

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 intergerating 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