Agreement Change Order, the Contractor shall immediately proceed with effecting the Changes covered by such Order. The parties shall thereafter attempt to reach agreement on the outstanding issues under the Change Proposal.

If the parties cannot reach agreement within 60 days from the date of issue of the Pending Agreement Change Order, then the matter may be referred to the Dispute Board in accordance with the provisions of GCC Subclause 45.3.

39.3 Changes Originating from Contractor

- 39.3.1 If the Contractor proposes a Change pursuant to GCC Subclause 39.1.2, the Contractor shall submit to the Project Manager a written "Application for Change Proposal," giving reasons for the proposed Change and including the information specified in GCC Subclause 39.2.1.

Upon receipt of the Application for Change Proposal, the parties

shall follow the procedures outlined in GCC Subclauses 39.2.6 and 39.2.7. However, should the Employer choose not to proceed, the Contractor shall not be entitled to recover the costs of preparing the Application for Change Proposal.

40. Extension of Time for Completion

40.1 The Time(s) for Completion specified in the SCC shall be extended if the Contractor is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following:

- (a) any Change in the Facilities as provided in GCC Clause 39;
- (b) any occurrence of Force Majeure as provided in GCC Clause 37, unforeseen conditions as provided in GCC Clause 35, or other occurrence of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Subclause 32.2;
- (c) any suspension order given by the Employer under GCC Clause 41 hereof or reduction in the rate of progress pursuant to GCC Subclause 41.2; or
- (d) any changes in laws and regulations as provided in GCC Clause 36; or
- (e) any default or breach of the Contract by the Employer, or any activity, act or omission of the Employer, or the Project Manager, or any other contractors employed by the Employer; or
- (f) any other matter specifically mentioned in the Contract; or
- (g) any delay on the part of a sub-contractor, provided such delay is due to a cause for which the Contractor himself would have been entitled to an extension of time under this Subclause

by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.

40.2 Except where otherwise specifically provided in the Contract, the Contractor shall submit to the Project Manager a notice of a claim for an extension of the Time for Completion, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after receipt of such notice and supporting particulars of the claim, the Employer and the Contractor shall agree upon the period of such extension. In the event that the Contractor does not accept the Employer's estimate of a fair and reasonable time extension, the Contractor shall be entitled to refer the matter to a Dispute Board, pursuant to GCC Subclause 45.3.

40.3 The Contractor shall at all times use its reasonable efforts to minimize any delay in the performance of its obligations under the Contract.

In all cases where the Contractor has given a notice of a claim for an extension of time under GCC 40.2, the Contractor shall consult with the Project Manager in order to determine the steps (if any) which can be taken to overcome or minimize the actual or anticipated delay. The Contractor shall there after comply with all reasonable instructions,

which the Project Manager shall give in order to minimize such delay. If compliance with such instructions shall cause the Contractor to incur extra costs and the Contractor is entitled to an extension of time under GCC 40.1, the amount of such extra costs shall be added to the Contract Price.

41. Suspension

- 41.1 The Employer may request the Project Manager, by notice to the Contractor, to order the Contractor to suspend performance of any or all of its obligations under the Contract. Such notice shall specify the obligation of which performance is to be suspended, the effective date of the suspension and the reasons therefor. The Contractor shall thereupon suspend performance of such obligation, except those obligations necessary for the care or preservation of the Facilities, until ordered in writing to resume such performance by the Project Manager.

If, by virtue of a suspension order given by the Project Manager, other than by reason of the Contractor's default or breach of the Contract, the Contractor's performance of any of its obligations is suspended for an aggregate period of more than 90 days, then at any time thereafter and provided that at that time such performance is still suspended, the Contractor may give a notice to the Project Manager requiring that the Employer shall, within 28 days of receipt of the notice, order the resumption of such performance or request and subsequently order a change in accordance with GCC Clause 39, excluding the performance of the suspended obligations from the Contract.

If the Employer fails to do so within such period, the Contractor may, by a further notice to the Project Manager, elect to treat the suspension, where it affects a part only of the Facilities, as a deletion of such part in accordance with GCC Clause 39 or, where it affects the whole of the Facilities, as termination of the Contract under GCC Subclause 42.1.

- 41.2 If
- (a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the Appendix (Terms and Procedures of Payment) to the Contract Agreement, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Subclause 12.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, or fails to remedy the breach or take steps to remedy the breach within 14 days after receipt of the Contractor's notice; or
 - (b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas in accordance with GCC Subclause 10.2, or failure to obtain any governmental permit

necessary for the execution and/or completion of the Facilities,
then the Contractor may by 14 days' notice to the Employer suspend performance of all or any of its obligations under the Contract, or reduce the rate of progress.

- 41.3 If the Contractor's performance of its obligations is suspended, or the rate of progress is reduced pursuant to this GCC Clause 41, then the Time for Completion shall be extended in accordance with GCC Subclause 40.1, and any and all additional costs or expenses incurred by the Contractor as a result of such suspension or reduction shall be paid by the Employer to the Contractor in addition to the Contract Price, except in the case of suspension order or reduction in the rate of progress by reason of the Contractor's default or breach of the Contract.
- 41.4 During the period of suspension, the Contractor shall not remove from the Site any Plant, any part of the Facilities or any Contractor's Equipment, without the prior written consent of the Employer.

42. Termination

42.1 Termination for Employer's Convenience

42.1.1 The Employer may at any time terminate the Contract for any reason by giving the Contractor a notice of termination that refers to this GCC Subclause 42.1.

42.1.2 Upon receipt of the notice of termination under GCC Subclause 42.1.1, the Contractor shall, either immediately or upon the date specified in the notice of termination,

- (a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition;
- (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) (ii) below;
- (c) remove all Contractor's Equipment from the Site, repatriate the Contractor's and its Subcontractors' personnel from the Site, remove from the Site any wreckage, rubbish and debris of any kind, and leave the whole of the Site in a clean and safe condition; and
- (d) subject to the payment specified in GCC Subclause 42.1.3,
 - (i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination;
 - (ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors; and
 - (iii) deliver to the Employer all non-proprietary drawings, specifications and other documents prepared by the Contractor or its Subcontractors as at the date of

termination in connection with the Facilities.

42.1.3 In the event of termination of the Contract under GCC Subclause 42.1.1, the Employer shall pay to the Contractor the following amounts:

- (a) the Contract Price, properly attributable to the parts of the Facilities executed by the Contractor as of the date of termination;
- (b) the costs reasonably incurred by the Contractor in the removal of the Contractor's Equipment from the Site and in the repatriation of the Contractor's and its Subcontractors' personnel;
- (c) any amounts to be paid by the Contractor to its Subcontractors in connection with the termination of any subcontracts, including any cancellation charges;
- (d) costs incurred by the Contractor in protecting the Facilities and leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Subclause 42.1.2; and
- (e) the cost of satisfying all other obligations, commitments and claims that the Contractor may in good faith have undertaken with third parties in connection with the Contract and that are not covered by paragraphs (a) through (d) above.

42.2 Termination for Contractor's Default

42.2.1 The Employer, without prejudice to any other rights or remedies it may possess, may terminate the Contract forthwith in the following circumstances by giving a notice of termination and its reasons therefor to the Contractor, referring to this GCC Subclause 42.2:

- (a) if the Contractor becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up, other than a voluntary liquidation for the purposes of amalgamation or reconstruction, a receiver is appointed over any part of its undertaking or assets, or if the Contractor takes or suffers any other analogous action in consequence of debt;
- (b) if the Contractor assigns or transfers the Contract or any right or interest therein in violation of the provision of GCC Clause 43; and
- (c) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices, as defined in GCC Clause 6, in competing for or in executing the Contract.

42.2.2 If the Contractor

- (a) has abandoned or repudiated the Contract;
- (b) has without valid reason failed to commence work on the Facilities promptly or has suspended, other than pursuant to GCC Subclause 41.2, the progress of Contract performance for more than 28 days after receiving a written instruction from the Employer to proceed;
- (c) persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause;
- (d) refuses or is unable to provide sufficient materials, services or Labour to execute and complete the Facilities in the manner specified in the program furnished under GCC Subclause 18.2 at rates of progress that give reasonable assurance to the Employer that the Contractor can attain Completion of the Facilities by the Time for Completion as extended;

then the Employer may, without prejudice to any other rights it may possess under the Contract, give a notice to the Contractor, stating the nature of the default and requiring the Contractor to remedy the same. If the Contractor fails to remedy or to take steps to remedy the same within 14 days of its receipt of such notice, then the Employer may terminate the Contract forthwith by giving a notice of termination to the Contractor that refers to this GCC Subclause 42.2.

42.2.3 Upon receipt of the notice of termination under GCC Subclauses 42.2.1 or 42.2.2, the Contractor shall, either immediately or upon such date as is specified in the notice of termination,

- (a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition;
- (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) below;
- (c) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination;
- (d) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors; and
- (e) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection

with the Facilities.

- 42.2.4 The Employer may enter upon the Site, expel the Contractor, and complete the Facilities itself or by employing any third party. The Employer may, to the exclusion of any right of the Contractor over the same, take over and use with the payment of a fair rental rate to the Contractor, with all the maintenance costs to the account of the Employer and with an indemnification by the Employer for all liability including damage or injury to persons arising out of the Employer's use of such equipment, any Contractor's Equipment owned by the Contractor and on the Site in connection with the Facilities for such reasonable period as the Employer considers expedient for the supply and installation of the Facilities.

Upon completion of the Facilities or at such earlier date as the Employer thinks appropriate, the Employer shall give notice to the Contractor that such Contractor's Equipment will be returned to the Contractor at or near the Site and shall return such Contractor's Equipment to the Contractor in accordance with such notice. The Contractor shall thereafter without delay and at its cost remove or arrange removal of the same from the Site.

- 42.2.5 Subject to GCC Subclause 42.2.6, the Contractor shall be entitled to be paid the Contract Price attributable to the Facilities executed as of the date of termination, the value of any unused or partially used Plant on the Site, and the costs, if any, incurred in protecting the Facilities and in leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Subclause 42.2.3. Any sums due the Employer from the Contractor accruing prior to the date of termination shall be deducted from the amount to be paid to the Contractor under this Contract.

- 42.2.6 If the Employer completes the Facilities, the cost of completing the Facilities by the Employer shall be determined.

If the sum that the Contractor is entitled to be paid, pursuant to GCC Subclause 42.2.5, plus the reasonable costs incurred by the Employer in completing the Facilities, exceeds the Contract Price, the Contractor shall be liable for such excess.

If such excess is greater than the sums due the Contractor under GCC Subclause 42.2.5, the Contractor shall pay the balance to the Employer, and if such excess is less than the sums due the Contractor under GCC Subclause 42.2.5, the Employer shall pay the balance to the Contractor.

The Employer and the Contractor shall agree, in writing, on the computation described above and the manner in which any sums shall be paid.

42.3 Termination by Contractor

42.3.1 If

- (a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the Appendix (Terms and Procedures of Payment) to the Contract Agreement, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Subclause 12.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, fails to remedy the breach or take steps to remedy the breach within 14 days after receipt of the Contractor's notice; or
- (b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities;

then the Contractor may give a notice to the Employer thereof, and if the Employer has failed to pay the outstanding sum, to approve the invoice or supporting documents, to give its reasons for withholding such approval, or to remedy the breach within 28 days of such notice, or if the Contractor is still unable to carry out any of its obligations under the Contract for any reason attributable to the Employer within 28 days of the said notice, the Contractor may by a further notice to the Employer referring to this GCC Subclause 42.3.1, forthwith terminate the Contract.

42.3.2 The Contractor may terminate the Contract forthwith by giving a notice to the Employer to that effect, referring to this GCC Subclause 42.3.2, if the Employer becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, being a corporation, if a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Employer takes or suffers any other analogous action in consequence of debt.

42.3.3 If the Contract is terminated under GCC Subclauses 42.3.1 or 42.3.2, then the Contractor shall immediately

- (a) cease all further work, except for such work as may be necessary for the purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition;
- (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) (ii);
- (c) remove all Contractor's Equipment from the Site and repatriate the Contractor's and its Subcontractors'

personnel from the Site; and

- (d) subject to the payment specified in GCC Subclause 42.3.4,
 - (i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination;
 - (ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors; and
 - (iii) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.

42.3.4 If the Contract is terminated under GCC Subclauses 42.3.1 or 42.3.2, the Employer shall pay to the Contractor all payments specified in GCC Subclause 42.1.3, and reasonable compensation for all loss, except for loss of profit, or damage sustained by the Contractor arising out of, in connection with or in consequence of such termination.

42.3.5 Termination by the Contractor pursuant to this GCC Subclause 42.3 is without prejudice to any other rights or remedies of the Contractor that may be exercised in lieu of or in addition to rights conferred by GCC Subclause 42.3.

42.4 In this GCC Clause 42, the expression "Facilities executed" shall include all work executed, Installation Services provided, and all Plant acquired, or subject to a legally binding obligation to purchase, by the Contractor and used or intended to be used for the purpose of the Facilities, up to and including the date of termination.

42.5 In this GCC Clause 42, in calculating any monies due from the Employer to the Contractor, account shall be taken of any sum previously paid by the Employer to the Contractor under the Contract, including any advance payment paid pursuant to the Appendix (Terms and Procedures of Payment) to the Contract Agreement.

43. Assignment

43.1 Neither the Employer nor the Contractor shall, without the express prior written consent of the other party which consent shall not be unreasonably withheld, assign to any third party the Contract or any part thereof, or any right, benefit, obligation or interest therein or thereunder, except that the Contractor shall be entitled to assign either absolutely or by way of charge any monies due and payable to it or that may become due and payable to it under the Contract.

I. Claims, Disputes, and Arbitration

44. Contractor's

44.1 If the Contractor considers himself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause

Claims

of these Conditions or otherwise in connection with the Contract, the Contractor shall submit a notice to the Project Manager, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 28 days after the Contractor became aware, or should have become aware, of the event or circumstance.

If the Contractor fails to give notice of a claim within such period of 28 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Subclause shall apply.

The Contractor shall also submit any other notices, which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Project Manager. Without admitting the Employer's liability, the Project Manager may, after receiving any notice under this Subclause, monitor the record keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Project Manager to inspect all these records, and shall (if instructed) submit copies to the Project Manager.

Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Project Manager, the Contractor shall send to the Project Manager a fully detailed claim, which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect,

- (a) this fully detailed claim shall be considered as interim;
- (b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Project Manager may reasonably require; and
- (c) the Contractor shall send a final claim within 28 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Project Manager.

Within 42 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Project Manager and approved by the Contractor, the Project Manager shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within such time.

Each payment certificate shall include such amounts for any claim as have been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

The Project Manager shall agree with the Contractor or estimate: (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with GCC Clause 40, and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

The requirements of this Subclause are in addition to those of any other Subclause, which may apply to a claim. If the Contractor fails to comply with this or another Subclause in relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Subclause.

In the event that the Contractor and the Employer cannot agree on any matter relating to a claim, either party may refer the matter to the Dispute Board pursuant to GCC 45 hereof.

45. Disputes and Arbitration

45.1 Appointment of the Dispute Board

Disputes shall be referred to a Dispute Board for decision in accordance with GCC Subclause 45.3. The Parties shall appoint a Dispute Board by the date stated in the SCC.

The Dispute Board shall comprise, as stated in the SCC, either one or three suitably qualified persons ("the members"), each of whom shall be fluent in the language for communication defined in the Contract and shall be a professional experienced in the type of activities involved in the performance of the Contract and with the interpretation of contractual documents. If the number is not so stated and the Parties do not agree otherwise, the Dispute Board shall comprise three persons, one of whom shall serve as chairman.

If the Parties have not jointly appointed the Dispute Board 21 days before the date stated in the SCC and the Dispute Board is to comprise three persons, each Party shall nominate one member for the approval of the other Party. The first two members shall recommend and the Parties shall agree upon the third member, who shall act as chairman.

However, if a list of potential members is included in the SCC, the members shall be selected from those on the list, other than anyone who is unable or unwilling to accept appointment to the Dispute Board.

The agreement between the Parties and either the sole member or each of the three members shall incorporate by reference the General Conditions of Dispute Board Agreement contained in the Appendix to these General Conditions, with such amendments as are agreed

between them.

The terms of the remuneration of either the sole member or each of the three members, including the remuneration of any expert whom the Dispute Board consults, shall be mutually agreed upon by the Parties when agreeing the terms of appointment of the member or such expert (as the case may be). Each Party shall be responsible for paying one-half of this remuneration.

If a member declines to act or is unable to act as a result of death, disability, resignation or termination of appointment, a replacement shall be appointed in the same manner as the replaced person was required to have been nominated or agreed upon, as described in this Subclause.

The appointment of any member may be terminated by mutual agreement of both Parties, but not by the Employer or the Contractor acting alone. Unless otherwise agreed by both Parties, the appointment of the Dispute Board (including each member) shall expire when the Operational Acceptance Certificate has been issued in accordance with GCC Clause 25.3.

45.2 Failure to Agree Dispute Board

If any of the following conditions apply, namely:

- (a) the Parties fail to agree upon the appointment of the sole member of the Dispute Board by the date stated in the first paragraph of GCC Subclause 45.1;
- (b) either Party fails to nominate a member (for approval by the other Party) of a Dispute Board of three persons by such date;
- (c) the Parties fail to agree upon the appointment of the third member (to act as chairman) of the Dispute Board by such date; or
- (d) the Parties fail to agree upon the appointment of a replacement person within 42 days after the date on which the sole member or one of the three members declines to act or is unable to act as a result of death, disability, resignation, or termination of appointment;

then the appointing entity or official named in the SCC shall, upon the request of either or both of the Parties and after due consultation with both Parties, appoint this member of the Dispute Board. This appointment shall be final and conclusive. Each Party shall be responsible for paying one-half of the remuneration of the appointing entity or official.

45.3 Obtaining Dispute Board's Decision

If a dispute (of any kind whatsoever) arises between the Parties in connection with the performance of the Contract, including any dispute as to any certificate, determination, instruction, opinion or valuation of the Project Manager, either Party may refer the dispute in writing to the Dispute Board for its decision, with copies to the other Party and the

Project Manager. Such reference shall state that it is given under this Subclause.

For a Dispute Board of three persons, the Dispute Board shall be deemed to have received such reference on the date when it is received by the chairman of the Dispute Board.

Both Parties shall promptly make available to the Dispute Board all such additional information, further access to the Site, and appropriate facilities, as the Dispute Board may require for the purposes of making a decision on such dispute. The Dispute Board shall be deemed to be not acting as arbitrator(s).

Within 84 days after receiving such reference, or within such other period as may be proposed by the Dispute Board and approved by both Parties, the Dispute Board shall give its decision, which shall be reasoned and shall state that it is given under this Subclause. The decision shall be binding on both Parties, who shall promptly give effect to it unless and until it shall be revised in an amicable settlement or an arbitral award as described below. Unless the Contract has already been abandoned, repudiated or terminated, the Contractor shall continue to proceed with the performance of the Facilities in accordance with the Contract.

If either Party is dissatisfied with the Dispute Board's decision, then either Party may, within 28 days after receiving the decision, give notice to the other Party of its dissatisfaction and intention to commence arbitration. If the Dispute Board fails to give its decision within the period of 84 days (or as otherwise approved) after receiving such reference, then either Party may, within 28 days after this period has expired, give notice to the other Party of its dissatisfaction and intention to commence arbitration.

In either event, this notice of dissatisfaction shall state that it is given under this Subclause, and shall set out the matter in dispute and the reason(s) for dissatisfaction. Except as stated in GCC Subclauses 45.6 and 45.7, neither Party shall be entitled to commence arbitration of a dispute unless a notice of dissatisfaction has been given in accordance with this Subclause.

If the Dispute Board has given its decision as to a matter in dispute to both Parties, and no notice of dissatisfaction has been given by either Party within 28 days after it received the Dispute Board's decision, then the decision shall become final and binding upon both Parties.

45.4 Amicable Settlement

Where notice of dissatisfaction has been given under GCC Subclause 45.3 above, both Parties shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both Parties agree otherwise, arbitration may be commenced on or after the fifty-sixth day after the day on which notice of dissatisfaction and intention to commence arbitration was given, even if no attempt at amicable settlement has been made.

45.5 Arbitration

Unless settled amicably, any dispute in respect of which the Dispute Board's decision (if any) has not become final and binding shall be finally settled by international arbitration. Unless otherwise agreed by both Parties,

- (a) arbitration proceedings shall be conducted as stated in the Special Conditions;
- (b) if no arbitration proceedings is so stated, the dispute shall be finally settled by institutional arbitration under the Rules of Arbitration of the International Chamber of Commerce;
- (c) the dispute shall be settled by three arbitrators; and
- (d) the arbitration shall be conducted in the language for communications defined in GCC Subclause 5.3.

The arbitrator(s) shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Project Manager, and any decision of the Dispute Board, relevant to the dispute. Nothing shall disqualify the Project Manager from being called as a witness and giving evidence before the arbitrator(s) on any matter whatsoever relevant to the dispute.

Neither Party shall be limited in the proceedings before the arbitrator(s) to the evidence or arguments previously put before the Dispute Board to obtain its decision, or to the reasons for dissatisfaction given in its notice of dissatisfaction. Any decision of the Dispute Board shall be admissible in evidence in the arbitration.

Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, the Project Manager and the Dispute Board shall not be altered by reason of any arbitration being conducted during the progress of the Works.

45.6 Failure to Comply with Dispute Board's Decision

In the event that a Party fails to comply with a Dispute Board decision which has become final and binding, then the other Party may, without prejudice to any other rights it may have, refer the failure itself to arbitration under GCC Subclause 45.5. GCC Subclauses 45.3 and 45.4 shall not apply to this reference.

45.7 Expiry of Dispute Board's Appointment

If a dispute arises between the Parties in connection with the performance of the Contract, and there is no Dispute Board in place, whether by reason of the expiry of the Dispute Board's appointment or otherwise,

- (a) GCC Subclauses 45.3 and 45.4 shall not apply, and
- (b) the dispute may be referred directly to arbitration under GCC Subclause 45.5.

APPENDIX A

General Conditions of Dispute Board Agreement

1 Definitions

Each "Dispute Board Agreement" is a tripartite agreement by and between

- (a) the "Employer";
- (b) the "Contractor"; and
- (c) the "Member" who is defined in the Dispute Board Agreement as being
 - (i) the sole member of the "Dispute Board" and, where this is the case, all references to the "Other Members" do not apply; or
 - (ii) one of the three persons who are jointly called the "Dispute Board" and, where this is the case, the other two persons are called the "Other Members".

The Employer and the Contractor have entered (or intend to enter) into a contract, which is called the "Contract" and is defined in the Dispute Board Agreement, which incorporates this Appendix. In the Dispute Board Agreement, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract.

2 General Provisions

Unless otherwise stated in the Dispute Board Agreement, it shall take effect on the latest of the following dates:

- (a) the Commencement Date defined in the Contract;
- (b) when the Employer, the Contractor and the Member have each signed the Dispute Board Agreement; or
- (c) when the Employer, the Contractor and each of the Other Members (if any) have respectively each signed a dispute board agreement.

This employment of the Member is a personal appointment. At any time, the Member may give not less than 70 days' notice of resignation to the Employer and to the Contractor, and the Dispute Board Agreement shall terminate upon the expiry of this period.

3 Warranties

The Member warrants and agrees that he/she is and shall be impartial and independent of the Employer, the Contractor and the Project Manager. The Member shall promptly disclose, to each of them and to the Other Members (if any), any fact or circumstance which might appear inconsistent with his/her warranty and agreement of impartiality and independence.

When appointing the Member, the Employer and the Contractor relied upon the Member's representations that he/she is

- (a) experienced in the work, which the Contractor is to carry out under the Contract,
- (b) experienced in the interpretation of contract documentation, and
- (c) fluent in the language for communications defined in the Contract.

4 General Obligations of the Member

The Member shall

- (a) have no interest financial or otherwise in the Employer, the Contractor or the Project Manager, nor any financial interest in the Contract except for payment under the Dispute Board Agreement;
- (b) not previously have been employed as a consultant or otherwise by the Employer, the Contractor, or the Project Manager, except in such circumstances as were disclosed in writing to the Employer and the Contractor before they signed the Dispute Board Agreement;
- (c) have disclosed in writing to the Employer, the Contractor, and the Other Members (if any), before entering into the Dispute Board Agreement and to his/her best knowledge and recollection, any professional or personal relationships with any director, officer, or employee of the Employer, the Contractor, or the Project Manager, and any previous involvement in the overall project of which the Contract forms part;
- (d) not, for the duration of the Dispute Board Agreement, be employed as a consultant or otherwise by the Employer, the Contractor, or the Project Manager, except as may be agreed in writing by the Employer, the Contractor, and the Other Members (if any);
- (e) comply with the annexed procedural rules and with GCC Subclause 45.3;
- (f) not give advice to the Employer, the Contractor, the Employer's Personnel, or the Contractor's Personnel concerning the conduct of the Contract, other than in accordance with the annexed procedural rules;
- (g) not while a Member enter into discussions or make any agreement with the Employer, the Contractor, or the Project Manager regarding employment by any of them, whether as a consultant or otherwise, after ceasing to act under the Dispute Board Agreement;
- (h) ensure his/her availability for all site visits and hearings as are necessary;
- (i) become conversant with the Contract and with the progress of the Facilities (and of any other parts of the project of which the Contract forms part) by studying all documents received, which shall be maintained in a current working file;
- (j) treat the details of the Contract and all the Dispute Board's activities and hearings as private and confidential, and not publish or disclose them without the prior written consent of the Employer, the Contractor, and the Other Members (if any); and
- (k) be available to give advice and opinions on any matter relevant to the Contract when requested by both the Employer and the Contractor, subject to the agreement of the Other Members (if any).

5 General Obligations of the Employer and the Contractor

The Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel shall not request advice from or consultation with the Member regarding the Contract, otherwise than in the normal course of the Dispute Board's activities under the Contract and the Dispute Board Agreement. The Employer and the Contractor shall be responsible for compliance with this provision, by the Employer's Personnel and the Contractor's Personnel respectively.

The Employer and the Contractor undertake to each other and to the Member that the Member shall not, except as otherwise agreed in writing by the Employer, the Contractor, the Member and the Other Members (if any)

- (a) be appointed as an arbitrator in any arbitration under the Contract;
- (b) be called as a witness to give evidence concerning any dispute before arbitrator(s) appointed for any arbitration under the Contract; or
- (c) be liable for any claims for anything done or omitted in the discharge or purported discharge of the Member's functions, unless the act or omission is shown to have been in bad faith.

The Employer and the Contractor hereby jointly and severally indemnify and hold the Member harmless against and from claims from which he is relieved from liability under the preceding paragraph.

Whenever the Employer or the Contractor refers a dispute to the Dispute Board under GCC Subclause 45.3, which will require the Member to make a site visit and attend a hearing, the Employer or the Contractor shall provide appropriate security for a sum equivalent to the reasonable expenses to be incurred by the Member. No account shall be taken of any other payments due or paid to the Member.

6 Payment

The Member shall be paid as follows, in the currency named in the Dispute Board Agreement:

- (a) a retainer fee per calendar month, which shall be considered as payment in full for
 - (i) being available on 28 days' notice for all site visits and hearings;
 - (ii) becoming and remaining conversant with all project developments and maintaining relevant files;
 - (iii) all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and
 - (iv) all services performed hereunder except those referred to in sub-paragraphs (b) and (c) of this Clause.

The retainer fee shall be paid with effect from the last day of the calendar month in which the Dispute Board Agreement becomes effective; until the last day of the calendar month in which the Taking-Over Certificate is issued for the whole of the Works.

With effect from the first day of the calendar month following the month in which Taking-Over Certificate is issued for the whole of the Works, the retainer fee shall be reduced by one-third.

This reduced fee shall be paid until the first day of the calendar month in which the Member resigns or the Dispute Board Agreement is otherwise terminated.

- (b) a daily fee, which shall be considered as payment in full for
 - (i) each day or part of a day up to a maximum of 2 days' travel time in each direction for the journey between the Member's home and the site, or another location of a meeting with the Other Members (if any);
 - (ii) each working day on site visits, hearings, or preparing decisions; and
 - (iii) each day spent reading submissions in preparation for a hearing.
- (c) all reasonable expenses, including necessary travel expenses (air fare in less than first class, hotel and subsistence and other direct travel expenses) incurred in connection with the Member's duties, as well as the cost of telephone calls, courier charges, facsimiles, and telexes, and use of the internet: a receipt shall be required for each item in excess of 5% of the daily fee referred to in sub-paragraph (b) of this Clause;
- (d) any taxes properly levied in the Country on payments made to the Member (unless a national or permanent resident of the Country) under this Clause 6.

The retainer and daily fees shall be as specified in the Dispute Board Agreement. Unless it specifies otherwise, these fees shall remain fixed for the first 24 calendar months, and shall thereafter be adjusted by agreement between the Employer, the Contractor and the Member, at each anniversary of the date on which the Dispute Board Agreement became effective.

If the parties fail to agree on the retainer fee or the daily fee, the appointing entity or official named in the SCC shall determine the amount of the fees to be used.

The Member shall submit invoices for payment of the monthly retainer and air fares quarterly in advance. Invoices for other expenses and for daily fees shall be submitted following the conclusion of a site visit or hearing. All invoices shall be accompanied by a brief description of activities performed during the relevant period and shall be addressed to the Contractor.

The Contractor shall pay each of the Member's invoices in full within 56 calendar days after receiving each invoice and shall apply to the Employer (in the Statements under the Contract) for reimbursement of one-half of the amounts of these invoices. The Employer shall then pay the Contractor in accordance with the Contract.

If the Contractor fails to pay to the Member the amount to which he/she is entitled under the Dispute Board Agreement, the Employer shall pay the amount due to the Member and any other amount which may be required to maintain the operation of the Dispute Board; and without prejudice to the Employer's rights or remedies. In addition to all other rights arising from this default, the Employer shall be entitled to reimbursement of all sums paid in excess of one-half of these payments, plus all costs of recovering these sums and financing charges calculated at the rate specified in accordance with GCC Subclause 12.3.

If the Member does not receive payment of the amount due within 70 days after submitting a valid invoice, the Member may (i) suspend his/her services (without notice) until the payment is received, and/or (ii) resign his/her appointment by giving notice under Clause 7.

7 Termination

At any time: (i) the Employer and the Contractor may jointly terminate the Dispute Board Agreement by giving 42 days' notice to the Member, or (ii) the Member may resign as provided for in Clause 2.

If the Member fails to comply with the Dispute Board Agreement, the Employer and the Contractor may, without prejudice to their other rights, terminate it by notice to the Member. The notice shall take effect when received by the Member.

If the Employer or the Contractor fails to comply with the Dispute Board Agreement, the Member may, without prejudice to his other rights, terminate it by notice to the Employer and the Contractor. The notice shall take effect when received by them both.

Any such notice, resignation and termination shall be final and binding on the Employer, the Contractor and the Member. However, a notice by the Employer or the Contractor, but not by both, shall be of no effect.

8 Default of the Member

If the Member fails to comply with any of his obligations under Clause 4 concerning his impartiality or independence in relation to the Employer or the Contractor, he/she shall not be entitled to any fees or expenses hereunder and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses received by the Member and the Other Members (if any), for proceedings or decisions (if any) of the Dispute Board which are rendered void or ineffective by the said failure to comply.

9 Disputes

Any dispute or claim arising out of or in connection with this Dispute Board Agreement, or the breach, termination or invalidity thereof, shall be finally settled by institutional arbitration. If no other arbitration institute is agreed, the arbitration shall be conducted under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with these Rules of Arbitration.

Annex - DISPUTE BOARD GUIDELINES

1. Unless otherwise agreed by the Employer and the Contractor, the Dispute Board shall visit the site at intervals of not more than 140 days, including times of critical construction events, at the request of either the Employer or the Contractor. Unless otherwise agreed by the Employer, the Contractor, and the Dispute Board, the period between consecutive visits shall not be less than 70 days, except as required to convene a hearing as described below.
2. The timing of and agenda for each site visit shall be as agreed jointly by the Dispute Board, the Employer, and the Contractor, or in the absence of agreement, shall be decided by the Dispute Board. The purpose of site visits is to enable the Dispute Board to become and remain acquainted with the progress of the Works and of any actual or potential problems or claims, and, as far as reasonable, to prevent potential problems or claims from becoming disputes.
3. Site visits shall be attended by the Employer, the Contractor, and the Project Manager and shall be coordinated by the Employer in cooperation with the Contractor. The Employer shall ensure the provision of appropriate conference facilities and secretarial and copying services. At the conclusion of each site visit and before leaving the site, the Dispute Board shall prepare a report on its activities during the visit and shall send copies to the Employer and the Contractor.
4. The Employer and the Contractor shall furnish to the Dispute Board one copy of all documents which the Dispute Board may request, including Contract documents, progress reports, variation instructions, certificates, and other documents pertinent to the performance of the Contract. All communications between the Dispute Board and the Employer or the Contractor shall be copied to the other Party. If the Dispute Board comprises three persons, the Employer and the Contractor shall send copies of these requested documents and these communications to each of these persons.
5. If any dispute is referred to the Dispute Board in accordance with GCC Subclause 45.3, the Dispute Board shall proceed in accordance with GCC Subclause 45.3 and these Guidelines. Subject to the time allowed to give notice of a decision and other relevant factors, the Dispute Board shall
 - (a) act fairly and impartially as between the Employer and the Contractor, giving each of them a reasonable opportunity of putting his case and responding to the other's case; and
 - (b) adopt procedures suitable to the dispute, avoiding unnecessary delay or expense.
6. The Dispute Board may conduct a hearing on the dispute, in which event it will decide on the date and place for the hearing and may request that written documentation and arguments from the Employer and the Contractor be presented to it prior to or at the hearing.
7. Except as otherwise agreed in writing by the Employer and the Contractor, the Dispute Board shall have power to adopt an inquisitorial procedure, to refuse admission to hearings or audience at hearings to any persons other than representatives of the Employer, the Contractor, and the Project Manager, and to proceed in the absence of any party who the Dispute Board is satisfied received notice of the hearing; but shall have discretion to decide whether and to what extent this power may be exercised.
8. The Employer and the Contractor empower the Dispute Board, among other things, to
 - (a) establish the procedure to be applied in deciding a dispute;

- (b) decide upon the Dispute Board's own jurisdiction, and as to the scope of any dispute referred to it;
 - (c) conduct any hearing as it thinks fit, not being bound by any rules or procedures other than those contained in the Contract and these Guidelines;
 - (d) take the initiative in ascertaining the facts and matters required for a decision;
 - (e) make use of its own specialist knowledge, if any;
 - (f) decide upon the payment of financing charges in accordance with the Contract;
 - (g) decide upon any provisional relief such as interim or conservatory measures;
 - (h) open up, review and revise any certificate, decision, determination, instruction, opinion or valuation of the Project Manager, relevant to the dispute; and
 - (i) appoint, should the Dispute Board so consider necessary and the Parties agree, a suitable expert at the cost of the Parties to give advice on a specific matter relevant to the dispute.
9. The Dispute Board shall not express any opinions during any hearing concerning the merits of any arguments advanced by the Parties. Thereafter, the Dispute Board shall make and give its decision in accordance with GCC Subclause 45.3, or as otherwise agreed by the Employer and the Contractor in writing. If the Dispute Board comprises three persons
- (a) it shall convene in private after a hearing, in order to have discussions and prepare its decision;
 - (b) it shall endeavour to reach a unanimous decision: if this proves impossible the applicable decision shall be made by a majority of the Members, who may require the minority Member to prepare a written report for submission to the Employer and the Contractor; and
 - (c) if a Member fails to attend a meeting or hearing, or to fulfil any required function, the other two Members may nevertheless proceed to make a decision, unless
 - (i) either the Employer or the Contractor does not agree that they do so, or
 - (ii) the absent Member is the chairman and he/she instructs the other Members to not make a decision.

Section 8 - Special Conditions of Contract

The following Special Conditions of Contract (SCC) shall supplement the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC. The clause number of the SCC is the corresponding clause number of the GCC.

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1.	Sub Clause 1.1	<p>Definitions</p> <p>The Employer is: Jaipur Metro Rail Corporation (JMRC) and its legal successors or permitted assigns.</p> <p>The Project Manager/Engineer is: Authorized Officer of DMRC</p> <p>The Bank is : Asian Development Bank</p> <p>Country of Origin: As per list of Eligible countries defined in section-5</p>
2.	Sub Clause 5.1	<p>Law and Language</p> <p>The Contract shall be interpreted in accordance with the laws of: India</p>
	Sub Clause 5.2	<p>The ruling language is: English</p>
	Sub Clause 5.3	<p>The language for communications is: English</p>
3.	Sub Clause 7.3	<p>Scope of Facilities</p> <p>The Contractor agrees to supply spare parts for a period of years: Two Years of Defect Liability Period</p> <p>The Contractor shall carry sufficient inventories to ensure an ex-stock supply of consumable spares for the Plant. In addition, in the event of termination of the production of spare parts, advance notification will be made to the Employer of the pending termination, with sufficient time to permit the Employer to procure the needed requirement. Following such termination, the Contractor will furnish to the extent possible and at no cost to the Employer the blueprints, drawings and specifications of the spare parts, if requested.</p> <p>The Contractor shall supply spare parts as per the Employers requirement.</p> <p>1.1 (a) The Contractor shall submit a schedule of spare parts duly indicating, for each item of spares, its description, part number, drawing number, lead time, shelf life and number of units required for the system during the first ten years, principal as well as secondary sources of supply, and also the unit price with escalation/de-escalation clause.</p> <p>1.2 (b) The Employer may, during a period of ten years from the date of taking-over of the whole of the Works, purchase as many parts as required by him, at the rates indicated in the pricing document and accepted by the Employer.</p> <p>1.3 (c) If during the period of ten years, the Contractor intends to discontinue the manufacture of spare or replacement parts for the any equipment / Machine the Contractor shall immediately give notice to the Employer of such intention. The Employer shall be given the opportunity of</p>

		<p>ordering at reasonable prices such quantities of such spare or replacement parts as the Employer requires in relation to the anticipated life of the equipment.</p> <p>In the event of Contractor failing to supply the spare parts in accordance with this Clause, he shall in respect of each item of spare, furnish free of cost to the Employer, the drawings, specifications, patterns and other information to enable the Employer to make or have made such spare parts. The Employer shall be entitled to retain the aforesaid drawings etc., for such time only as is necessary for the exercise by the Employer of his rights under this clause and the drawings, if the Contractor so requires, shall be returned by the Employer to the Contractor in good order and condition (fair wear and tear excepted).</p> <p>Under such circumstances, the Contractor shall also grant to the Employer, without payment of any royalty or charge, full right and liberty to make or have made spare or replacement parts as aforesaid and for such purposes only to use, make and have made copies of all drawings, patterns, specifications and other information supplied by the Contractor to the Employer pursuant to the Contract.</p> <p>The Contractor will so far as it is reasonably able to bind his sub-contractors to conform with the requirements of this Clause and shall, prior to entry into any sub-contracts, provide the Employer with full details of any sub-contractor who will not so conform in which event the Employer may direct the Contractor to seek an alternative sub-contractor.</p> <p>If the Contractor fails to provide spare or replacement parts as described in this Sub-clause and these are available from the Contractor's sub-contractor, the Employer shall have the right to obtain such spare and replacement parts from the sub-contractor or any other supplier and any additional cost incurred by the Employer shall be recoverable from the Contractor.</p> <p>(d) The Employer may require the Contractor to enter into a Maintenance Contract with the Employer for the System / Machine provided under the Contract under terms and conditions to be mutually agreed.</p>
4.	Sub Clause 8.1	<p>Time for Commencement and Completion</p> <p>The Contractor shall commence work on the Facilities within 7 days</p>

		from the date of issue of Letter of Acceptance (LOA).
	Sub Clause 8.2	The Time for Completion of the whole of the Facilities shall be as per Key dates defined in the Bid Documents Section 9 (Appendix 4).
5.	Sub Clause 10.	<p>Employer's Responsibilities</p> <p>The following responsibilities are also of employer:</p> <p>The Engineer may from time to time assign duties and delegate authority to assistants, and may also revoke such assignment or delegation. These assistants may include a resident engineer, Project Manager, and/or independent inspectors appointed to inspect and/or test items of Plant and/or Materials. The assignment, delegation or revocation shall be in writing and shall not take effect until copies have been received by both Parties.</p> <p>Assistants shall be suitably qualified persons, who are competent to carry out these duties and exercise this authority, and who are fluent in the language for communications defined in Clause 2 of SCC.</p> <p>Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorised to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by an assistant, in accordance with the delegation, shall have the same effect as though the act had been an act of the Engineer. However:</p> <ul style="list-style-type: none"> (a) any failure to disapprove any work, Plant or Materials shall not constitute approval, and shall therefore not prejudice the right of the Engineer to reject the work, Plant or Materials; (b) if the Contractor questions any determination or instruction of an assistant, the Contractor may refer the matter to the Engineer, who shall promptly confirm, reverse or vary the determination or instruction <p>In addition to the duties mentioned in General Conditions of Contract, the Engineer:</p> <ul style="list-style-type: none"> (a) Shall watch and inspect the Works, monitor the test results and examine any material to be used and workmanship employed by the Contractor in connection with the Works; (b) Shall carry out such duties and exercise such powers vested in the Engineer in accordance with the provisions of the Contract; (c) Shall issue instructions which in his opinion are necessary for the execution of the Works; and (d) May issue any other instruction which in his opinion is desirable in connection with the Works. <p>Notwithstanding the obligation, as set out above to obtain approval, if</p>

		<p>in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he may, without reliving the Contractor of any of his duties and responsibility under the Contract, instruct the contractor to execute all such work or to do all such things as may, in the opinion of the engineer, be necessary to abate or reduce the risk. The contractor shall forthwith comply, despite the absence of approval of the Employer, with any such instruction of Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with variation clause and shall notify the Contractor accordingly, with a copy to the Employer.</p> <p>In case The Engineer is employee of any agency hired by the Employer, the Engineer shall take the approval of the Employer for all technical and financial matters otherwise he shall be considered deemed to have taken the approval of the Employer.</p>
6.	Sub Clause 11.1	<p>Contract Price</p> <p>The Contract Price shall be as specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement as given in Section 9.</p> <p>The rates and prices quoted in the Bill of Quantities shall be quoted separately in the following currencies:</p> <ol style="list-style-type: none"> a) For inputs to the Works, which are expected to be supplied from within India, in Indian Rupees. b) For those inputs to the Works, which are expected to be supplied from outside India, in foreign currencies. <p>1.4 The Contract Price shall not be adjusted on account of fluctuations in the rates of exchange between the foreign currencies of the Contract and Indian Rupees.</p> <p>1.5 The Bidder is required to note the following while quoting his prices:-</p> <p>1.6 As this project is funded by Asian Development Bank (ADB), the project is governed by the following exemptions.</p> <p>A. Custom Duty and Excise Duty</p> <ol style="list-style-type: none"> a) The project is eligible for exemption of custom duty as per notification no. 84/97-customs dated 11.11.1997, as amended by notification no. 85/99-cus. Dated 06.07.1999 and no. 119/99-cus. Dated 02.11.1999 and notification no. 75/2001 dated 0-07-01 and notification no. 107/2001-cus. Dated 12.10.2001 b) The project is eligible for exemption of Excise duty as per notification no. 108/95- CE, dated 28.08.1995, as amended vide central excise notification no. 7/98-CE, dated

		<p>02.06.1998; 33/98-CE, dated 13.10.1998; 4/99- CE dated 11.02.1999 and 40/99- CE, dated 02.11.1999.</p> <p>1.7 Note: 1. Amendments to above notifications, if any, up to the date 28 days prior to the deadline for submission of bids shall also be deemed to be taken into consideration in the Contract Price. The copy of above notification is attached as Annexure-I to the SCC.</p> <p>1.8 Note: 2. In order to seek exemptions of Custom Duty and/or Excise Duty the JMRC shall issue the required certificates for the project on the request of the contract.</p> <p>B. VAT, Rajasthan Entry Tax and Service Tax :-</p> <p>Bidder to note that as per the following Notifications of Government of Rajasthan, Rajasthan Value Added Tax and Rajasthan Entry Tax on certain goods are exempted for this Contract and Bidder shall take into consideration these exemptions in their Contract Price:</p> <p>1. Rajasthan Tax on Entry of Goods into Local Areas Act, 1999:</p> <p>a. Notification No. F.12 (100)FD/Tax/10-81 dated 6th October 2010 issued by Finance Department (Tax Division) of Government of Rajasthan.</p> <p>i. Amendment No. F.12(100)FD/Tax/10-76 dated 08th December 2011</p> <p>ii. Amendment No. F.12(100)FD/Tax/2010-10 dated 17th April 2013</p> <p>2. Rajasthan Value Added Tax Act. 2003</p> <p>a. Notification No. F.12 (100)FD/Tax/10-78 dated 6th October 2010 issued by Finance Department (Tax Division) of Government of Rajasthan.</p> <p>i. Amendment No. F.12(100)FD/Tax/10-73 dated 08th December 2011</p> <p>ii. Amendment No. F.12(100)FD/Tax/10-11 dated 24th April 2013</p> <p>iii. Amendment No. F.12(79)FD/Tax/2014-Pt-I-151 dated 08th Feb 2016</p> <p>b. Notification No. F.12 (100)FD/Tax/10-79 dated 6th October 2010 issued by Finance Department (Tax Division) of Government of Rajasthan.</p> <p>i. Amendment No. F.12(100)FD/Tax/10-74 dated 08th December 2011</p>
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		<p>c. Notification No. F.12(63)FD/Tax/2005-81 dated 08th August 2006 issued by Finance Department (Tax Division) of Government of Rajasthan.</p> <p>i. Amendment No. F.12(100)FD/Tax/10-80 dated 06th October 2010</p> <p>ii. Amendment No.F.12(100)FD/Tax/10-75 dated 08th December 2011</p> <p>3. Service Tax</p> <p>Exemption on construction, erection, commissioning or installation of original works pertaining to monorail or metro as per notification no. 25/2012 Service Tax dated 20.06.2012, in respect of contracts entered into on or after 1st March 2016 has been withdrawn vide notification no. 09/2016- Service Tax, dated 01.03.2016 w.e.f. 01.03.2016 & now the service tax is applicable on all such contracts to be executed on or after 01.03.2016. However, the abatement as available on original works may also be available as per the provisions of the Act and service tax may be leviable on 40% of total value @ 15% = 6% on gross value plus cess/surcharge etc as applicable. For the works on which abatement is not available as per applicable law, the applicable Service Tax shall be included in the Price.</p> <p>Note:1 Amendments to above notifications, if any, up to the date 28 days prior to the deadline for submission of bids shall also be deemed to be taken into consideration in the Contract Price. The copies of above notifications are attached as Annexure – I to the SCC.</p> <p>Note:2 In addition to above exemptions (Custom Duty, Excise Duty, VAT and Rajasthan Entry Tax), if any other exemptions which are available to the contractor by virtue of any notification of Govt./Local Bodies existing as on 28 days prior to the submission of the bids, may be availed by the contractor and JMRC will issue the necessary required certificates for availing such exemptions on the request of the contractor.</p> <p>C. Bid Evaluation:-</p> <p>1. The bidders shall quote fix lump sum price or as per BOQ price (as the case may be) inclusive of all taxes, levies, duties, cess, freight, insurance and all other incidental charges required to fulfill the contract requirements including statutory deduction viz., TDS towards Income Tax T/Works Contract Tax etc., except the exemptions stated in clause A, B above to the extent the same are applicable and available.</p>
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	Sub Clause 11.2	The Contract price shall be adjusted in accordance with the provisions of Appendix-2 (Price adjustment) to the contract agreement
7.	Sub Clause 12.1	<p>Terms of Payment</p> <p>The Payments shall be made as per preamble of Bill of Quantities</p>
8.	Sub Clause 13	<p>(a) Securities</p> <p>(b) Advance Payment: - The advance shall be paid interest free against acceptable bank guarantee. Total advance payment shall be 10% of the Accepted Contract Amount. The first instalment shall be five percent (5%) payable within 21 days from the date of receipt of guarantees acceptable to the Employer. The second instalment shall be five percent (5%) payable on submission of proof of utilization of the first instalment for the works and the Employer is satisfied that the utilization has been done in purposeful manner and contractor has achieved the Key Dates of detailed Engineering and submitted the technical proposal of major equipments. Advance shall be payable in the currencies and proportions in types and proportions of the currencies mentioned BOQ.</p> <p>(c) Recovery of Advance:-</p> <p>(d) The recovery of advances shall commence when 20% of the original contract value of the work has been paid and it will be completed by the time 85% of the Contract Value has been paid or the completion date whichever is earlier. As far as possible the recovery of advances shall be limited to 30% of an account bill.</p> <p>(e) No advance shall be given after 40% of the original contract amount has been paid.</p> <p>(f) The contractor shall always have the option to have the recoveries commenced and/or completed earlier, and/or to have recoveries affected in instalments of higher amount and also to</p>

		<p>repay part or whole of the advance by direct payment rather than through on-account bills.</p> <p>(g) In case the contract is terminated due to default of the contractor or rescinded/foreclosed due to any other reason, the contractor shall return the unrecovered amount of all advances within 15 days of issue of notice of termination/ rescission/fore closer of the contract and if the contractor fails to do so due to any reason whatsoever, then interest at an interest rate equal to State Bank of India prime lending rate plus 3% per annum or 12% per annum whichever is higher shall be charged on the unrecovered amount of such advances from 16 days onwards till the same is returned by the contractor.</p>
9.	Sub Clause 13.3	<p>Performance Security</p> <p>13.3.1 The amount of performance security, as a percentage of the Contract Price for the Facility or for the part of the Facility for which a separate Time for Completion is provided, shall be 10% of the contract value in types and proportions of currencies in which the contract price is payable.</p>
		<p>13.3.2 The performance security shall be in the form of the bank guarantee as perform included in Section 9 (Contract Forms).</p>
		<p>13.3.3 The performance security shall not be reduced on the date of the Operational Acceptance. The value of Bank Guarantee can be revised "Once in a year" during the Contract period by the contractor with the consent / approval of the Employer. The reduction in the amount of Performance Security will be proportionate to the Equipment for which the DLP obligations have been completed.</p>
		<p>Forfeiture</p> <p>i. Failure of the successful Bidder to furnish the required Performance Security shall be a ground for the annulment of the award of Contract and forfeiture of the tender security.</p> <p>ii. The whole of the Performance Security amount shall be liable to be forfeited by the Employer at the discretion of the Employer, in the event of any breach of contract on the part of the Contractor.</p> <p>iii. On termination of contract due to contractor's default as per GCC Clause 42.2 the performance security shall be forfeited by encashing the bank guarantee and the balance work shall be got done independently without risk and cost of the failed contractor. The failed contractor shall be debarred from participating in the tender for executing the balance work. If the failed contractor is a JV or a partnership firm, then every member/partner of such JV or partnership firm shall be debarred from participating in the bid for the balance work either in his/her individual capacity or as a</p>

		<p>partner of any other JV/partnership firm.</p> <p>The Engineer shall not make a claim under the Performance Security except for amounts to which the JMRC is entitled under the contract (Not withstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:</p> <ul style="list-style-type: none"> a) Failure by the contractor to extend the validity of the Performance Security, in which event the Engineer may claim the full amount of the Performance Security. b) Failure by the contractor to pay JMRC any amount due, either as agreed by the contractor or determined under any or the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by Engineer. <p>The contractor being determined or rescinded under provision of the GCC the Performance Security shall be forfeited in full and shall be absolutely at the disposal of the JMRC.</p>
		<p>Release</p> <ul style="list-style-type: none"> i. On completion of the entire work, one half of the Performance Security shall be refunded to the Contractor, on issue of Completion Certificate by the Engineer, in accordance with GCC Clause 24. This shall not relieve the Contractor from his obligations and liabilities, to make good that may be detected during the Defects Liability Period. ii. The balance amount shall become due and shall be paid to the Contractor on signing of the Performance Certificate after the expiry of the final Defects Liability Period in accordance with GCC Clause 27 & SCC Clause 18.
10.		Not Used
11.	Sub Clause 19	<p>Sub-contracting</p> <ul style="list-style-type: none"> a) Contractor need to submit the technical proposal for makes as specified in the contract <p>For major sub-contracts (each costing over Rs Five Million), it will be obligatory on the part of the Contractor to obtain consent of the Employer. The Employer will give his consent after assessing and satisfying himself of the capability, experience and equipment resources of the sub-contractor. In case the Employer intends to withhold his consent, he should inform the Contractor within 21 days to enable him to make alternative arrangements to fulfill his programme.</p> <p>The Contractor shall provide sufficient superintendence, whether on the site or elsewhere, to ensure that the work to be carried out by a sub- contractor complies with the requirements of the Contract.</p>

		<p>In the case of sub-contracts for, which the Contractor intends to procure on the basis of outline design, design briefs and performance specification, the Contractor shall, prior to inviting bid from sub-contractors, submit such documents to the Engineer for review.</p> <p>The proposed sub-contract terms and conditions shall impose on the sub-contractor such terms of the Contract as are applicable and appropriate to the part of the Works to be sub-contracted, to enable the Contractor to comply with his obligations under the Contract.</p> <p>Notwithstanding any consent to sub-contract given by the Engineer, if in his opinion it is consider necessary, the Engineer shall have full authority to order the removal of any sub-contractor from the Site or off-Site place of manufacture or storage.</p> <p>b) For the subcontractor submitted at the time of bidding:-</p> <p>For the work proposed for sub contracting at the time of submission of bid (for evaluation of this contract) as per section 3 (EQC), no change in sub-contractor (submitted for the said work) shall be allowed from LOA to completion of works.</p>
12.	Sub Clause 18.3	<p>Progress Report</p> <p>(c) monitoring of the obligations in Sub-Clauses 21.1, 22.1.1, 22.2.3 (d), 22.2.7 (d), 22.2.15, 22.2.16 and 53</p>
13.	Sub Clause 20	<p>Design and Engineering</p> <p>Following shall be read in conjunction with GCC clause:</p> <p>General Obligations/Statutory Requirements</p> <p>The Design and Construction Standards shall be in conformity with the requirements of "Rules for Opening of a Railway or a Section of a Railway for Public Carriage of Passengers" and "Rules for Introduction of New Type of Rolling Stock" and to the satisfaction of the Commissioner of Railway Safety whose sanction is mandatory for commissioning of the System. The Contractor shall in this regard carry out all statutory tests and trials necessary for obtaining sanction of the competent authority for opening the system for public carriage of passengers and provide assistance and information as required by the appropriate statutory authorities in India.</p> <p>Construction and/or Manufacture Documents</p> <p>The Contractor shall submit drawings and documents, as required by the Contract, to the Engineer in accordance with any submittal schedule agreed with the Engineer. This submittal shall be made sufficiently before the Works are to be carried out to give the Engineer and the Employer reasonable time to examine the drawings or other</p>

		<p>documents, to prepare comments and for any changes to be accommodated by the Contractor.</p> <p>Where the consent of the Engineer is required, the Engineer shall notify the Contractor in writing of his decision either within such period as may expressly be stipulated in the Contract or otherwise within a reasonable time.</p> <p>If the Engineer has reasonable cause for being dissatisfied with the proposals set out in the Contractor's drawings or documents, the Engineer shall, within a period of 28 days from the date of submittal, require the Contractor in writing to make such amendments thereto as the Engineer may consider necessary. The Contractor shall make and be bound by such amendments at no additional expense to the Employer and shall resubmit the amended drawings or documents for Engineer's consent.</p> <p>Within 14 days of notification of the Engineer's consent the Contractor shall provide the Engineer with the type and number of sets of the relevant drawings or documents as stipulated in the Employer's Requirement.</p> <p>Should it be found at any time after notification of consent that the relevant drawings or documents do not comply with the Contract or do not agree with drawings or documents in relation to which the Engineer has previously notified his consent, the Contractor shall, at his own expense, make such alterations or additions as, in the opinion of the Engineer, are necessary to remedy such non-compliance or non-agreement and shall submit all such varied or amended drawings or documents for the consent of the Engineer.</p> <p>No examination by the Engineer of the drawings or documents submitted by the Contractor, nor any consent of the Engineer in relation to the same, with or without amendment, shall absolve the Contractor from any of his obligations under the Contract or any liability for or arising from such drawings or documents.</p> <p>Prior to commencement of the Tests on completion, the Contractor shall prepare, and submit to the Employers' Representative, As Built Drawings of the system and interactive Operation & Maintenance Manuals in soft copy and hard copy with Four (4) sets of each as in accordance with the Employer's Requirements and in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair the Works. The Works shall not be considered to be completed for the purposes of Completion until such Operation and Maintenance Manuals have been submitted to the Employer's Representative and received his consent.</p> <p>The interactive Operation and Maintenance Manuals and drawings submitted by the Contractor shall, if required, be updated by him during the Defects Liability Period and re-submitted and approved by the Engineer.</p>
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14.	Sub Clause 21.1	Material The Contractor shall adequately record the condition of roads, agricultural land and other infrastructure prior to the start of transporting materials, goods and equipment, and construction.
15.	Sub Clause 22.1.1	Bench Mark The Contractor shall comply with <ul style="list-style-type: none"> i) The measures and requirements relevant to the Contractor which are set forth in the Resettlement Plan ("RP") / Environmental Management Plan ("EMP") attached as Annexure – IV to the SCC, to the extent it concerns impacts on affected people during construction; and ii) Any corrective or preventive actions set out in safeguards monitoring reports that the Employer will prepare from time to time to monitor implementation of the resettlement plan
16.	Sub Clause 22.2.3	Labour laws (d) The Contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The Contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The Contractor shall provide equal wages and benefits to men and women for work of equal value or type.
17.	Sub Clause 22.2.	Installation 22.2 Labour 22.2.5 Working Hours (a) Normal working hours are: 8 Hours per day
18.	Sub Clause 22.2.7	Health and Safety (d) The Contractor shall throughout the contract (including the Defect Liability Period): <ul style="list-style-type: none"> (i) conduct Information, Education and Consultation Communication (IEC) campaigns, at least every other month, addressed to all the Site staff and labour (including all the Contractor's employees, all Sub-Contractors and Employer's and Project Manager's employees, and all truck drivers and crew making deliveries to Site for construction activities) and to the immediate local communities, concerning the risks, dangers and impact,

		<p>and appropriate avoidance behavior with respect to of Sexually Transmitted Diseases (STD)—or Sexually Transmitted Infections (STI) in general and HIV/AIDS in particular;</p> <p>(ii) provide male or female condoms for all Site staff and labour as appropriate; and</p> <p>(iii) provide for STI and HIV/AIDS screening, diagnosis, counseling and referral to a dedicated national STI and HIV/AIDS program, (unless otherwise agreed) of all Site staff and labour.</p> <p>The Contractor shall include in the program to be submitted for the execution of the Facilities under Subclause 18.2 an alleviation program for Site staff and labour and their families in respect of Sexually Transmitted Infections (STI) and Sexually Transmitted Diseases (STD) including HIV/AIDS. The STI, STD and HIV/AIDS alleviation program shall indicate when, how and at what cost the Contractor plans to satisfy the requirements of this Subclause and the related specification. For each component, the program shall detail the resources to be provided or utilized and any related sub-contracting proposed. The program shall also include provision of a detailed cost estimate with supporting documentation. Payment to the Contractor for the preparation and implementation this program shall not exceed the amount dedicated for this purpose.</p> <p>The Contractor shall conduct health and safety programs for workers employed under the project, and shall include information on the trafficking of women and the risk of sexually transmitted diseases, including HIV/AIDs in such programs.</p>
19.	Sub Clause 22.2.8	<p>Funeral Arrangements</p> <p>Funeral arrangements: The bidder shall be responsible for making funeral arrangements if required.</p>
20.	Sub Clause 22.2.16	<p>Prohibition of Harmful Child Labour</p> <p>“Child” means a child below the statutory minimum age specified under applicable national, provincial or local law of India.”</p>
21.	Sub Clause 24.9	<p>Completion of Facilities</p> <p>Upon the completion of construction, the Contractor shall fully reinstate pathways, other local infrastructure, and agricultural land to at least their pre-project condition as recorded by the Contractor in consonance with its obligation in Clause 21.1.”</p>
22.	Sub Clause 25.2.2	<p>Commissioning and Operational Acceptance</p> <p>The Guarantee Test of the Facilities shall be successfully completed within 3 months from the date of Completion.</p>

23.	Sub Clause 26.2	<p>Completion Time Guarantee</p> <p>Time is the essence of the contract and therefore if the work is delayed on account of the contractor, liquidated damage shall be recovered @ 0.01% of the contract value per one week delay of the individual KD (Key Dates). However the total liquidated damage is subjected to 10% of the contract value. The liquidated damage of 0.01% is for two stations (Choti Chaupar and Badi Chaupar) which will be distributed equally for each station and the same shall be levied only for the station (s) where key date is not achieved”.</p> <p>The liquidated damages are recovered by the Employer from the Contractor for delay and not as penalty.</p> <p>The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any sum due, or to become due, to the Contractor. In the event of an extension of time being granted, the amount due under this Sub-Clause shall be recalculated accordingly, and any over-payment refunded. The payment or deduction of such damages shall not relieve the Contractor from his obligations to complete the Works, or from any other of his duties, obligations or responsibilities under the Contract.</p> <p>The Contractor shall use and continue to use his best endeavours to avoid or reduce further delay to the Works, or any relevant Stages.</p> <p>At any time after the Employer has become entitled to liquidated damages, the Engineer may give notice to the Contractor under clause 42 of GCC requiring the Contractor to complete the Works within a specified reasonable time. Such action shall not prejudice the Employer's entitlements to recovery of liquidated damages, under this Sub-Clause and to terminate under clause 42 of GCC.</p>
24.	Sub Clause 26.3	<p>No bonus will be given for earlier Completion of the Facilities or part thereof.</p>
25.	Sub Clause 27.2	<p>Defect Liability</p> <p>Defect liability period shall be 24 months from the date of issue of Completion certificate for the facilities or any part thereof. During the Defects Liability Period the Contractor shall provide, free of cost, competent and skilled personnel and maintain adequate stock of spares so as to promptly fulfill his obligations during the Defects Liability Period as laid down in GCC and Employer's Requirements. A penalty of Rs.10000/- per day in DLP period will be imposed if major equipment (as defined in the contract documents) or any complete system is not working for more than 24 Hrs.</p> <ul style="list-style-type: none"> • Maintenance during Defects Liability Period <p>Contractor shall establish an office for the purpose with communication facility so as to facilitate communication for reporting failures and liaison with maintenance staff manning</p>

		<p>the stations round the clock. The supervisor in-charge should be provided with mobile communication facility to ensure his presence at the site immediately after reporting. Contractor shall ensure restoration /rectification/replacement, within reasonable time, to the satisfaction of Engineer. The Engineer in case of the delay as deems fit shall be empowered to carry out the maintenance at the risk and cost of the Contractor.</p> <ul style="list-style-type: none"> • Routine Maintenance Submit Monthly status report to the Engineer –in – Charge. • Repairs All equipment that requires repairing shall be immediately serviced and repaired. • Complaints The Contractor shall receive calls for any and all problems experienced in the operation of the systems, attend to these within 120 minutes of receiving the complaints and shall take steps to immediately correct any deficiencies that may exist. • Maintenance Log Book. The Contractor shall maintain a Maintenance Log Book at each Station, the format for which shall be approved by Engineer – in – charge. In the Maintenance Log book the details about date of Routine Maintenance, Routine Maintenance activities performed, Details of Call – out visit / Break – down maintenance, etc. shall be maintained. Copy of relevant pages of the Log book to be submitted to the Engineer – in – charge with the Monthly status report. • Failure Analysis Report. The Contractor shall submit a report for the Failure Analysis in the format approved by the “Engineer” giving the details of the type of fault, cause of fault, analysis of faulty component, etc correlated with the details of last preventive maintenance activity performed. The Contract shall not be considered to be completed until the Performance Certificate has been signed by the Engineer and delivered to the Contractor at the end of ‘Defect Liability Period, stating the date on which the Contractor completed his obligations related to completion of works and rectification of defects during Defect Liability Period to the Engineer's satisfaction. Only the Performance Certificate shall be deemed to constitute approval of the Works.
26.	Sub Clause 30.1	<p>Limitation of Liability</p> <p>(b) The multiplier of the Contract Price is: One</p>

27.	Sub Clause 35.3	<p>Unforeseen Conditions</p> <p>In addition to notice of any Unforeseeable physical conditions, the Contractor shall provide the Engineer with a written notice of any unanticipated environmental or resettlement risks or impacts that arise during construction, implementation or operation of the Plant or Permanent Works, which were not considered in the initial environmental examination, the environmental management plan or the resettlement plan attached as Annexure – IV to the SCC.</p>
28.	Sub Clause 39.	<p>Change in the Facilities</p> <p>Following is added to the clause 39 of GCC</p> <ul style="list-style-type: none"> i) The quantities of items shown in the Bill of Quantities are approximate, and liable to vary during the actual execution of the work. Some items/group of items may have to be altered, added or omitted. The Contractor shall be bound to carry out and complete the stipulated work as instructed by the Engineer, irrespective of the magnitude of variations including additions, alterations or omissions in the Bill of Quantities, individual items or group of items, specified in the Bill of Quantities. ii) Such variations shall be paid as follows: <ul style="list-style-type: none"> a) At the accepted rates of the Contract for Positive variation in quantities to the extent of 25%, except in the case of foundation works. Unless otherwise specifically provided for in the Bill of Quantities or elsewhere in the Contract, the variation of 25% shall be applicable to a group of items mentioned therein and not to individual items. In case of variation in quantities on minus side, contract rates will be payable for executed quantities. b) In case of foundation work, no variation limit applies and Contractor shall carry out the Work, at rates stipulated in the Contract irrespective of any variation. c) In case of earth work, the aforesaid variation limit of 25% shall apply to the gross quantity of earth work and variation in the quantity of individual classifications of soil will not be subject to this limit where any variation can take place. d) For items against which the quantity given in the Bills of Quantities is “if or as required”, there shall be no increase/decrease of rates whatever be the quantity finally executed. e) Variation in the quantity of items individually costing upto 1% of the total contract value, shall be payable at the rates stated in the Contract. notwithstanding the magnitude of variation upto 2% of the original Contract Value for each item.

		<p>f) In case the variation in individual items or the group of items as stipulated above, is more than 25% (positive or negative) , the rate for the varied quantity beyond 25% shall be negotiated between the Engineer and the Contractor and mutually agreed rates arrived at before actual execution of the extra quantity.</p> <p>g) In case Engineer introduces an item for which the Contract does not contain any rates or prices applicable to the varied Works, the rate of such items shall be derived, wherever possible, from rate for similar items available in the Bill of Quantities of the accepted Bid. In case this is not possible, the rate may be decided on the following basis:</p> <ul style="list-style-type: none"> i) Cost of Materials at current market price, as actually utilised in the final finished Permanent Works, including a reasonable percentage for wastage and transportation. ii) Cost of enabling works if any(unless provided for separately) worked out on the above basis but with less stringent quality. Specifications minus salvage value of serviceable material released after completion of work and cost of material released as scrap. iii) Cost of labour actually used at the site of work at rates under Payment of Minimum Wages Act for the area of work for each category of worker, further enhanced by a percentage of 10% of the aforesaid rates to account for labour not directly utilised at Site and other ancillary and incidental expenses on labour. iv) Hire charges for Plant & Machinery, scaffolding, shuttering, forms, etc., required to be used at the site of the work. The tools used by the various trades shall not be counted as Plant & Machinery for this purpose. v) An amount of 20% of items (i), (ii), (iii) and (iv) above to allow for Contractor's overheads, profits and corporate taxes. This percentage shall also apply to estimated cost of Materials supplied free to the Contractor. vi) In all cases where extra items of work are involved, for which there are no rates in the accepted Bill of Quantities the Contractor shall give a notice to the Engineer, of at least 7 days before the need for their execution arises. <p>h) In the event of disagreement in respect of items (f) and (g) above, the Engineer shall fix such rates of price as are, in his opinion appropriate and shall notify the Contractor</p>
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		<p>accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on account payments to the Contractor. Alternatively, in the event of disagreement, the Contractor shall have no claim to execute extra quantities/new items and the Engineer shall be free to get such additional quantities beyond 25% new items executed through any other agency. However, if the Engineer or the Employer so directs the Contractor shall be bound to carry out any such additional quantities beyond the limits stated above original quantities and or new items and the disagreement or the difference regarding rates to be paid for the same shall be settled in the manner laid down under the conditions for the settlement of dispute.</p>
29.	Sub Clause 45.1	<p>Disputes and Arbitration</p> <p>If the efforts to resolve all or any of the disputes through conciliation fails, then such disputes or differences, whatsoever arising between the parties, arising out of touching or relating to construction/manufacture, measuring operation or effect of the Contract or the breach thereof shall be referred to Arbitration in accordance with the following provisions:</p> <p>(a) Matters to be arbitrated upon shall be referred to a sole Arbitrator if the total value of the claim is upto Rs.5 million and to a panel of three Arbitrators if total value of claims is more than Rs.5 million. The Employer shall provide a panel of three arbitrators for the claims upto Rs.5 million and a panel of five Arbitrators for claims of more than Rs.5 million. The Contractor shall have to choose the sole Arbitrator from the panel of three and/or one Arbitrator from the panel of five in case three Arbitrators are to be appointed. The Employer shall also choose one Arbitrator from this panel of five and the two so chosen will choose the third arbitrator from the panel only. . The Arbitrator(s) shall be appointed within a period of 30 days from the date of receipt of written notice/ demand of appointment of Arbitrator from either party. Neither party shall be limited in the proceedings before such arbitrator(s) to the evidence or arguments put before the Engineer for the purpose of obtaining his decision. No decision given by the Engineer in accordance with the foregoing provisions shall disqualify him from being called as a witness and giving evidence before the arbitrator(s) on any matter, whatsoever, relevant to dispute or difference referred to arbitrator/s. The arbitration proceedings shall be held in Jaipur only. The language of proceedings, that of documents and communication shall be English.</p> <p>(b) The Employer at the time of offering the panel of Arbitrator(s)</p>

		<p>to be appointed as Arbitrator shall also supply the information with regard to the qualifications of the said Arbitrator nominated in the panel along with their professional experience, phone nos. and addresses to the contractor.</p> <p>(c) The award of the sole Arbitrator or the award by majority of three Arbitrators as the case may be shall be binding on all parties.</p> <p>Interest on Arbitration Award</p> <p>Where the arbitral award is for the payment of money, no interest shall be payable on whole or any part of the money for any period, till the date on which the award is made.</p> <p>Cost of Arbitration</p> <p>The cost of arbitration shall be borne by the respective parties. The cost shall, inter alia, include the fees of the arbitrator (s) as agreed by both the parties or provided under the International Arbitration Rules.</p> <p>Jurisdiction of Courts</p> <p>Where recourse to a Court is to be made in respect of any matter, the court at Jaipur shall have the exclusive jurisdiction to try all disputes between the parties.</p> <p>Suspension of Work on Account of Arbitration</p> <p>The reference to Conciliation / Arbitration shall proceed notwithstanding that the Works shall not then be or be alleged to be complete, provided always that the obligations of the Employer, Engineer and the Contractor shall not be altered by reasons of arbitration being conducted during the progress of the Works. Neither party shall be entitled to suspend the work or part of the work to which the dispute relates on account of arbitration and payments to the Contractor shall continue to be made in terms of the Contract.</p>
	Sub Clause 45.2	Appointment (if not agreed) to be made by: Employer
	Sub Clause 45.2	Rules of procedure for arbitration proceedings: As per law of the Republic of India
30.	Additional Clause	<p>Claims, Disputes and Conciliation</p> <p>(i) Procedure for Claims</p> <p>If the Contractor intends to claim any additional payment under any clause of these Conditions or otherwise, the Contractor shall give notice to the Engineer as soon as possible and in any event within 28 days of the start of the event giving rise to the claim.</p> <p>The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or</p>

		<p>at any other location acceptable to the Engineer. Without admitting the Employer's liability, the Engineer shall, on receipt of such notice, inspect such records and may instruct the Contractor to keep further contemporary records. The Contractor shall permit the Engineer to inspect all such records, and shall (if instructed) submit copies to the Engineer.</p> <p>Within 28 days of such notice, or such other time as may be agreed by the Engineer, the Contractor shall send to the Engineer an account, giving detailed particulars of the amount and basis of the claim. Where the event giving rise to the claim has a continuing effect, such amount shall be considered as interim. The Contractor shall then, at such intervals as the Engineer may reasonably require, send further interim accounts giving the accumulated amount of the claim and any further particulars. Where interim accounts are sent to the Engineer, the Contractor shall send a final account within 28 days of the end of the effects resulting from the event.</p> <p>If the Contractor fails to comply with this Sub-Clause, he shall not be entitled to claim any additional payment.</p> <p>(ii) Payment for Claims</p> <p>The Contractor shall be entitled to have included in any Interim Payment Certificate such amount for any claim as the Engineer considers due, after taking approval from the Employer. If the particulars supplied are insufficient to substantiate the whole of the claim, the Contractor shall be entitled to payment for such part of the claim as has been substantiated.</p> <p>(iii) No legal action Till Dispute Settlement Procedure is Exhausted</p> <p>Any and all Disputes shall be settled in accordance with the provisions of this clause. No action at law concerning or arising out of any Dispute shall be commenced unless and until all applicable Dispute resolution procedures set out in this clause shall have been finally exhausted in relation to that Dispute or any Dispute out of which that Dispute shall have arisen with which it may be or may have been connected.</p> <p>(iv) Notice of Dispute</p> <p>For the purpose of clause (v), a Dispute shall be deemed to arise when one party serves on the other party a notice in writing (hereinafter called a "Notice of Dispute") stating the nature of the Dispute provided that no such notice shall be served later than 28 days after the date of issue of</p>
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		<p>Performance Certificate by the Engineer.</p> <p>(v) Two Stages for Dispute Resolution</p> <p>Disputes shall be settled through two stages:</p> <ol style="list-style-type: none"> Conciliation procedures as established by "The Arbitration and Conciliation Act-1996" (as amended from time to time) and in accordance with this Clause. In the event this procedure fails to resolve the Dispute then; Arbitration procedures undertaken as provided by "The Arbitration and Conciliation Act -1996" (as amended from time to time) and in accordance with this Clause. <p>(vi) Conciliation</p> <p>Within 60 days of receipt of Notice of Dispute, either party shall refer the matter in dispute to conciliation.</p> <p>Conciliation proceedings shall be initiated within 30 days of one party inviting the other in writing to Conciliation. Conciliation shall commence when the other party accepts in writing this invitation. If the invitation is not accepted then Conciliation shall not take place. If the party initiating conciliation does not receive a reply within 30 days from the date on which he sends the invitation he may elect to treat this as a rejection of the invitation to conciliate and inform the other party accordingly.</p> <p>The Conciliator shall assist the parties to reach an amicable settlement in an independent and impartial manner.</p> <p>(vii) Conciliation Procedure</p> <p>For the purpose of conciliation in this contract, the conciliation shall be undertaken by one conciliator selected from panel of conciliators maintained by the employer, who shall be from serving or retired engineers of Government Departments, or of Public Sector Undertakings. Out of this panel, a list of three Conciliators shall be sent to the Contractor who shall choose one of them to act as Conciliator and conduct conciliation proceedings in accordance with "The Arbitration and Conciliation Act, 1996", of India.</p> <p>The Employer and the Contractor shall in good faith co-operate with the Conciliator and, in particular, shall endeavour to comply with requests by the Conciliator to submit written materials, provide evidence and attend meetings. Each party may, on his own initiative or at the invitation of the Conciliator, submit to the Conciliator suggestions for the settlement of the dispute.</p> <p>When it appears to the Conciliator that there exist elements of</p>
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		<p>a settlement which may be acceptable to the parties, he shall formulate the terms of a possible settlement and submit them to the parties for their observations. After receiving the observations of the parties, the Conciliator may reformulate the terms of a possible settlement in the light of such observations.</p> <p>If the parties reach agreement on a settlement of the dispute, they may draw up and sign a written settlement agreement. If requested by the parties, the Conciliator may draw up, or assist the parties in drawing up, the settlement agreement.</p> <p>When the parties sign the settlement agreement, it shall be final and binding on the parties and persons claiming under them respectively.</p> <p>The Conciliator shall authenticate the settlement agreement and furnish a copy thereof to each of the parties.</p> <p>As far as possible, the conciliation proceedings should be completed within 60 days of the receipt of notice by the Conciliator.</p> <p>The parties shall not initiate, during the conciliation proceedings, any arbitral or judicial proceedings in respect of a dispute that is the subject matter of the conciliation proceedings.</p> <p>(viii) Termination of Conciliation Proceedings</p> <p>The conciliation proceedings shall be terminated:</p> <ol style="list-style-type: none"> by the signing of the settlement agreement by the parties on the date of agreement; or by written declaration of the conciliator, after consultation with the parties, to the effect further efforts at conciliation are no longer justified, on the date of declaration; or by a written declaration of the parties to the conciliator to the effect that the conciliation proceedings are terminated, on the date of declaration; or by a written declaration of a party to the other party and the conciliator, if appointed, to the effect that the conciliation proceedings are terminated, on the date of declaration. <p>Upon termination of the conciliation proceedings, the conciliator shall fix the costs of the conciliation and give written notice thereof to the parties. The costs shall be borne equally by the parties unless settlement agreement provides for a different apportionment. All other expenses incurred by a party shall be borne by that party.</p>
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31.	Sub Clause 46	<p>Eligibility</p> <p>46.1 The Contractor shall have the nationality of an ADB member country. The Contractor shall be deemed to have the nationality of a country if the Contractor is a citizen or is constituted, or incorporated, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed subcontractors or suppliers for any part of the Contract including related services.</p> <p>46.2 The materials, equipment and services to be supplied under the Contract shall have their origin in eligible source countries and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer's request, the Contractor may be required to provide evidence of the origin of materials, equipment and services.</p> <p>46.3 For purposes of SCC 46.2, "origin" means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.</p>
32.	Additional Clause	<p>Quantity Variation</p> <p>The quantities of items shown in the Bill of Quantities are approximate, and liable to vary during the actual execution of the work. The Contractor shall be bound to carry out and complete the stipulated work irrespective of variation in individual items, at the same rate as specified in the Bill of Quantities subject to variation in the value of the Contract being limited to 25% of the total original/enhanced value of the contract.</p> <p>The variations can be implemented anywhere in the network of JMRC.</p>
33.	Additional Clause	<p>Retention Money</p> <p>Retention money equal to 10 percent of the amount due to the Contractor from each on account payment will be retained, so as to maintain a reserve in the hands of the Employer equal to 5 percent of the Contract Price. Contractor will have the option to submit Bank Guarantee in lieu of deduction of retention money.</p> <p>The Retention money shall be held by the Employer without obligation to invest them or account for interest thereon or to place them in a designated account. No interest of whatsoever nature and type will be payable by the Employer in respect of Retention monies.</p> <p>Retention money shall become due to the Contractor on the date of issue of the Completion Certificate of works in respective</p>

		sections/corridors.
34.	Additional Clause	<p>Manufacture, Construction, Execution, Supply, Installation, Testing and Commissioning (Including Integrated Testing and Commissioning) Methods</p> <p>The Contractor shall submit complete documents and information pertaining to the methods of manufacture, construction, execution, supply, installation, testing and commissioning (including Integrated Testing and Commissioning) which the Contractor proposes to adopt or use. The Engineer will then check to see whether, if such methods are adhered to, the Works can be executed in accordance with the Contract and without detriment to the Works (when completed) and to other works comprising the Project.</p> <p>The Engineer shall inform the Contractor in writing within a reasonable period after receipt of the above information;</p> <ul style="list-style-type: none"> a) that the Contractor's proposed methods of manufacture, construction, execution, testing and commissioning (including Integrated Testing and Commissioning) have the approval of the Engineer; or b) in what respects, in the opinion of the Engineer, the Contractor's proposed methods of manufacture, construction, execution, etc: <ul style="list-style-type: none"> I. fail to comply with the Employer's Requirements; II. would be detrimental to the Works and/or to the other works comprising the Project; III. do not comply with the other requirements of the Contract; or c) as to the further documents or information which are required to enable the Engineer to properly assess the proposed methods of manufacture, etc. <p>In the event that the Engineer does not give his approval, the Contractor shall take such steps or make such changes in the said methods or supply such further documents or information as may be necessary to meet the Engineer's requirements and to obtain his approval. The Contractor shall not change the methods of manufacture, construction, execution, supply, installation, testing and commissioning (including Integrated Testing and Commissioning) which have received the Engineer's approval without further review and approval in writing of the Engineer.</p> <p>Notwithstanding the foregoing provisions of this Clause, or that certain of the Contractor's proposed methods of manufacture, etc. may be the subject of the approval of the Engineer, the Contractor shall not be relieved of any liability or obligation under the Contract.</p>

35.	Additional Clause	<p>Operation and Maintenance</p> <p>The Contractor shall provide Expert team for Maintenance till the end of DLP and assistance in operation for initial 6 months from R.O.D. The deployment of these Experts and team shall be continuous. These Experts and team shall work under the administrative control of the Employer. These Experts and team shall also ensure that the Client's maintenance staff acquire necessary skills and follow correct procedures and practices in the maintenance, overhaul and repair of various components for the system as well as for the maintenance of the related software (if any) after the DLP. The qualification and experience of the Experts to be deployed by the Contractor shall be as prescribed in the Employer's Requirements. Prior approval of the Employer shall be necessary before the Experts are deployed for maintenance and operation. The Contractor shall replace promptly, Contractor's experts who are not considered suitable by the Engineer.</p>
36.	Additional Clause	<p>Deployment of Personnel by the Employer</p> <p>The Contractor shall deploy personnel sponsored by the Employer during the Contract Period in areas stipulated in the Employer's Requirements.</p> <p>The travel expenses, salary and allowances, boarding and lodging expenses of these sponsored personnel shall be borne by the Employer but the Contractor shall provide other facilities required for the purpose of performing their duties. The sponsored personnel shall be under the technical and administrative control of the Contractor.</p>
37.	Additional Clause	<p>Indemnity Bond</p> <p>The contractor shall submit an Indemnity Bond in the format given in Annexure-II against payments made for Plant and Equipment delivered to Jaipur.</p>
38.	Additional Clause	<p>Digitised Data</p> <p>All Drawings, Proposal, Manuals, Design, Correspondence, Final Bid (Contract) documents and submittals etc. should be submitted in digitized form along with the Hard Copy. Price if any to be included in the quoted price.</p>
39.	Additional Clause	<p>Technology Transfer</p> <p>The Contractor shall provide the Transfer of Technology as stipulated in bid document.</p>
40.	Additional Clause	<p>Quality Plan</p> <p>The detailed Quality Plan shall be developed from the Outline Quality Plan to meet the stipulations of the Employer's Requirements.</p> <p>Upon the Engineer notifying his consent to the Site Quality Plan, or</p>

		<p>any supplement thereto, the Contractor shall, adhere to the principles and procedures contained in such document, except where the Engineer gives his consent to any amended or varied version thereof. The Contractor shall cause any sub-contractors to adhere to this Plan.</p> <p>The Contractor shall appoint a suitably qualified and experienced person, not otherwise engaged in the performance of the Contract, to act as manager of the quality assurance system and shall provide such other personnel and resources as required to ensure effective operation of the quality assurance system. The said manager shall carry out audits of the application of the quality assurance system, and ensure effective quality control and delivery of quality assurance.</p> <p>The Contractor shall provide all necessary access, assistance and facilities to enable the Engineer to carry out surveillance visits both on and off the Site to verify that the quality assurance system is being properly and fully implemented. No extra payment shall be made in this regard and the cost of the Work under this element shall be deemed to be included in the Contract Price.</p>
41.	Additional Clause	<p>Work by persons other than the Contractor</p> <p>If the Contractor shall fail to carry out any work required under the Contract or refuse to comply with any instruction or order given by the Engineer in accordance with the Contract within a reasonable time, the Engineer may give the Contractor 14 days' notice in writing to carry out such work or comply with such instruction. If the Contractor fails to comply with such notice, the Employer shall be entitled to carry out such work or instruction by his own workmen or by other contractors. Without prejudice to any other right or remedy, all additional expenditure properly incurred by the Employer in having such work or instruction carried out shall be recoverable by the Employer from the Contractor.</p> <p>If by reason of any accident or failure or other event occurring to, in, or in connection with the Works any remedial or other work shall, in the opinion of the Engineer, be urgently necessary and the Contractor is unable or unwilling at once to do such remedial or other work, the Engineer may authorise the carrying out of such remedial or other work by a person other than the Contractor. If the remedial or other work so authorised by the Engineer is work, which, in the Engineer's opinion, the Contractor was liable to do under the defect liability period Contract, all expenses properly incurred in carrying out the same shall be recoverable by the Employer from the Contractor, provided that the Engineer shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof in writing.</p>
42.	Additional Clause	<p>Entry with full preparation as per SHE</p> <p>The contractor need to mobilize at site with full preparation with proper</p>

		provision of display boards (mentioning various details like Contract Name, Contract Value, Scope, Organization, Contract Details, Labour Laws obligations as per agreement with the engineer), lighting, Water Supply, Ventilation Facility, Toilet Facility, Tea & Coffee facility, Cleaning arrangement etc (this list is indicative not exhaustive). The engineer shall approve after inspection and shall issue no objection certificate for erection of the equipment.
43.	Additional Clause	Nuisance Contractor will be responsible for any unhygienic conditions in the area under their possession and liable to be penalized if condition does not improve despite warnings/notices
44.	Additional Clause	Interface Requirement The contractor shall be responsible to interface with the other contractors as per the interface table provided in the contract. JMRC will supervise/facilitate the coordination between the contractor and other designated contractors. However, the contractor will allow for liaison with, and modifications to his design to cater for the work of such other contractors. The list of interface items is indicative only and the ultimate responsibility of commissioning lies with the contractor.
45.	Additional Clause	Site Progress The contractor shall prepare Performa in consultation with the engineer and submit to engineer the monthly progress report and will be required to deliver the Power Point presentation as and when instructed by the engineer.
46.	Additional Clause	Maintaining the Site In general the cleanliness, lighting, safety, security, drinking water, first aid etc will be the responsibility of the civil contractor as specified in the interface document. The contractor shall be responsible for maintaining the site. The daily sweeping and cleaning of the area under his possession/work shall be his responsibility. In case of repeated aberrations noticed by the engineer a minimum penalty of Rs. 5000/- shall be imposed for each instance.
47.	Additional Clause	Material not as per approved makes Once the contractor has got the vendor approved the contractor shall procure the material from the 'approved' sources. In the event, material found at site from the unapproved sources, the engineer can decide not to pay the BOQ price for the same.
48.	Additional Clause	BOCW (Building and Other Construction Works) Cess Bidders need to judge the applicability of BOCW for the work. Any

		<p>liabilities on account of BOCW at any stage shall be on part of bidder and the quoted price shall be inclusive of BOCW charges.</p> <p>If same is not applicable, the bidder needs to submit required undertaking/certificates. The JMRC shall make the deduction accordingly and deposit the amount to the concerned authorities.</p>
49.	Additional Clause	<p>Bank Guarantee for Supplementary Agreement</p> <p>The contractor shall submit the Bank Guarantee for 10 % value for works to be executed through supplementary agreement at the time of signing of the supplementary agreement. The bank Guarantee shall be valid till the 28 days beyond the completion of the works to be executed through supplementary agreement.</p>
50.	Additional Clause	<p>Service Tax for AMC Work</p> <p>The contractor shall submit his offer for AMC works beyond DLP inclusive of service tax.</p>
51.	Additional Clause	<p>Professional Indemnity Insurance (PII)</p> <p>The Contractor shall effect and maintain professional indemnity insurance, preferably in the name of JMRC, for the amount in Indian Rupees stipulated in Contract forms in respect of any design of the Works to be carried out by, or on behalf of the Contractor. This insurance, which shall ensure the Contractor's liability by reason of professional negligence and errors in the design of the works, shall be valid from the date of commencement of Works, until 5 years after the date of issue of Performance Certificate. Alternatively the Contractor shall redeem the insurance before the expiry of the Yearly Insurance in such a way that the entire validity period is covered.</p> <p>The Engineer will not issue Final Payment Certificate until the Contractor has produced evidence that coverage of the professional indemnity insurance has been provided for the aforesaid period.</p> <p>The Contractor shall, within the respective periods stated in the Bid documents (calculated from the Commencement Date), submit to the Employer:</p> <p>(a) evidence that the insurances described in this Clause have been effected, with an Insurance Company operating in India, and</p> <p>(b) copies of the policies for the insurances.</p> <p>When each premium has been paid, the contractor shall submit copy of receipts to the employer. The contractor shall also, when providing such evidence, policies and receipts to the employer, notify the engineer of so doing.</p> <p>The contractor shall effect all insurances for which he is responsible with insurers and in terms approved by the employer. Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify such loss or damage. Payments</p>

		<p>received from insurers shall be used for the rectification of such loss or damage.</p> <p>The contractor (and, if appropriate, the employer) shall comply with the conditions stipulated in each of the insurance policies. The contractor shall make no material alteration to the terms of any insurance without the prior approval of the employer. If an insurer makes (or purports to make) any such alteration, the-contractor shall notify the employer immediately.</p> <p>If the contractor fails to effect and keep in force any of the insurances required under the contract, or fails to provide satisfactory evidence, policies and receipts in accordance with this sub-clause, the employer may, without prejudice to any other right or remedy, effect insurance for the coverage relevant to such default, and pay the premiums due. In such cases the premium paid by the employer plus overheads (equal to 50% of the premium paid) shall be recoverable from the contractor by the employer, and may be deducted by the employer from any monies due, or to become due, to the contractor or recover the same as debt due from the contractor. The contractor shall not dispute the amount of premium paid by the employer or the overhead charges thereon.</p> <p>Nothing in this clause limits the obligations, liabilities or responsibilities of the contractor or the employer, under the other terms of the contract or otherwise. Any amount not insured or not recovered from the insurers shall be borne by the contractor.</p> <p>The Contractor shall submit to the Engineer, the details of all claims made with the insurer and claims accepted by the insurer or any other details as required by the Engineer on monthly basis.</p>
52.	Additional Clause	<p>Extension of time of completion</p> <p>The site shall be made available progressively and if some part is not made available then the extension of time shall be allowed only to the work/KD of that particular part.</p>
53.	Additional Clause	<p>"The Contractor shall comply with all applicable national, provincial, and local environmental laws and regulations.</p> <p>The Contractor shall (a) establish an operational system for managing environmental impacts, (b) carry out all of the monitoring and mitigation measures set forth in the [Initial Environmental Examination ("IEE")] or [Environmental Management Plan ("EMP")] and (c) allocate the budget required to ensure that such measures are carried out. The Contractor shall submit semi-annual reports on the carrying out of such measures to the Employer.</p> <p>More particularly, the Contractor shall comply with (i) the measures and requirements set forth in the initial environmental examination and the environmental management plan attached as Annexure – IV to the SCC and (ii) any corrective or preventative actions set out in</p>

		<p>safeguards monitoring reports that the Employer will prepare from time to time to monitor implementation of the initial environmental examination and the environmental management plan.</p> <p>The Contractor shall allocate a budget for compliance with these measures, requirements and actions.”</p>
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ANNEXURE-I

Notification No. 108/95-CE, Dt. 28-8-95

Goods supplied to UN/Intnl. Organisations or Proj.
As amended vide Central Excise Notification No. 7/98-CE, dt. 2-6-1998;
33/98-CE, dt. 13-10-1998; 4/99-CE, dt. 11-2-99 and 40/99-CE, dt. 2-11-99.

In exercise of the powers conferred by sub-section (1) of section 5A of the Central Excises and Salt Act, 1944 (1 of 1944) read with sub-section (3) of section 3 of the Additional Duties of Excise (Goods of Special Importance) Act, 1957 (58 of 1957), the Central Government, being satisfied that it is necessary in the public interest so to do, hereby exempts all goods falling under the Schedule to the Central Excise Tariff Act, 1985 (5 of 1986) (hereinafter referred to as the said goods) when supplied to the United Nations or an international organisation for their official use or supplied to the projects financed by the said United Nations or an international organisation and approved by the Government of India, from the whole of-

(i) the duty of excise leviable thereon under section 3 of the Central Excises Act, 1944 (1 of 1944); and

(ii) the additional duty of excise leviable thereon under sub-section (1) of section 3 of the Additional Duties of Excise (Goods of Special Importance) Act, 1957 (58 of 1957):

Provided that before clearance if the said goods, the manufacturer produces before the Assistant Commissioner of Central Excise having jurisdiction over his factory :-

(a) in case the said goods are intended for the official use by the United Nations or an international organisation, a certificate from the United Nations or that international organisation that the said goods are intended for such use;

(b) in case of the said goods are-

(i) Supplied to an international organisation listed in the Annexure appended to this notification for use in a project that has been approved by the Government of India and financed (whether by a loan or a grant) by such an organisation, a certificate from such an organisation that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India; or

(ii) Supplied to a project that has been approved by the Government of India and financed (whether by a loan or a grant) by an international organisation listed in the said annexure, a certificate from an officer not below the rank of Deputy Secretary to the Government of India, in the Ministry of finance (Department of Economic Affairs) that the said goods are required for the execution of the said project and that the said project has duly been approved by the government of India;

(Above b) i & ii have been substituted vide Cen Exc NTF 40/99 dt. 2-11-99)

(c) in case the said goods are intended to be supplied to a project financed (whether by a loan or a grant) by the World Bank, the Asian Development Bank or any international organisation, other than those listed in the

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- 8 -

Annexure, and

(Above c) has been amended vide Cen Exc NTF 40/99 dt. 2-11-99)

(i) if the said project has been approved by the Government of India, a certificate from the executive head of the Project Implementing Authority and countersigned by an officer not below the rank of a Joint Secretary to the Government of India, in the concerned Line Ministry in the Government of India, that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India, and

(ii) If the said project has been approved by the Government of India for implementation by the Government of a State or a Union Territory, a certificate from the executive head of the Project Implementing Authority and countersigned by the Principal Secretary or the Secretary (Finance), as the case may be, in the concerned State Government or the Union Territory, that the said goods are required for the execution of the said project, and that the said project has duly been approved by the Government of India for implementation by the concerned State Government.

(Above proviso has been amended vide Central Excise Notification No. 4/99 dt. 11-2-99)

Explanation.-For the purpose of this notification,-

(a) "international organisation" means an international organisation to which the Central Government has declared, in pursuance of section 3 of the United Nations (Privileges and Immunities) Act, 1947 (46 of 1947), that the provisions of the Schedule to the said Act shall apply;

(b) "Line Ministry" means a Ministry in the Government of India, which has been so nominated with respect to a project, by the Government of India, in the Ministry of Finance (Department of Economic Affairs).'

(Above explanation has been amended vide Central Excise Notification No. 4/99 dt. 11-2-99)

ANNEXURE

1. United Nations Development Programme,
2. United Nations International Childrens' Fund,
3. Food and Agricultural Organisation,
4. International Labour Organisation,
5. World health Organisation,
6. United Nations Population Fund.
7. United Nations World Food Programme

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8. United Nations Industrial Development Organisation.

(Above Sl. No. (8.) has been inserted vide Ntf. No. 50/2001-CE, dt. 12-10-2001)

(Above Sl. No. (7.) has been inserted vide Ntf. No. 36/2001-CE, dt. 6-7-2001)

(Above ANNEXURE has been added vide Cen NTF 40/98 dt. 2-11-99)

(Note:-see Ntf. No. 31/2001-CE(NT), dt. 21/06/2001)

9C313

Notification No. 84/97-Customs

S. 111

Liste C

Seeks to Exempt Imports by United Nations or International organisation for execution of projects in India.

11-11-1997

Notification No. 84/97-Customs

In exercise of the powers conferred by sub-section (1) of section 25 of the Customs Act, 1962 (52 of 1962), read with sub-section (4) of section 68 of the Finance (No. 2) Act, 1996 (33 of 1996), the Central Government, being satisfied that it is necessary in the public interest so to do, hereby exempts all the goods imported into India for execution of projects financed by the United Nations or an International Organisation and approved by the Government of India, from the whole of the duty of customs leviable thereon under First Schedule to the Customs Tariff Act, 1975 (51 of 1975), the whole of the additional duty of customs leviable thereon under section 3 of the said Customs Tariff Act and the whole of the special duty of customs leviable under section 68 of the Finance (No. 2) Act 1996 (33 of 1996).

Provided that the importer, at the time of clearance of the goods, produces before the Assistant Commissioner of Customs or Deputy Commissioner of Customs, as the case may be, having jurisdiction, -

(i) in case the said goods are -

(a) Imported by an international organisation listed in the Annexure appended to this notification and intended to be used in a project that has been approved by the Government of India and financed (whether by a loan or a grant) by such an organisation, a certificate from such organisation that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India; or

(b) Imported for use in a project that has been approved by the Government of India and financed (whether by a loan or a grant) by an international organisation listed in the said Annexure, a certificate from an officer not below the rank of Deputy Secretary to the Government of India, in the Ministry of Finance (Department of Economic Affairs) that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India;

(ii) In case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the World Bank, the Asian Development Bank or any other international organisation other than those listed in the Annexure, and the said project has been approved by the Government of India, a certificate from the executive head of the Project Implementing Authority and countersigned by an officer not below the rank of a Joint Secretary to the Government of India, in the concerned Line Ministry in the Government of India, that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India, and

(iii) In case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the World Bank, the Asian Development Bank or any other international organisation, other than those listed in the Annexure and the said project has been approved by the Government of India for implementation by the Government of a State or a Union Territory, a certificate from the executive head of the Project Implementing Authority and countersigned by the Principal Secretary or the Secretary (Finance), as the case may be, in the concerned State Government or the Union Territory, that the said goods are required for the execution of the said project, and that the said project has duly been approved by the Government of India for implementation by the concerned State Government.

Explanation. - For the purposes of this notification, -

(a) "International organisation" means an international organisation to which the Central Government has declared, in pursuance of section 3 of the United Nations (Privileges and Immunities) Act, 1947 (46 of 1947), that the provisions of the Schedule to the said Act shall apply;

(b) "Line Ministry" means a Ministry in the Government of India, which has been so nominated with respect to a project, by the Government of India, in the Ministry of Finance (Department of Economic Affairs).

www.cbec.gov.in/customs/cs-act/notifications/notifications-before-2012/cs84-97c.htm

1/2

9/3/13

ANNEXURE

Notification No. 84/97-Customs

133-5-

1. United Nations Development Programme,
2. United Nations International Childrens' Fund,
3. Food and Agricultural Organisation,
4. International Labour Organisation,
5. World Health Organisation,
6. United Nations Population Fund,
7. United Nations World Food Programme,
8. United Nations Industrial Development Organisation.

Notification No. 84/97-Cus., dated 11-11-1997 as amended by Notification No. 85/99-Cus., dated 6-7-1999 and No. 119/99-Cus., dated 2-11-1999 and Notification No. 75/2001 dt. 0-07-01 and Notification No. 107/2001-Cus., dated 12.10.2001.

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Cus Ntf No.85/1999 Date 6/7/1999

Imports for Projects financed by UN - Duty Exemption conditions changed

In exercise of the powers conferred by sub-section (1) of section 25 of the Customs Act, 1962 (52 of 1962), the Central Government, being satisfied that it is necessary in the public interest so to do, hereby makes the following amendment in the notification of the Government of India in the Ministry of Finance (Department of Revenue), No.84/97 Customs, dated the 11th November, 1997, namely:

In the said notification,-

- i. for the words "all the goods imported into India by the United Nations or an international organisation for execution of projects financed by them", the following words shall be substituted, namely:-

"all the goods imported into India for execution of projects financed by the United Nations or an international organisation"

- ii. for the proviso, the following shall be substituted, namely:-

"Provided that the importer, at the time of clearance of the goods, produces before the Assistant Commissioner of Customs or Deputy Commissioner of Customs, as the case may be, having jurisdiction:-

- i. in case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the United Nations and the said project has been approved by the Government of India, a certificate from an officer not below the rank of a Deputy Secretary to the Government of India, in the Ministry of Finance (Department of Economic Affairs), that the said goods are required for the execution of the said project financed by the United Nations and that the said project has duly been approved by the Government of India, or
- ii. in case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the World Bank, the Asian Development Bank or any other international organisation, and the project has been approved by the Government of India, a certificate from the executive head of the Project Implementing Authority and countersigned by an officer not below the rank of a Joint Secretary to the Government of India, in the concerned Line Ministry in the Government of India, that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India, and
- iii. in case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the World Bank, the Asian Development Bank or any other international organisation, and the said project has been approved by the Government of India for implementation by the Government of a State or a Union Territory a certificate from the executive head of the Project Implementing Authority and countersigned by the Principal Secretary or the Secretary (Finance), as the case may be, in the concerned State

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-3- 131

Government or the Union Territory, that the said goods are required for the execution of the said project, and that the said project has duly been approved by the Government of India for implementation by the concerned State Government";

iii. for the Explanation, the following Explanation shall be substituted, namely:-

"Explanation For the purposes of this notification,-

- a. "international organisation" means an international organisation to which the central Government has declared, in pursuance of section 3 of the United Nations (Privileges and Immunities) Act, 1947 (46 of 1947), that the provisions of the Schedule to the said Act shall apply;
- b. "Line Ministry" means a Ministry in the Government of India, which has been so nominated with respect to a project, by the Government of India, in the Ministry of Finance (Department of Economic Affairs)".

Sd/-
(Prashant Kumar Sinha)
Under Secretary to the Government of India

Issued by:
Ministry of Finance Department of Revenue
New Delhi.

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GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)

NOTIFICATION

Jaipur, dated December 8, 2011

In exercise of the powers conferred by sub-section (3) of section 8 of the Rajasthan Value Added Tax Act, 2003 (Act No.4 of 2003), the State Government being of the opinion that it is expedient in the public interest so to do, hereby makes the following amendment in this Department's notification number F.12(100)FD/Tax/2010-79 dated 06-10-2010, namely:-

AMENDMENT

In the said notification, after the existing expression "awarded by the" and before the existing expression "Delhi Metro Rail Corporation Limited", the expression "Jaipur Metro Rail Corporation Ltd. or the" shall be inserted.

This shall have effect from 06-10-2010.

[No. F.12(100)FD/Tax/10-74]

By Order of the Governor,

(Mewa Ram Jat)

Dy. Secretary to Government

Copy forwarded to the following for information and necessary action:-

1. Superintendent, Government Central Press, Jaipur 2011 along with a soft copy in CD for publication of this notification in part 4(c) of today's extra ordinary Gazette. It is requested that 10 copies of this notification may be sent to this Department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department, Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Secretary, Finance (Revenue).
7. Director, Public Relations, Jaipur.
8. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
9. Guard File.

Dy. Secretary to Government

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GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)

NOTIFICATION

Jaipur, Dated: 06-10-2010

In exercise of the powers conferred by sub-section (3) of section 8 of the Rajasthan Value Added Tax Act, 2003 (Act No. 4 of 2003), the State Government being of the opinion that it is expedient in the public interest so to do, hereby exempts from payment of tax payable by any registered dealer on transfer of property in goods involved in execution of works contracts related to Metro Rail project in Jaipur City awarded by the Delhi Metro Rail Corporation Limited for Jaipur Metro Rail Project.

[No. F.12(100) FD/Tax/10-79]

By Order of the Governor,

(Bhawani Singh Detha)

Deputy Secretary to Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur for publication of this notification in part 4(c) of extra ordinary gazette along with a soft copy in CD. It is requested 10 copies of this notification may sent to this department and 20 copies along with bill may be sent Commissioner, Commercial Taxes Department Rajasthan, Jaipur, Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Principal Secretary, Law.
7. PS to Principal Secretary, LSG & UDH and Chairman & Managing Director, JMRC.
8. PS to Secretary, Finance (Revenue).
9. Director, Public Relations, Jaipur.
10. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
11. Guard File.

Deputy Secretary to Government

GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)

Jaipur, Dated: 11.8.2006

In pursuance of clause (3) of Article 348 of the Constitution of India, the Governor is pleased to authorize the publication of this Notification No F.12(63)FD/Tax/2005-81 dated 11.8.2006, in English language, in the Rajasthan Gazette of Finance (Tax) Department.

By Order of the Governor,


(Arun Gupta)

Deputy Secretary to Government

NOTIFICATION

Jaipur, Dated: 11.8.2006

In exercise of the powers conferred by sub-section (2) of section 20 of the Rajasthan Value Added Tax Act, 2003 (Act No. 4 of 2003), read with sub-rule (2) of rule 40 of the Rajasthan Value Added Tax Rules, 2006, the State Government hereby notifies that the awardee or any person authorised by him, at the time of credit of any sum to the account of the contractor or at the time of making such payment by any mode, for carrying out any work, shall deduct, in lieu of tax, an amount equal to 3% of such sum:

Provided that in case of contractors having exemption certificate under notification No. F.12(63)FD/Tax/2005-80 dated 11.8.2006, the awardee or any person authorised by him shall deduct in lieu of tax an amount equal to rate of exemption fee as mentioned in the said exemption certificate.

[No.F.12(63)FD/Tax/2005-81]

By Order of the Governor,


(Arun Gupta)

Deputy Secretary to Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur for publication of this notification in part 4(c) of extra ordinary gazette. 10 copies of this notification may sent to this department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department Raj. Jaipur.
2. Principal Secretary to Chief Minister (Finance Minister).
3. PS to Chairman, Rajasthan VAT Grievances Redressal Committee, Jaipur.
4. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
5. PS to Principal Secretary, Finance.
6. PS to Secretary, Finance (II).
7. PS to Director, Public Relations Jaipur.
8. ACP, Finance Department, Secretariat, Jaipur.
9. Guard file.


Deputy Secretary to Government

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GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)

NOTIFICATION

Jaipur, Dated: 06.10.2010

In exercise of the powers conferred by sub-section (2) of section 20 of the Rajasthan Value Added Tax Act, 2003 (Act No. 4 of 2003), read with sub-rule (2) of rule 40 of the Rajasthan Value Added Tax Rules, 2006, the State Government hereby makes the following amendment in this department's notification No.F.12(63) FD/Tax/ 2005-81 dated 11.08.2006, as amended from time to time, namely:-

AMENDMENT

In the said notification, after the existing last proviso, the following new proviso shall be added, namely:-

"Provided further that in case of works contracts related to Metro Rail Project in Jaipur City awarded by the Delhi Metro Rail Corporation Limited for Jaipur Metro Rail Project, no amount in lieu of tax shall be deducted by the Delhi Metro Rail Corporation Limited or any person authorized by him."

[No. F.12(100) FD/Tax/10-80]
By Order of the Governor,

(Bhawani Singh Detha)
Deputy Secretary to Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur for publication of this notification in part 4(c) of extra ordinary gazette along with a soft copy in CD. It is requested 10 copies of this notification may sent to this department and 20 copies along with bill may be sent Commissioner, Commercial Taxes Department Rajasthan, Jaipur, Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Principal Secretary, Law.
7. PS to Principal Secretary, LSG & UDH and Chairman & Managing Director, JMRC.
8. PS to Secretary, Finance (Revenue).
9. Director, Public Relations, Jaipur.
10. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
11. Guard File.

Deputy Secretary to Government

(5)

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, dated December 8, 2011

In exercise of the powers conferred by sub-section (2) of section 20 of the Rajasthan Value Added Tax Act, 2003 (Act No.4 of 2003), read with sub-rule (2) of rule 40 of the Rajasthan Value Added Tax Rules, 2006, the State Government being of the opinion that it is expedient in the public interest so to do, hereby makes the following amendment in this Department's notification number F.12(63)FD/Tax/2005-81 dated 11-08-2006, as amended from time to time, namely:-

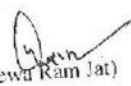
AMENDMENT

In the said notification, the existing last proviso shall be substituted by the following, namely:-

"Provided further that in case of works contracts related to Metro Rail Project in Jaipur City awarded by the Jaipur Metro Rail Corporation Ltd. or Delhi Metro Rail Corporation Limited for Jaipur Metro Rail Project, no amount in lieu of tax shall be deducted by the Jaipur Metro Rail Corporation Ltd. or Delhi Metro Rail Corporation Limited or any person authorized by them."

This shall have effect from 06-10-2010.


[No. F.12(100)FD/Tax/10-75]
By Order of the Governor.


(Mewa Ram Jat)

Dy. Secretary to Government

Copy forwarded to the following for information and necessary action:-

1. Superintendent, Government Central Press, Jaipur 2011 along with a soft copy in CD for publication of this notification in part 4(c) of today's extra ordinary Gazette. It is requested that 10 copies of this notification may be sent to this Department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department, Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Secretary, Finance (Revenue).
7. Director, Public Relations, Jaipur.
8. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
9. Guard File.


Dy. Secretary to Government

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GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)

NOTIFICATION

Jaipur, Dated: 06.10.2010

In exercise of the powers conferred by section 9 of the Rajasthan Tax on Entry of Goods into Local Areas Act, 1999 (Act No. 13 of 1999), the State Government being of the opinion that it is expedient in the public interest so to do, hereby exempts from payment of tax payable under the said Act by any registered dealer on goods and equipments mentioned in Annexure-A of this notification, which are brought into the local area for exclusive use in execution of works contracts related to Metro Rail project in Jaipur City awarded by the Delhi Metro Rail Corporation Limited for Jaipur Metro Rail Project on the condition that such dealer shall submit a declaration to the assessing authority, in the form as specified in Annexure-'B' of this notification duly certified by the authorized officer of the Delhi Metro Rail Corporation Limited.

ANNEXURE-'A'

List of goods required for execution of Metro Rail Project in Jaipur City

S.No.	Name of Goods	S.No.	Name of Goods
1.	Cement	10.	Marble/granite/tiles/ kota stone
2.	Steel (a) TOR, TMT (b) HTS (c) Binding wire (d) Plate, structural Steel (i) Angle (ii) Channel (iii) SMB etc. (iv) Pipe	11.	Sanitary fitting/wares
3.	Aggregate	12.	Sheet AC/GI/others
4.	Sand	13.	Paver block/ CC blocks
5.	Ply	14.	Bitumen
6.	Batten- wooden	15.	Stainless steel pipe/hollow section
7.	Hardware -Nail etc	16.	Paint/snow-cem/putty etc
8.	Bearing i. Neoprene ii. Pot /PTFE	17.	Diesel/petrol
9.	Beaonite	18.	Tyre

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19.	Ready mix concrete	26.	Spare part of 4 wheeler dumper, Tractor, Crane, Gantry
20.	Jacks	27.	Electrical cable/ fitting
21.	GI/CI/PVC/SW Pipes	28.	Signal & telecom cable & fittings equipments
22.	JCB, excavator, loader, truck, Car, Jeep, dumper, tractor, trailer, cranes, battery plant, concrete pump, placer, transit mixer, gantry, launchings girder, piling rig	29.	Rail
23.	Bricks/stone	30.	PSC sleeper, CI inserts
24.	Aluminum	31.	Track fittings: - Points and crossing, pandrol clip, rubber pad, liner
25.	Wooden/ply doors	32.	Ballast

List of electrical equipment:

1. **25 Km. (S.P.) AC Traction:** All equipment used for erecting of overhead (25 KV - A.C. traction System including. Contact wire, centenary wire, Droppers, Insulators, Masts, Portals, Drop Arm, Steel structures, Automatic Tensioning Device, Traction Return Rail Bonding, Earthing System etc.
2. **Power & Distribution transformers:** 220/132 KV, 132/33 KV, 33 KV /25 KV - Power 33/0.415 Aux. transformers, Booster transformers etc.
3. **Sub Stations:** All the equipments installed in substation including single Bus Bar with Bus sectioning or Double Bus Bar with Bus coupler, circuit breakers, interrupters (220 KV, 132 KV, 25 KV single phase) for traction load and 33 KV side for Auxiliary loads, lightening protection equipment, Instrument transformers (current & Voltage), Protection Relays etc.
4. **H.T. & L.T. Cables :** All cables used for connecting the Equipments in the above stated system for operation & control.
5. **Stand By arrangement:** A) D.G. Set. 200 KVA at elevated Stations, D.G. Set. 2x1000/750 KVA at U.G. Station (chandpole)
(B) Battery Chargers with Batteries for control supply.
6. Equipments used in supervisory control & Data Acquisition (SCADA) system with Optical Fibre Glass Cables.
7. All the Equipment used in Ventilation & Air Conditioning System.
8. Equipments used for Illumination.
9. Equipments used for provision of Fans.
10. Equipments used for provision of exhaust fans.
11. Equipments used for provision of Escalators/Lifts.
12. Equipments used for provision of Pump Sets.
13. Equipments required for cool drinking water.
14. Equipments for provision of Sign age on P.F & Sin Bldg's

MM

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ANNEXURE-'B'

DECLARATION FOR GOODS BROUGHT INTO LOCAL AREA

No.

Dated:

To,

(Name of the assessing authority of the registered dealer)

It is hereby certified that the goods brought by M/s into the local area vide invoice No. dated for ₹. (in words) have been exclusively utilized in completion of Metro Rail Project in Jaipur City.

Seal

Signature of Authorized officer of DMRC
Name
Designation

[No. F.12(100) FD/Tax/10-81]
By Order of the Governor,

(Bhawani Singh Detha)
Deputy Secretary to Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur for publication of this notification in part 4(c) of extra ordinary gazette along with a soft copy in CD. It is requested 10 copies of this notification may sent to this department and 20 copies along with bill may be sent Commissioner, Commercial Taxes Department Rajasthan, Jaipur, Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Principal Secretary, Law.
7. PS to Principal Secretary, LSG & UDH and Chairman & Managing Director, JMRC.
8. PS to Secretary, Finance (Revenue).
9. Director, Public Relations, Jaipur.
10. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
11. Guard File.

Deputy Secretary to Government

4/4

(27)

**GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)**

NOTIFICATION

Jaipur, dated December 8, 2011

In exercise of the powers conferred by section 9 of the Rajasthan Tax on Entry of Goods into Local Areas Act, 1999 (Act No.13 of 1999), the State Government being of the opinion that it is expedient in the public interest so to do, hereby makes the following amendments in this Department's notification number F.12(100)FD/Tax/2010-81 dated 06-10-2010, namely:-

AMENDMENTS

In the said notification,-


(i) for the existing expression "Delhi Metro Rail Corporation Limited" wherever occurring, the expression "Jaipur Metro Rail Corporation Ltd. or Delhi Metro Rail Corporation Limited" shall be substituted.

(ii) the existing expression "of DMRC" appearing in Annexure "B", shall be deleted.

This shall have effect from 06-10-2010.

[No. F.12(100)FD/Tax/10 - 76]

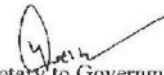
By Order of the Governor,


(Mewa Ram Jat)

Dy. Secretary to Government

Copy forwarded to the following for information and necessary action:-

1. Superintendent, Government Central Press, Jaipur 2011 along with a soft copy in CD for publication of this notification in part 4(c) of today's extra ordinary Gazette. It is requested that 10 copies of this notification may be sent to this Department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department, Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Secretary, Finance (Revenue).
7. Director, Public Relations, Jaipur.
8. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
9. Guard File.


Dy. Secretary to Government

26

GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)

NOTIFICATION
Jaipur, April 17, 2013

In exercise of the powers conferred by section 9 of the Rajasthan Tax on Entry of Goods into Local Areas Act, 1999 (Act No.13 of 1999), the State Government being of the opinion that it is expedient in the public interest so to do hereby, with immediate effect, makes the following amendments in this Department's notification No.F.12 (100)FD/Tax/10-81 dated 06.10.2010, as amended from time to time, namely:-

AMENDMENTS

In the List of goods required for execution of Metro Rail Project in Jaipur City of Annexure 'A' of said notification.-

- (i) the existing serial number 28 and entries thereto shall be substituted by the following, namely:-

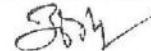
28.	Equipments required for provision of Signaling, Telecommunication and Ticketing systems (including electronic, electrical & IT), Cables, Batteries, Equipments racks and UPS
-----	--

- (ii) after existing serial number 32 and entries thereto the following new serial number 33 and entries thereto shall be added, namely:-

33.	Rolling stock including Sub-assemblies, Components, Accessories and Spares thereof
-----	--

[No. F.12 (100)FD/Tax/2010-10]

By Order of the Governor,



(Aditya Pareek)

Deputy Secretary to Government

25

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur along with a soft copy in CD for publication² of this notification in part 4(c) of extra ordinary gazette. It is requested that 10 copies of this notification may be sent to this department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy as provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, UDH & LSG.
6. PS to Principal Secretary, Finance.
7. PS to Secretary, Finance (Revenue).
8. Director, Public Relations, Jaipur.
9. SA (Joint Director), Finance (Computer Cell) Department, Secretariat, Jaipur.
10. Guard File.



Dy. Secretary to the Government

24

GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)

NOTIFICATION

Jaipur, Dated:- 06-10-2010

In exercise of the powers conferred by sub-section (3) of section 8 of the Rajasthan Value Added Tax Act, 2003 (Act No. 4 of 2003), the State Government being of the opinion that it is expedient in the public interest so to do, hereby exempts from payment of tax payable on purchases of taxable goods and equipments mentioned in annexure-'A' of this notification, made by any registered dealer for exclusive use in execution of works contracts related to Metro Rail Project in Jaipur City awarded by the Delhi Metro Rail Corporation Limited for Jaipur Metro Rail Project on the following conditions, namely:-

1. That the purchasing registered dealer has a valid contract with the Delhi Metro Rail Corporation Limited for execution of works contracts related to Metro Rail project in Jaipur City;
2. That the purchasing registered dealer shall ensure that the sale invoice of goods contains the expression "The goods purchased by this invoice have been purchased in pursuance to contract with Delhi Metro Rail Corporation Limited for exclusive use in the Jaipur Metro Rail Project";
3. That the purchasing registered dealer shall submit a monthly statement of such taxable purchases to his assessing authority within fifteen days from the close of the month; and
4. That the purchasing registered dealer shall submit a declaration to the selling dealer in the form specified in Annexure- 'B' of this notification, for every taxable purchase made by him, duly certified by the authorized officer of the Delhi Metro Rail Corporation Limited. Exemption from payment of tax on such sales made by the selling dealer shall be allowed only on furnishing of the said declaration to his assessing authority.

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ANNEXURE-'A'

List of goods required for execution of Metro Rail Project in Jaipur City

S.No.	Name of Goods	S.No.	Name of Goods
1.	Cement	17.	Marble/granite/tiles/ kota stone
2.	Steel (a) TOR, TMT (b) HTS (c) Binding wire (d) Plate, structural Steel (i) Angle (ii) Channel (iii) SMB etc. (iv) Pipe	18.	Sanitary fitting/wares
3.	Aggregate	19.	Sheet AC/GI/others
4.	Sand	20.	Paver block/ CC blocks
5.	Ply	21.	Bitumen
6.	Batten- wooden	22.	Stainless steel pipe/hollow section
7.	Hardware -Nail etc	23.	Paint/snow-cem/putty etc
8.	Bearing i. Neoprene ii. Pot /PTFE	24.	Diesel/petrol
9.	Bentonite	25.	Tyre
10.	Ready mix concrete	26.	Spare part of 4 wheeler dumper, Tractor, Crane, Gantry
11.	Jacks	27.	Electrical cable/ fitting
12.	GI/CI/PVC/SW Pipes	28.	Signal & telecom cable & fittings equipments
13.	JCB, excavator, loader, truck, Car, Jeep, dumper, tractor, trailer, cranes, battery plant, concrete pump, placer, transit mixer, gantry, launchings girder, piling rig	29.	Rail
14.	Bricks/stone	30.	PSC sleeper, CI inserts
15.	Aluminum	31.	Track fittings: - Points and crossing, pandrol clip, rubber pad, liner
16.	Wooden/ply doors	32.	Ballast

List of electrical equipment:

1. 25 Km. (S.P.) AC. Traction: All equipment used for erecting of overhead (25 KV -A.C. traction System including. Contact wire, centenary wire, Droppers, Insulators, Masts, Portals, Drop Arm, Steel structures, Automatic Tensioning Device, Traction Return Rail Bonding, Earthing System etc.
2. **Power & Distribution transformers:** 220/132 KV, 132/33 KV, 33 KV /25 KV - Power 33/0.415 Aux.transformers, Booster transformers etc.
3. **Sub Stations:** All the equipments installed in substation including single Bus Bar with Bus sectioning or Double Bus Bar with Bus coupler, circuit breakers, interrupters (220 KV, 132 KV, 25 KV single phase) for traction load and 33 KV side for Auxiliary loads, lightning protection equipment, Instrument transformers (current & Voltage), Protection Relays etc.
4. **H.T. & L.T. Cables :** All cables used for connecting the Equipments in the above stated system for operation & control.
5. **Stand By arrangement:** A) D.G. Set. 200 KVA at elevated Stations, D.G. Set. 2x1000/750 KVA at U.G. Station (chandpole)
B) Battery Chargers with Batteries for control supply.
6. Equipments used in supervisory control & Data Acquisition (SCADA) system with Optical Fibre Glass Cables.
7. All the Equipment used in Ventilation & Air Conditioning System.
8. Equipments used for Illumination.
9. Equipments used for provision of Fans.
10. Equipments used for provision of exhaust fans.
11. Equipments used for provision of Escalators/Lifts.
12. Equipments used for provision of Pump Sets.
13. Equipments required for cool drinking water.
14. Equipments for provision of Sign age on P.F & Sin Bldg's

21

ANNEXURE-'B'

DECLARATION FOR PURCHASE OF GOODS

To,

(Name and complete address of the seller)

I/We hereby declare that the goods.....ordered vide our order
No.....dated.....and purchased from you as per your
VAT Invoice No.....dated.....for ₹
..... (in words) have been purchased in
pursuance to contract with Delhi Metro Rail Corporation Limited for exclusive
use in the Jaipur Metro Rail Project

Seal

Signature
Name
TIN

Certification to be made by the authorized officer of the Delhi Metro Rail
Corporation limited

No.

Dated:

It is hereby certified that the goods mentioned above have been utilized in
completion of Metro Rail Project in Jaipur City.

Seal

Signature of Authorized officer of DMRC
Name
Designation

[No. F.12(100) FD/Tax/10- 78]
By Order of the Governor,

(Bhawani Singh Detha)
Deputy Secretary to Government

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur for publication of this notification in part 4(c) of extra ordinary gazette along with a soft copy in CD. It is requested 10 copies of this notification may sent to this department and 20 copies along with bill may be sent Commissioner, Commercial Taxes Department Rajasthan, Jaipur, Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Principal Secretary, Law.
7. PS to Principal Secretary, LSG & UDH and Chairman & Managing Director, JMRC.
8. PS to Secretary, Finance (Revenue).
9. Director, Public Relations, Jaipur.
10. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
11. Guard File.

Deputy Secretary to Government

19

GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)

NOTIFICATION

Jaipur, dated December 8, 2011

In exercise of the powers conferred by sub-section (3) of section 8 of the Rajasthan Value Added Tax Act, 2003 (Act No. 4 of 2003), the State Government being of the opinion that it is expedient in the public interest so to do, hereby makes the following amendments in this Department's notification number F.12(100)FD/Tax/2010-78 dated 06-10-2010, namely:-

AMENDMENTS

In the said notification:-

(i) for the existing expression "Delhi Metro Rail Corporation Limited" wherever occurring, the expression "Jaipur Metro Rail Corporation Ltd. or Delhi Metro Rail Corporation Limited" shall be substituted.

(ii) the existing expression "of DMRC" appearing in Annexure "B", shall be deleted.

This shall have effect from 06-10-2010.

[No. F.12(100)FD/Tax/10-73]

By Order of the Governor,

(Mewa Ram Jat)

Dy. Secretary to Government

Copy forwarded to the following for information and necessary action:-

1. Superintendent, Government Central Press, Jaipur 2011 along with a soft copy in CD for publication of this notification in part 4(c) of today's extra ordinary Gazette. It is requested that 10 copies of this notification may be sent to this Department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department, Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, Finance.
6. PS to Secretary, Finance (Revenue).
7. Director, Public Relations, Jaipur.
8. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
9. Guard File.

Dy. Secretary to Government

18

GOVERNMENT OF RAJASTHAN
FINANCE DEPARTMENT
(TAX DIVISION)

NOTIFICATION
Jaipur, April 24, 2013

In exercise of the powers conferred by sub-section (3) of section 8 of the Rajasthan Value Added Tax Act, 2003, (Act No. 4 of 2003), the State Government being of the opinion that it is expedient in the public interest so to do hereby, with immediate effect, makes the following amendments in this Department's notification No.F.12(100)FD/Tax/10-78 dated 06.10.2010, as amended from time to time, namely:-

AMENDMENTS

In the List of goods required for execution of Metro Rail Project in Jaipur City of Annexure 'A' of said notification.-

- (i) the existing serial number 28 and entries thereto shall be substituted by the following, namely:-

28.	Equipments required for provision of Signaling, Telecommunication and Ticketing systems (including electronic, electrical & IT), Cables, Batteries, Equipments racks and UPS
-----	--

- (ii) after existing serial number 32 and entries thereto the following new serial number 33 and entries thereto shall be added, namely:-

33.	Rolling stock including Sub-assemblies, Components, Accessories and Spares thereof
-----	--

[No. F.12(100)FD/Tax/10-11]
By Order of the Governor,




(Aditya Pareek)
Deputy Secretary to the Government

(17)

Copy forwarded to the following for information and necessary action:

1. Superintendent, Government Central Press, Jaipur along with a soft copy in CD for publication of this notification in part 4(c) of today's extra ordinary Gazette. It is requested that 10 copies of this Notification may be sent to this department and 20 copies along with bill may be sent to Commissioner, Commercial Taxes Department, Rajasthan, Jaipur. Please ensure that soft copy in CD is same as hard copy as provided to you for publication.
2. Principal Secretary to Hon'ble Chief Minister (Finance Minister).
3. Commissioner, Commercial Taxes Department, Rajasthan, Jaipur.
4. Accountant General, Rajasthan, Jaipur.
5. PS to ACS, UDH & LSG.
6. PS to Principal Secretary, Finance.
7. PS to Principal Secretary, Law.
8. PS to Secretary, Finance (Revenue).
9. Director, Public Relations, Jaipur.
10. SA, Finance (Computer Cell) Department, Secretariat, Jaipur.
11. Guard File.


Deputy Secretary to the Government

[TO BE PUBLISHED IN THE GAZETTE OF INDIA, EXTRAORDINARY, PART II,
SECTION 3, SUB-SECTION (i)]

GOVERNMENT OF INDIA
MINISTRY OF FINANCE
(DEPARTMENT OF REVENUE)
NOTIFICATION
No.9/2016-Service Tax,

New Delhi, the 1st March, 2016

G.S.R.....(E).-In exercise of the powers conferred by sub-section (1) of section 93 of the Finance Act, 1994 (32 of 1994), the Central Government being satisfied that it is necessary in the public interest so to do, hereby makes the following further amendments in the notification of the Government of India in the Ministry of Finance (Department of Revenue) No.25/2012-Service Tax, dated the 20th June, 2012, published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (i) *vide* number G.S.R. 467 (E), dated the 20th June, 2012, namely:-

1. In the said notification,-

(a) in the first paragraph,-

(i) in entry 6, for clause (b) and clause (c), the following clauses shall be substituted, namely,-

“(b) a partnership firm of advocates or an individual as an advocate other than a senior advocate, by way of legal services to-

(i) an advocate or partnership firm of advocates providing legal services;

(ii) any person other than a business entity; or

(iii) a business entity with a turnover up to rupees ten lakh in the preceding financial year; or

(c) a senior advocate by way of legal services to a person other than a person ordinarily carrying out any activity relating to industry, commerce or any other business or profession;”;

(ii) after entry 9A, the following entry shall be inserted with effect from 1st March, 2016, namely,-

“9B. Services provided by the Indian Institutes of Management, as per the guidelines of the Central Government, to their students, by way of the following educational programmes, except Executive Development Programme, -

- (a) two year full time residential Post Graduate Programmes in Management for the Post Graduate Diploma in Management, to which admissions are made on the basis of Common Admission Test (CAT), conducted by Indian Institute of Management;
- (b) fellow programme in Management;
- (c) five year integrated programme in Management.”;

(iii) after entry 9B as so inserted, the following entries shall be inserted, namely:-

“9C. services of assessing bodies empanelled centrally by Directorate General of Training, Ministry of Skill Development and Entrepreneurship by way of assessments under Skill Development Initiative (SDI) Scheme;

9D. services provided by training providers (Project implementation agencies) under Deen Dayal Upadhyaya Grameen Kaushalya Yojana under the Ministry of Rural Development by way of offering skill or vocational training courses certified by National Council For Vocational Training.”;

(iv) after entry 12, with effect from the 1st March, 2016, the following entry shall be inserted, namely-

“12A. Services provided to the Government, a local authority or a governmental authority by way of construction, erection, commissioning, installation, completion, fitting out, repair, maintenance, renovation, or alteration of -

- (a) a civil structure or any other original works meant predominantly for use other than for commerce, industry, or any other business or profession;
- (b) a structure meant predominantly for use as (i) an educational, (ii) a clinical, or (iii) an art or cultural establishment; or
- (c) a residential complex predominantly meant for self-use or the use of their employees or other persons specified in the Explanation 1 to clause (44) of section 65 B of the said Act;

under a contract which had been entered into prior to the 1st March, 2015 and on which appropriate stamp duty, where applicable, had been paid prior to such date:

provided that nothing contained in this entry shall apply on or after the 1st April, 2020.”;

(v) in entry 13, after item (b), the following items shall be inserted with effect from 1st March, 2016, namely –

- “(ba) a civil structure or any other original works pertaining to the ‘In-situ rehabilitation of existing slum dwellers using land as a resource through

private participation' under the Housing for All (Urban) Mission/Pradhan Mantri Awas Yojana, only for existing slum dwellers.

- (bb) a civil structure or any other original works pertaining to the 'Beneficiary-led individual house construction / enhancement under the Housing for All (Urban) Mission/Pradhan Mantri Awas Yojana;';

(vi) in entry 14, with effect from 1st March, 2016,

A. for item (a), the following shall be substituted, namely:-

“(a) railways, excluding monorail and metro;

Explanation.-The services by way of construction, erection, commissioning or installation of original works pertaining to monorail or metro, where contracts were entered into before 1st March, 2016, on which appropriate stamp duty, was paid, shall remain exempt.”

B. after item (c), the following item shall be inserted, namely –

“(ca) low cost houses up to a carpet area of 60 square metres per house in a housing project approved by the competent authority under:

- (i) the “Affordable Housing in Partnership” component of the Housing for All (Urban) Mission/Pradhan Mantri Awas Yojana;
- (ii) any housing scheme of a State Government.”.

(vii) after entry 14, with effect from the 1st March, 2016, the following entry shall be inserted, namely-

“14A. Services by way of construction, erection, commissioning, or installation of original works pertaining to an airport or port provided under a contract which had been entered into prior to 1st March, 2015 and on which appropriate stamp duty, where applicable, had been paid prior to such date:

provided that Ministry of Civil Aviation or the Ministry of Shipping in the Government of India, as the case may be, certifies that the contract had been entered into before the 1st March, 2015:

provided further that nothing contained in this entry shall apply on or after the 1st April, 2020.”;

(viii) in entry 16, for the words “one lakh rupees”, the words “one lakh and fifty thousand rupees” shall be substituted;

(ix) in entry 23,-

(A) after clause (b), the following clause shall be inserted with effect from 1st June 2016, namely,-

“(bb) stage carriage other than air-conditioned stage carriage;”;

(B) clause (c) shall be omitted;

(x) in entry 26, after clause (p), the following clause shall be inserted, namely,-

“(q) Niramaya* Health Insurance Scheme implemented by Trust constituted under the provisions of the National Trust for the Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act, 1999 (44 of 1999).”;

(xi) after entry 26B, the following entry shall be inserted, namely,-

“26C. Services of life insurance business provided by way of annuity under the National Pension System regulated by Pension Fund Regulatory and Development Authority of India (PFRDA) under the Pension Fund Regulatory And Development Authority Act, 2013 (23 of 2013).”;

(xii) after entry 48, the following entries shall be inserted, namely,-

“49. Services provided by Employees’ Provident Fund Organisation (EPFO) to persons governed under the Employees’ Provident Funds and Miscellaneous Provisions Act, 1952 (19 of 1952);

50. Services provided by Insurance Regulatory and Development Authority of India (IRDA) to insurers under the Insurance Regulatory and Development Authority of India Act, 1999 (41 of 1999);

51. Services provided by Securities and Exchange Board of India (SEBI) set up under the Securities and Exchange Board of India Act, 1992 (15 of 1992) by way of protecting the interests of investors in securities and to promote the development of, and to regulate, the securities market;

52. Services provided by National Centre for Cold Chain Development under Ministry of Agriculture, Cooperation and Farmer’s Welfare by way of cold chain knowledge dissemination.”;

(xiii) after entry 52 as so inserted, the following entries shall be inserted with effect from 1st June 2016, namely:-

"53. Services by way of transportation of goods by an aircraft from a place outside India upto the customs station of clearance in India.";

(b) in paragraph 2, -

(i) after clause (b), the following clause shall be inserted with effect from such date on which the Finance Bill, 2016 receives assent of the President of India, namely: -

'(ba) "approved vocational education course" means, -

(i) a course run by an industrial training institute or an industrial training centre affiliated to the National Council for Vocational Training or State Council for Vocational Training offering courses in designated trades notified under the Apprentices Act, 1961 (52 of 1961); or

(ii) a Modular Employable Skill Course, approved by the National Council of Vocational Training, run by a person registered with the Directorate General of Training, Ministry of Skill Development and Entrepreneurship;';

(ii) for clause (oa), the following shall be substituted with effect from such date on which the Finance Bill, 2016, receives assent of the President of India, namely: -

'(oa) "educational institution" means an institution providing services by way of:

(i) pre-school education and education up to higher secondary school or equivalent;

(ii) education as a part of a curriculum for obtaining a qualification recognised by any law for the time being in force;

(iii) education as a part of an approved vocational education course;";

(iii) after clause (zd), the following clause shall be inserted, namely:-

'(zdd) "senior advocate" has the meaning assigned to it in section 16 of the Advocates Act, 1961 (25 of 1961);'

2. Save as otherwise provided in this notification, this notification shall come into force on the 1st of April, 2016.

[F. No.334/8/2016 -TRU]

(K. Kalimuthu)
Under Secretary to the Government of India

Note:-The principal notification was published in the Gazette of India, Extraordinary, *vide* notification No. 25/2012 - Service Tax, dated the 20th June, 2012, *vide* number G.S.R. 467 (E), dated the 20th June, 2012 and last amended *vide* notification number 07/2016 - Service Tax, dated the 18th February, 2016 *vide* number G.S.R. 184(E), dated the 18th February, 2016.

Annexure-II

(Refer Clause 28 of SCC)

(To be stamped in accordance with Stamp Act)

INDENTURE FOR STAGE PAYMENT

THIS INDENTURE made onbetween(hereinafter called the contractor) which expression shall where the context do admits or implies be deemed to include its executors, administrators and assigns of the one part and the Jaipur Metro Rail Corporation Ltd. (hereinafter called JMRC of the other part.

WHEREAS by the agreement (LOA No dated.....) (hereinafter called the said agreement) the contractor has agreed to "Design Verification, Detail Engineering, Supply, Installation, Testing and Commissioning of Environment Control System (ECS), Tunnel Ventilation System (TVS), Electrical and Mechanical System (E&M) and Building Management System (BMS) for two underground Metro Stations at Chhoti Chaupar and Badi Chaupar on East-West Corridor of Jaipur Metro Phase- 1B" and whereas the contractor has applied to the JMRC Ltd. That they may be allowed advance on the security of materials absolutely belonging to them and brought by them to the site of the works covered under the project of the said agreement for use in the construction of such of the work as they have under taken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges).

AND WHEREAS the JMRC Ltd. Has agreed to make stage payment to the contractor the total sum of Rs.-----(Rupees -----only) for stage payment Bill. The quantities and other particulars of which are detailed in this bill for the said works signed by the Contractor on "-----" and JMRC Ltd has reserved to itself option of making any further advances till date on the security of other materials brought by the contractor to site of the said work.

NOW THIS INDENTURE WITNESS that in pursuance of the said agreement and its consideration of the sum of Rs. ----- (Rupees -----only) on or before the execution of these present amount paid to the contractor by the JMRC Ltd (the receipt where of the contractor) both hereby acknowledge and of such further Stage payment, if any, as may be made to him so aforesaid to the contractor do the covenant and agreed with the JMRC Ltd and declare as follows:

1. That the said sum of Rs. ----- (Rupees ----- only) so Stage Payment by the JMRC Ltd to the contractors as aforesaid and all or any further sum or sum's advanced as aforesaid shall be employed by the contractor in or towards the execution of the said works and for no other purpose whatsoever.
2. That the Stage Payment detailed in the said running account bill which have been offered to and accepted by the JMRC Ltd as security are absolutely the contractor's own property and free from encumbrances of any kind and the contractor's shall not make any application for or receive any further payments on the security of work executed which are not absolutely his own property and free from encumbrances of any kind the Contractor indemnifies the JMRC Ltd against all claims on any materials in respect of which any Stage Payment has been made to him as aforesaid.
3. That the Stage Payment detailed in the said running account bill and all other stage payments on the

security of which further payments or Stage Payment any hereafter be made as aforesaid (hereinafter called the said materials) shall be used by the contractor solely in the execution of the said works in accordance with the directions of the Engineer / JMRC Ltd and in the terms of the said agreement.

4. That the contractor shall be fully liable for the materials/components and shall make at his own cost all necessary and adequate arrangement for the proper watch, safe custody and protection against all risks including, acts of the God of the said materials/components and provide on approved insurance in favour of JMRC Ltd that until used in construction as aforesaid the said materials shall remain at the site of said works in the contractor's custody and on his own responsibility and shall at the time be open to inspection by the Engineer/JMRC Ltd. This insurance will be valid for a period until this material is approved and fixed in the building or advance has been fully recovered from contractor.
5. That the said materials/components shall not on any account be removed/shifted from the site of the works except with the written permission of the Engineer/JMRC Ltd.
6. That issue of any Stage Payment excess of what is finally required to be used at site would be the contractor's property without any liability on JMRC Ltd., who would recover the cost of this from the contractor.
7. That the contractor hereby charges all the said materials components with the repayment to the JMRC of the said sum of **Rs. ----- (Rupees -----only)** and any further sum or sums advanced as aforesaid and all cost charges. Damages and expenses payable under these presents provided always and it is hereby agreed and declared that not with power contained therein, if any, whenever the convenient for payment, and repayment herein before contained shall become enforceable and the money owned shall not be paid in accordance therewith, the JMRC Ltd., may at any time thereafter adopt all or any of the following courses as he may deem best.
 - a. That if the contractor shall at any time not be able to complete any part of the Component / equipment as per provision in contract Agreement it shall be considered as the work being left incomplete by the contractor and action as per the conditions of the contract shall be taken.
 - b. Deduct all or any of the money owing out of the performance security or any sum due to the contractor under the said agreement.

That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail.

This widening shall be co-extensive to the agreement dated between Jaipur Metro Rail Corporation Limited, Khanij Bhawan, Tilak Marg, C-Scheme, Jaipur (Rajasthan), India, PIN-302 005. (Client) and (Contractor).

IN WITNESS where of the said contractor and by the order under the direction of JMRC Ltd has here set their respective hands the day and years first above written.

Signed, Sealed & Delivered by the said Contractor:

**IN THE PRESENCE OF:
WITNESS:**

1. NAME:

Signature:

SIGNED BY (ADDRESS)
BY THE ORDER AND DIRECTION OF THE JMRC LTD IN THE PRESENCE OF:

SIGNATURE:

WITNESS

(NAME AND ADDRESS)

Annexure-III

REQUIREMENTS UNDER GCC/SCC

S.N	DESCRIPTION	Clause Ref.	REQUIREMENT
i	Amount of Performance Security	Clause 9 of the SCC	10% of the Contract Price in types and proportions of currencies in which the contract price is payable. In the event of variations during the execution of the contract which result in payments to the Contractor over and above the contract price, the Performance Security shall be suitably adjusted.
ii	Latest 'date for commencement' of the Works	Clause 4 of the SCC	7 days from the date of LOA or Employer's Notice to Proceed
iii	'Time for completion' of the work from the date of commencement of the work	Clause 8.2 of the GCC	<i>As per key dates</i>
iv	Liquidated Damages	Clause 23 of the SCC	As per the referred clauses of SCC
v	'Defects Liability Period' for the whole of the Works	Clause 25 of the SCC	As per clause 25 of SCC after the date of issue of Completion Certificate for the Part of the Works or from the date of ROD for the equipments and systems employer starts using and accepted by employer for DLP.
vi	Amount of advance payment	Clause 8 of the SCC	As per the referred clauses of SCC
vii	Amount of Professional Indemnity Insurance (PII). (for the contracts having Design in scope of work)	Clause 51 of SCC	AOA (any one accident) limit equal to 6% of the contract value against BOQ in respect of 'design and construct' with AOY (any one year) limit of 2 incidents in a year . In the Professional Indemnity insurance Policy the deductible amount shall not be more than 5% of AOA limit. PII Policy shall be obtained within four weeks from 'date of commencement' and shall be valid for five years after date of issue of

			<i>'Performance Certificate'</i> . Wherever the contractor submits policy for shorter period /annual renewable policy, the same shall be renewed before its expiry date. In such situation, the performance guarantee (5% of contract value) shall be retained till required validity period. The contractor's submission of such shorter period /renewable policy shall be construed as their irrevocable consent for retention of the performance guarantee.
viii	Insurance cover for Contractor's All Risk and other requirements as specified in the GCC	Clause 34 of the GCC	100% of the Total Contract Price.
ix	Amount of Third Party Insurance	Clause 34 of GCC	INR 0.50 Million for any one incident, with no. of incidents unlimited.
x	Period in which all insurances have to be submitted	Clause 34 of GCC	Within 4 weeks from the "Date of commencement of Work"
xi	Contract Key Dates		As per Appendix-4 of Section-9 (Contract Forms)

Annexure-IV

59.0 ADB Environment Management Plan

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
PRE-CONSTRUCTION					
PC1	Contractor Preparatory Works (Upon issuance of Notice to Proceed)	Nuisance from traffic congestion	<p>The Contractor will complete the following activities no later than 30 days upon issuance of Notice to Proceed:</p> <ol style="list-style-type: none"> 1.) Submit appointment letter and resume of the Contractor's Health and Safety Officer (HSC) and environmental focal person to CSC 2.) HSC will engage CSC-Environment Specialist; to a meeting to discuss in detail the EMP, seek clarification and recommend corresponding revisions if necessary 3.) HSO will request CSC-ES copy of monthly monitoring formats and establish deadlines for submission. 4.) HSO will submit for CSC-ES approval an action plan to secure all permits and approvals needed to be secured during construction stage which include but not limited to: i) operation of crushers and hot mix plants, ii) transport and storage of hazardous materials (e.g. fuel, lubricants, explosives), iii) waste disposal sites and disposal management plan, iv) temporary storage location v) water use, and vi) emission compliance of all vehicles. Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan. 5.) HSC will submit for approval of CSC-ES the construction camp layout before its establishment. <p>The Contractors will discuss and coordinate the implementation of the traffic re-routing scheme particularly in Chhoti Chaupad and Bad Chaupad when it starts the cut and cover activities and the hauling and disposal of excavated materials to the Ambabari village.</p>	Contractor and CSC	Part of contractor's cost
PC2	Coordinate with the Jaipur Development Authority on Traffic Management Plan	Nuisance from traffic congestion	At the minimum, the traffic management plan will have the following components: construction traffic, ensuring access to properties, accommodating pedestrians, parking, access by construction vehicles, faulty traffic lights and problem interchanges, use of public roads, parking provision during construction, use of residential streets and traffic diversion due to temporary road closures, and construction and use of temporary access roads.	Contractor and CSC	Part of Contractor's cost

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
PC3	Community Liaison	Complaints	To ensure that ongoing feedback is provided on the progress of the JMRP together with feedback on the environmental management performance of the project. Contractor will provide a minimum of two (2) weeks notification to directly affected residents, businesses and other relevant groups of the intended construction commencement date. In providing a mechanism for communication between the contractor and the community and informing the public of construction details (timing, expected impacts), the concessionaire will undertake consultation and information activities.	Contractor, CSC and JMRP Safeguards cell	Part of Contractor's cost
PC4	Ground saking	Chance find of artefacts	At least 30 days before the start of tunneling, the Contractor with supervision from the Archeology Department will employ a ground penetrating radar (GPR), detect the presence of buried artefacts along the tunnel alignment. The Contractor, on behalf of the JMRP, will coordinate with the Archeology Department to designate an on-site representative during the entire duration of the project.	Contractor, CSC	Part of construction cost
PC5	Briefing on working near heritage resource.	Damage to heritage resource. Cultural conflicts	All workers will undergo a briefing with the Archeology Department to ensure safeguarding of heritage resource and cultural/religious practices. A proof of compliance to this requirement to include the name of participants and date and location of briefing will form part of the monthly report to the CSC.	Contractor, CSC	Part of construction cost
CONSTRUCTION					
C1.0	Tunnel boring and cut and fill	Damage to heritage resources. Tunnel boring namely Chandpole Gate, Krishna Temple, Isar Lat, Jantar Mantar, Hava Mahal, Chitti Chaupad, and Badi Chaupad.	No heritage resources are inadvertently damaged during construction.		

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
C1.1			<p>The contractor will ensure that no inadvertent damage is incurred to the Chandpole gate.</p> <p>Ground settlement cannot be avoided in tunneling works due to the loss of volume loss, which is estimated at 0.45% for the JMFP. Estimated settlement under the Chandpole gate is less than 5mm. The contractor will ensure that the design value is not exceed and the trigger value = 3.5mm and Allowable value = 4.2 meters are implemented.</p> <p>Tilt meters will be installed at key positions on the gate to ensure the 21000 design value is observed with trigger and allowable values of 1.4/1000 and 1.7/1000, respectively</p> <p>Crack meters will be installed at key positions to ensure design value of 3.0mm is not exceeded with 2.1mm trigger value and 2.5 mm allowable value</p> <p>The contractor will immediately cease all operation if any of the trigger values are breached. The CSC will advise the contractor mitigation measures and practices to control settlement, tilt and cracks to include but not limited to structural reinforcement and operation parameters of the TBM.</p> <p>The contractor will ensure that no structural damage is incurred and cosmetic damages are repaired under the supervision and control of the Jaipur Archeology Department.</p>	Contractor and CSC	Part of Contractor's cost
C1.2	Vibration from the tunnel boring machine	Cosmetic and Structural damages to the structures along the underground metro alignment along Chandpole Bazar and Tripole Bazar. Most notable are	<p>Expected vibration at the Chandpole Gate during tunneling is 0.662 mm/s which is lower than internationally accepted limits. However, to be on the safe side and as practice in DMRC, the Contractor is to ensure that vibration levels at the Chandpole Gate foundation will not exceed 2.0 mm/s</p>	Contractor and CSC	Part of Contractor's Cost

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
C1.3	Surface noise from excavating equipment in Chhoti and Badi Choupad	Damage and nuisance to Krishna Temple, Jantar Mantar, and Hewa Mehal. Disurbance of patients in the Pink City Hospital near Chaudary Hospital, Majareja School at the corner of Chhoti Chaudad.	<p>The contractor will ensure that noise from construction activities does not result to exceedences of relevant limits prescribed in the Indian Ambient Air Quality Standards for Commercial Area and Silence Zone. Mitigation measures to be implemented by the Contractors are:</p> <ol style="list-style-type: none"> 1) Issue with local residents on how to best minimize construction noise along the Chhoti and Badi Choupads. 2) Local residents and shop owners should be informed of the nature and duration of interceded activities prior to commencement and kept updated as to changes in the management and mitigation plan 3) equipment compounds will be located off-site 4) noise barriers will be installed at critical work areas particularly around the Choupads 5) enclose especially noisy activities if above the noise limits 6) employ transportable noise screens between noise sources and identified noise sensitive areas for the duration of noisy construction activities 7) minimize the possibility of scheduling noisy activities at the same time to minimize the duration of exposure <p>Noise from vehicles particularly for hauling of excavated materials to the dump site will be controlled through strict adherence to operating and maintenance instructions, routing of heavy vehicles away from noise sensitive areas whenever possible, conform with speed limits, and construction vehicles will only use routes specified in the traffic management plan.</p>		
C1.4	Demolition of Chhoti and Badi Choupads	Loss of heritage structures	The project calls for the demolition of the Chhoti and Badi Choupads and its restoration to its original condition as a requirement from Jaipur Development Authority. The demolition and restoration will be under the supervision and control of these agencies.	Contractor, CSC	Part of construction cost

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
C1.4.1		Chances heritage finds during the cut and fill operations	Please refer to FIDIC Sec. 4.24. Fossils, Recording (including chain of custody) will be made by the contractor to be validated by the CSC, and expert verification will be made by the Jauru Archeology Department. Temporary work stoppage in the immediate area of the chances find for up to 72 hours to allow for the on-site representative of Archeology Department to visit the site to make an assessment and provide instructions. Work in the areas adjacent to the chance find will continue as provided in the detailed design.	Contractor and CSC	
C2	Soil Disposal (Ambabari Village)	Generate sediment and runoff from the work site during monsoon. Contamination of disposal sites from construction debris. Community hazard of uncollected and improperly disposed materials.	A spoil management plan will be implemented that details the location of spoil disposal sites, transporting soil, and disposing of soil. The Contractor will perform the following: 1) disposed spoils on permitted sites as instructed by the JMRC 2) ensure the adequacy of the disposal site to handle the volume of spoils that will be generated 3) Prepare, submit and seek approval from the CSC a spoil dump plan that provides the: i) dump size, layout, and form, ii) means of controlling water and wind erosion, iii) measures to prevent soil dump contamination, vehicular, and public access, 4) Explore the possibility of using spoil materials to rehabilitate borrow pits to 5) All hauling vehicles should be maintained at an acceptable working order and serviced regularly 6) Haul vehicles should be routed away from noise sensitive areas 7) Speed limit in built up areas is 40 km/h 8) All haul vehicles should be covered or soil sprayed with water before leaving the site specially during windy condition 9) Spoil dumps shall have slopes no steeper than 1V:2.5H 10) Final shaping, topsoiling, and immediate revegetation 11) No vehicles are to be allowed to enter a revegetated spoils dump The Contractor shall secure necessary permits from pertinent groundwater authorities before establishing borrowpits. Water conservation and recycling will be observed in all aspects of constructions to include water main breaks, watering roads for dust control, spraying concrete, equipment cleaning and site clean-up.	Contractor and CSC	Part of Construction Cost
C3	Groundwater Extraction	Depletion of groundwater Compatible with existing groundwater users			

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
C4	Disruption of essential services	Nuisance from temporary damage or shifting in utilities particularly buried water pipes and electrical lines	<p>The Contractor will ensure that the public will be minimally affected when constructing in close proximity to essential services through:</p> <ol style="list-style-type: none"> 1) coordinate and secure necessary permits for utility shifting with the Jaipur Development Authority and other service utility agencies to locate all services prior to construction in any particular area 2) inform residents of planned interruptions through local media, fliers, and public address system 3) all planned interruptions schedules will be submitted to the safeguards cell, MRC no later than 10 working days before the interruption 4) all affected landowners, tenants, institutions, and businesses to be notified in writing prior to commencement and kept updated in changes of schedule 5) in the event of unforeseen disruptions, the contractor will take all reasonable actions to have the service promptly restored 6) relevant utility agencies will be informed of the construction proximity to essential service line and be kept on standby in the event of unforeseen disruption <p>All unplanned interruption will be immediately reported to the safeguards cell within 24 hour through an incident report.</p>		
C5	Construction camp, batching plant and casting yard operators, and occupational safety	<p>Solid and liquid waste generation.</p> <p>Communicable diseases</p> <p>Hazardous materials storage</p> <p>Re-fueling</p> <p>Lifting</p> <p>Emergency preparedness</p> <p>Excavation and tunneling</p> <p>Personal protective equipment</p> <p>Energy management</p>	Please refer to SI-E.	Contractor and CSC	Part of construction cost

SN	Project Activity	Potential Impact	Mitigation measures	Institutional Responsibilities	Cost Estimate
C6	Cleanup Operations, Restoration and Rehabilitation		Contractor shall prepare site restoration plans, which shall be subject for review and approval by the CSC, JMRC Safeguard Cell, Japur Development Authority and the Archeology Department to ensure consistency with zoning and town plans. The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization. All spaces excavated and not occupied by the foundation or other permanent works shall be refilled with earth up to surface of surrounding ground.	Contractor and CSC	Part of construction cost
OPERATION					
01	Noise and Vibration	Vibration from train operation may cause structural or cosmetic damage to Chandpole Gate, Krishna Temple, Isar Lat, Jantar Mantar, and Hawa Mahal.	The JMRC will continue and maintain the monitoring sites established by the contractor for noise and vibration and will observe the same trigger values	JMRC	Operating cost
02	Waste water from Depot	Contamination of groundwater by petroleum laden waste	JMRC will install wastewater treatment plant at the Mansarovar depot station capable of removing petroleum contaminants and will meet national standards before re-injection to the groundwater	JMRC	Operating Cost
03	Depletion of groundwater	Water requirement for train and facility cleaning, and water for commuters. Each station will require 18,000 liters per day, platform washing is 5 liters/square meter, 70,000 l/day for car washing, and plus passenger water requirement.	Rain water harvesting facilities will be installed at Mansarovar station. All stations will employ a cooling water recirculation system for air-conditioning. Only recycled water will be used for facility cleaning and landscape irrigation. All toilets will be equipped with low-flow fixtures.	JMRC	Operating Cost

ADB Environmental Monitoring Plan						
Envd Indicators	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Approx. Cost
Construction Phase						
Air Quality	TSPM, PM ₁₀ , NO _x , SO _x , CO _x	Qualitative analysis of dust development at selected sites/sensitive spots through High Volume Sampler	2 locations at Chotti and Badi Chupad where cut and fill activities will be implemented	24 hours continuous every month during construction activities completed	National Ambient Air Quality Standards (NAAQS)	360/10,000 360,000
Water Quality	DO, Turbidity, Conductivity, pH, E.Coli, TSS, Cr and Grease and TDS	<ul style="list-style-type: none"> Collect and analyze sample from source Observation of blockage of waterways - extent and location reported Water pollution incidents due to landfill disposal of waste and spoil analyzing effects on local fisheries Observations on vehicle and equipment washing practices in rivers 	Ground water at construction camp and	Quarterly	National Drinking Water Quality Standards (NDWQS) and Water Quality Guidelines	1260,750 =Rs. 45,000
Noise Levels	(1hr L _{eq} dB(A)) W-10 Standards	<ul style="list-style-type: none"> Point source measurements in dB(A) at settlement sites/sensitive spots for noise level at 2, 5 and 15 m from road shoulder Traffic volume measurements 	Krishna Temple, Jarjar Minjar, and Pawa Mahal, Pink City Hospital near Champole, Chaudhry Hospital, Maharaja School at the corner of Choti Chupad	Monthly	Indian Ambient Air Quality Standards for Noise	8x12x36x2, 450 =Rs. 705,600
						Contractor
						SC, PCDOR

Env't Indicators	Parameters	Methods/Guidelines	Tentative Location	Frequency and duration	Standards	Approx. Cost	Implementation	Supervision
Vibration	ppv mm/s	Accelerometer	Krishna Temple, Jantar Mantar, and Hava Mahal, Pink City Hospital near Chandpole, Maaraja School at the corner of Chhoti Chaudh	Monthly	Commercial: 10 mm/s (day), Archaeological structures: 2.5 mm/s	\$6230,300 Rs7,200,000	Contractor	CSC
Underground artifacts	Number and location	Ground Penetrating Radar	Along the entire tunnel length	Once 30 days before tunneling	None	Rs200,000	Contractor	CSC
Water Quality	DO, Conductivity, pH, E.Coli, TSS, Oil and Grease and TDS	<ul style="list-style-type: none"> • Collect and analyze sample from source • Observation of bio-ge of waterways - extent and secondary impacts • Water pollution incidents due to unsafe disposal of waste and spot analyzing of waterways • Observations on vehicle and equipment washing practices in rivers 	2 stations Operation Phase	Annual	National Drinking Water Quality Standards (NDWQS) and Water Quality Guidelines	Rs. 45,000	JMRC	SPCB
Vibrator	ppv mm/s	Accelerometer	Krishna Temple, Jantar Mantar, and Hava Mahal, Pink City Hospital near Chandpole, Maaraja School at the corner of Chhoti Chaudh	Annual	Commercial: 10 mm/s (day), Archaeological structures: 2.5 mm/s	Rs200,000	JMRC	Department of Archaeology

Section 9 - Contract Forms

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Notification of Award

[*Employer's letterhead*]

Letter of Acceptance

[*date*]

To: [*Name and address of the contractor*]

This is to notify you that your Bid dated [*date*] for execution of the **JP/EW/1B/E2: “Design Verification, Detail Engineering, Supply, Installation, Testing and Commissioning of 25 KV Traction (Rigid OHE), 33 KV Auxiliary Sub Station(ASS),Associated Cabling and SCADA Systems for underground corridors of Jaipur Mass Rapid Transport System Project Phase-1B”** for the Contract Price in the aggregate of [*amounts in numbers and words*] [*name of currency*], as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by our Agency.

You are requested to furnish the Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose one of the Performance Security Forms included in Section 9 (Contract Forms) of the Bidding Document.

Authorized Signature:

Name and Title of Signatory:

Name of Agency:

Attachment: Contract Agreement

Contract Agreement

THIS AGREEMENT made on the [*insert number*] day of [*insert month*], [*insert year*],

BETWEEN

(1) JAIPUR METRO RAIL CORPORATION LTD., a corporation incorporated under the laws of [*country of employer*] and having its principal place of business at Khanij Bhawan, Tilak Marg, C-Scheme, Jaipur (Rajasthan), India, PIN-302 005 (hereinafter called “the Employer”), and (2) [*name of contractor*], a corporation incorporated under the laws of [*country of contractor*] and having its principal place of business at [*address of contractor*] (hereinafter called “the Contractor”).

WHEREAS the Employer desires to engage the Contractor to “Design Verification, Detail Engineering, Supply, Installation, Testing and Commissioning of 25 KV Traction (Rigid OHE), 33 KV Auxiliary Sub Station(ASS),Associated Cabling and SCADA Systems for underground corridors of Jaipur Mass Rapid Transport System Project Phase- 1B NCB No. JP/EW/1B/E2:” (“the Facilities”) and the Contractor have agreed to such engagement upon and subject to the terms and conditions hereinafter appearing.

NOW IT IS HEREBY AGREED as follows:

Article 1 Contract Documents

1.1 Contract Documents (Reference GCC Clause 2)

The following documents shall constitute the Contract between the Employer and the Contractor, and each shall be read and construed as an integral part of the Contract:

- (a) This Contract Agreement and the Appendices hereto
- (b) Letter of Price Bid and Price Schedules submitted by the Contractor
- (c) Employer’s requirements
 - (i) Technical and General Specifications
 - (ii) Drawings
 - (iii) Other requirements
- (d) Special Conditions of Contract
- (e) List of Eligible Countries that was specified in Section 5 of the Bidding Document
- (f) General Conditions of Contract
- (g) Other completed Bidding Forms submitted with the Letters of Technical and Price Bids
- (h) Any other documents part of the Employer’s Requirements
- (i) Letter of Technical Bid and Technical Proposal submitted by the Contractor

1.2 Order of Precedence (Reference GCC Clause 2)

In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Contract Documents are listed in Article 1.1 (Contract Documents) above.

1.3 Definitions (Reference GCC Clause 1)

Capitalized words and phrases used herein shall have the same meanings as are ascribed to them in the General Conditions.

Article 2
Contract Price and
Terms of Payment

2.1 **Contract Price** (Reference GCC Clause 11)
 The Employer hereby agrees to pay to the Contractor the Contract Price in consideration of the performance by the Contractor of its obligations hereunder. The Contract Price shall be the aggregate of [. . . amounts of foreign currency in words . . .], [. . . amounts in figures. . .] as specified in Bill of Quantities (Grand Summary), [. . . amounts of local currency in words . . .], [. . . amounts in figures. . .], or such other sums as may be determined in accordance with the terms and conditions of the Contract.

2.2 **Terms of Payment** (Reference GCC Clause 12)
 The terms and procedures of payment according to which the Employer will reimburse the Contractor are given in the Volume-3 of Section 6 (Employer's Requirements).

The Employer shall instruct its bank to issue an irrevocable confirmed documentary credit made available to the Contractor in a bank in the country of the Contractor. The credit shall be for an amount of [. . . amount equal to the total named in Schedule 1 less the advance payment to be made for plant and mandatory spare parts supplied from abroad. . .]; and shall be subject to the Uniform Customs and Practice for Documentary Credits 1993 Revision, ICC Publication No. 500.¹

In the event that the amount payable under ~~Schedule No. 1~~ is adjusted in accordance with GCC 11.2 or with any of the other terms of the Contract, the Employer shall arrange for the documentary credit to be amended accordingly

Article 3
Effective Date
Article 4
Communications

3.1 Effective date shall be as specified in the Letter of Acceptance.

4.1 The address of the Employer for notice purposes, pursuant to GCC 4.1 is: [*Employer's address*].

4.2 The address of the Contractor for notice purposes, pursuant to GCC 4.1 is: [*Contractor's address*].

Article 5.
Appendixes

5.1 The Appendixes listed in the attached List of Appendixes shall be deemed to form an integral part of this Contract Agreement.

5.2 Reference in the Contract to any Appendix shall mean the Appendixes attached hereto, and the Contract shall be read and construed accordingly.

IN WITNESS WHEREOF the Employer and the Contractor have caused this Agreement to be duly executed by their duly authorized representatives the day and year first above written.

Signed by, for and on behalf of the Employer

[*Signature*]

[*Title*]

¹ Or Uniform Customs and Practice for Documentary Credits 2007 Revision, ICC Publication No. 600 (or the latest version).

in the presence of

[*Signature*]

[*Title*]

Signed by, for and on behalf of the Contractor

[*Signature*]

[*Title*]

in the presence of

[*Signature*]

[*Title*]

APPENDIXES

Appendix 1 - Terms and Procedures of Payment

Appendix 2 - Price Adjustment

Appendix 3 - Insurance Requirements

Appendix 4 - Time Schedule

Appendix 5 - List of Major Items of Plant and Services and List of Approved Subcontractors

Appendix 6 - Scope of Works and Supply by the Employer

Appendix 7 - List of Documents for Approval or Review

Appendix 8 - Functional Guarantees

Appendix 1 - Terms and Procedures of Payment

Please refer Price Schedules in Section-4 Vol-2 (BoQ, Preamble) of Bid document

Appendix 2 - Price Adjustment

Prices payable to the Contractor, in accordance with the Contract, shall be subject to adjustment during performance of the Contract to reflect changes in the cost of material components during manufacturing of equipments, in accordance with the following formula:

$$P_1 = P_0 \times \left(a + b \frac{L_1}{L_0} + c \frac{M_1}{M_0} \right) - P_0$$

in which:

P_1 = adjustment amount payable to the Contractor

P_0 = Contract price of the equipment (base price)

a = percentage of fixed element in Contract price (**$a = 0.15$**)

b = percentage of labour component in Contract price ($b = \%$). For Supply/delivery $b=0.2$.

c = percentage of material and equipment component in Contract price ($c = \%$). For Supply/delivery $c=0.65$.

L_0, L_1 = Labour indices applicable as issued by Ministry of Labour & Employment, GOI (Consumer Price Index numbers) as applicable to the place of execution of the contract on the base date and the date for adjustment, respectively

M_0, M_1 = Wholesale Price Indices (for basic metals, alloys & Metal Product) as issued by RBI, on the base date and the date for adjustment, respectively

Conditions Applicable to Price Adjustment

The base date shall be the date 28 days prior to the deadline for submission of the Bid.

The date of adjustment shall be the mid-point of the period of manufacture of the component or Plant.

Note: Incase, if the corresponding date is not available in the data for this purpose, then the data of the month having major period shall be considered.

The following conditions shall apply:

- a. The price adjustment shall only be applicable for the supply/delivery items in the contract for the items as specified.
- b. No price increase will be allowed beyond the original delivery date unless covered by an extension of time awarded by the Employer under the terms of the Contract. No price increase will be allowed for periods of delay for which the Contractor is responsible. The Employer will, however, be entitled to any price decrease occurring during such periods of delay.

- c. If the currency in which the Contract price, Po, is expressed is different from the currency of the country of origin of the labour and/or materials indexes, a correction factor will be applied to avoid incorrect adjustments of the Contract price. The correction factor shall correspond to the ratio of exchange rates between the two currencies on the base date and the date for adjustment as defined above.
- d. No price adjustment shall be payable on the portion of the Contract price paid to the Contractor as an advance payment against the equipment if applicable.
- e. The price adjustment shall be applicable for the following only:-

S.No.	Item
1	ROCS Conductor Rail, Interlocking Joints & Insulators
2	Contact Wire
3	Steel Parts
4	Overhead Protection Conductor(OPC)
5	Return Conductor (RC)
6	Tunnel Earth Wire (TEW)
7	Dry type Transformers as per BOQ
8	33 KV Cable FRLSOH, as per BOQ
9	33 KV GIS Switchgear as per BOQ
10	25 KV Cable
11	25 KV Switchgear

Note: The price adjustment shall also be applicable for spares in case, ordered by the employer beyond DLP (DLP+2 Years).

Appendix 3 - Insurance Requirements

(A) Types of Insurance to Be Taken Out by the Contractor

In accordance with the provisions of GCC Clause 34, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the types of insurance set forth below in the sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, such approval not to be unreasonably withheld.

(a) Cargo Insurance

Covering loss or damage occurring, while in transit from the supplier's or manufacturer's works or stores until arrival at the Site, to the Facilities (including spare parts therefore) and to the construction equipment to be provided by the Contractor or its Subcontractors.

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

(b) Installation All Risks Insurance

Covering physical loss or damage to the Facilities at the Site, occurring prior to completion of the Facilities, with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the defect liability period while the Contractor is on the Site for the purpose of performing its obligations during the defect liability period.

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

(c) Third Party Liability Insurance

Covering bodily injury or death suffered by third parties (including the Employer's personnel) and loss of or damage to property (including the Employer's property and any parts of the Facilities that have been accepted by the Employer) occurring in connection with the supply and installation of the Facilities.

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

(d) Automobile Liability Insurance

Covering use of all vehicles used by the Contractor or its Subcontractors (whether owned by them or not) in connection with the supply and installation of the Facilities. Comprehensive insurance in accordance with statutory requirements.

(e) Workers' Compensation

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(f) Employer's Liability

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(g) Other Insurance

The Contractor is also required to take out and maintain at its own cost the following types of insurance:

Details:

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Subclause 34.1, except for the Third Party Liability, Workers' Compensation, and Employer's Liability Insurance, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Subclause 34.1, except for the Cargo, Workers' Compensation and Employer's Liability Insurance. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

(h) Professional Indemnity Insurance (PII)

Amount of Professional Indemnity Insurance (PII). (for the contracts having Design in scope of work):- Clause 51 of the SCC:-

AOA (any one accident) limit equal to 6% of the contract value against BOQ in respect of 'design and construct' with AOY (any one year) limit of 2 incidents in a year. In the Professional Indemnity insurance Policy the deductible amount shall not be more than 5% of AOA limit. PII Policy shall be obtained within four weeks from 'date of commencement' and shall be valid for five years after date of issue of 'Performance Certificate'. Wherever the contractor submits policy for shorter period /annual renewable policy, the same shall be renewed before its expiry date. In such situation, the performance guarantee (5% of contract value) shall be retained till required validity period. The contractor's submission of such shorter period /renewable policy shall be construed as their irrevocable consent for retention of the performance guarantee.

Appendix 4 - Time Schedule

Key dates for– Rigid OHE (ROCS) Works

Key Dates	Description	Key Date in Weeks Chand pole to Badi Chaupar Corridors
KD-1	Preliminary Design Submission	12
KD-2	Definitive Design Submission	18
KD-3	Submission of Preliminary Simulation Study	16
KD-4	Submission of Final Simulation Study	22
KD-5	Submission of Earthing and Bonding scheme along with detailed drawings based upon Simulation study.	26
KD-6	Submission of Detail Engineering and Submittal of Technical proposals of major equipment/vendors to Engineer for Approval along with technical parameters.	18
KD-7	Delivery of major material at Site e.g. Contact wire, Aluminum Rail, insulator, bracket, Section insulator, Tunnel Earth Wire, GIS Interrupters/ Circuit Breakers, Return Conductor, Earth Wire etc	38
KD-8	Installation of Rigid Catenaries System in tunnel sections, Neutral sections and completion of Earthing & bonding	42
KD-9	Installation of all equipment at SP (Sectioning Post) and Sub Sectioning Post as per the Cost Centers	43
KD-10	Testing and Commissioning of Rigid Catenaries System (ROCS) in tunnel Sections and SP (Sectioning Post) and Sub Sectioning Post as per the Cost Centers	48
KD-11	Charging of the Sectioning Post & Rigid OCS (ROCS) for Trail Runs, Signaling & rolling stock testing.	52
KD-12	Submission of Report by Independent Agency for Verification (Auditing) of design and installation of ROCS.	54
KD-13	System Acceptance Test including Integrating Testing of Rigid OCS of Section and checking/ measuring parameters e.g. step and touch Voltage and Parameters obtained by Simulation Study.	58
KD-14	Taking-over Certificate	80

Key dates for Auxiliary Substations (ASS) Works

Key Dates	Description	Key Date in Weeks Chand pole to Badi Chaupar Corridors
KD-1	Detail Engineering and Submittal of Technical proposals of major equipment to Engineer for Approval	12
KD-2	Submission of Working Drawings/ Shop Drawings	18
KD-3	Delivery of Major Equipment (33 KV panels, TR's, HT & LT cables, SCADA equipment etc) to Site	40
KD-4	Installation of Majority of ASS Equipment and commence system testing, SCADA testing.	46
KD-5	Commissioning of Auxiliary Sub Stations	50
KD-6	Charging of the Auxiliary power supply network for E&M supply extension and for Trail Runs, Signaling & rolling stock testing.	52
KD-7	Completion of acceptance test after integrated testing with SCADA System	58
KD-8	Taking over of the system	80

Note:

- a) All the key dates are from the date of commencement.
- b) For the part week, full week will be considered for this purpose.
- c) The site shall be made available progressively and if some part is not made available then the extension of time shall be allowed only to the work/KD of that particular part.

Appendix 5 - List of Major Items of Plant and Services and List of Approved Subcontractors

Not Used

Appendix 6 - Scope of Works and Supply by the Employer

N/A

Appendix 7 - List of Documents for Approval or Review

N/A

Appendix 8 - Functional Guarantees

N/A

Performance Security

..... *Bank's name, and address of issuing branch or office*¹

Beneficiary: *Name and address of employer*

Date:

Performance Guarantee No.:

We have been informed that *name of the contractor*. . . . (hereinafter called "the Contractor") has entered into Contract No. *reference number of the contract*. . . . dated with you, for the execution of *name of contract and brief description of plant and services*. . . . (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we *name of the bank*. . . . hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *name of the currency and amount in figures*². . . . (..... *amount in words*. . . .) such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire no later than the earlier of

(a) 24 months after our receipt of

- (i) a copy of the Completion Certificate; or
- (ii) a registered letter from the Contractor, attaching a copy of the notice to the project manager that the Facilities are ready for commissioning, and stating that 14 days have elapsed from receipt of such notice (or 7 days have elapsed if the notice was a repeated notice) and the project manager has failed to issue a Completion Certificate or inform the Contractor in writing of any defects or deficiencies; or
- (iii) a registered letter from the Contractor stating that no Completion Certificate has been issued but the Employer is making use of the Facilities; or

(b) the ____ day of ____, 2____.

Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458 (*or ICC Publication No. 758 as applicable*), except that subparagraph (ii) of Sub-Article 20(a) is hereby excluded.³

¹ All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

² The guarantor shall insert an amount representing the percentage of the contract price specified in the contract and denominated either in the currency(ies) of the contract or a freely convertible currency acceptable to the employer.

³ Or the same or similar to this clause specified in the Uniform Rules for Demand Guarantees, ICC Publication No. 758, where applicable.

.....
Seal of bank and signature(s)

-- Note to Bidder --

If the institution issuing the performance security is located outside the country of the employer, it shall have a correspondent financial institution located in the country of the employer to make it enforceable.

Advance Payment Security

..... *Bank's name, and address of issuing branch or office*¹

Beneficiary: *Name and address of employer*

Date:

Advance Payment Guarantee No.:

We have been informed that *name of the contractor*. (hereinafter called "the Contractor") has entered into Contract No. *reference number of the contract*. dated with you, for the execution of *name of contract and brief description of works*. (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum *name of the currency and amount in figures*². (..... *amount in words*.) is to be made against an advance payment guarantee.

At the request of the Contractor, we *name of the bank*. hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *name of the currency and amount in figures*³. (..... *amount in words*.) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the advance payment for purposes other than the costs of mobilization in respect of the Works.

It is a condition for any claim and payment under this guarantee to be made that the advance payment referred to above must have been received by the Contractor on its account number *contractor's account number*. at *name and address of the bank*.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of interim statements or payment certificates, which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate, indicating that 80% of the Contract Price has been certified for payment, or on the ... day of,, ⁴ whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458 (*or ICC Publication No. 758 as applicable*).

.....
Seal of bank and signature(s)

¹ All italicized text serves as a guide for preparing this demand guarantee and shall be deleted from the final document.

² The guarantor shall insert an amount representing the amount of the advance payment denominated either in the currency(ies) of the advance payment as specified in the contract, or in a freely convertible currency acceptable to the employer.

³ Footnote 2.

⁴ Insert the expected expiration date of the time for completion. The employer should note that in the event of an extension of the time for completion of the contract, the employer would need to request an extension of this guarantee from the guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [6 months][1 year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."

-- Note to Bidder --

If the institution issuing the advance payment security is located outside the country of the employer, it shall have a correspondent financial institution located in the country of the employer to make it enforceable.