DIVISION 16

ELECTRICAL

BUILDING WORK

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DIVISION 16 – ELECTRICAL WORKS

Section

SECTION 1

GENERAL CONDITIONS AND REQUIREMENTS

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GENERAL CONDITIONS AND REQUIREMENTS

16-1 GENERAL

16-1-1 INTRODUCTION

This part of specifications covers the electrical installation and it indicates the minimum standard of work.

Workmanship and materials necessary for the execution of the contract to satisfaction of The Engineer and the true of this specification and associated drawings and bill of quantities.

The specification does not generally indicate the specific number of items or amounts of material required. The specification is intended to provide product data and installation requirements.
It is necessary to refer to schedules; drawings (layouts, riser diagrams, schematics, details) and the specification to provide correct quantities. Singular may be read as plural and vice-versa in the specification.

In the case of discrepancies or conflicts between the tender documents. The contractor has to draw the attention of the Engineer to this conflict before submitting his prices, other wise he will be responsible to execute the works in the manner that the Engineer accepts.

16-2 STANDARDS

The electrical installation shall comply with one or more with the following:

1. General technical specifications of buildings , set by the local authorities
2. General and specific requirements of local power company
3. The regulations for the electrical equipment of the buildings (Sixteenth Edition) published by the Institution of Electrical Engineers, London–U.K.
4. British Standards/ Codes of Practice, CIBSE, and/ or those of the International Electromechanical Commission (I.E.C) or comparable standards.
5. All related standards, regulations and requirements of appropriate local authorities.

16-2-1 SCOPE OF WORK

The scope of work outlined below covers the supply and installation of electrical material as described under this section of the specification and/ or shown on the drawings including all other associated work such as supporting structure, building, ancillary work, attendance, etc. and the like.

Unless otherwise specifically indicated, the work shall include the supply of electric power to all electrically operated equipment and shall cover all equipment specified & supplied under other sections of the specification.
The electric power supply point for all stationary, electrically operated equipment, shall be supply terminal box on the equipment or its nearby isolating/ starting device if the equipment is supplied with a flexible cable and ready for connection.

16-2-3 WORK COVERED UNDER THIS SECTION

Without restricting the generality of the foregoing, the electrical installation covered under this section of the specification shall include mainly (but not limited to) the supply and installation of the following:

- Complete distribution network system for lighting and power from the transformer low voltage terminals to all electrically operated equipment, including busbars, feeder and sub-feeder cables, distribution and sub-circuit pandelboards, wiring & control equipment and the like.
- Main distribution boards and pandelboards.
- Indoor, outdoor and other special lighting installation.
- Miscellaneous other electrical fittings and accessories.
- Lighting protection system.
- Earthing system.
- Telephone fire, alarm, paging, security... etc. of low current systems.
- Testing of the installation at handing over.
- Loose equipment, spares and accessories to be delivered into the stores of the Employer as detailed in the specification.
- Shop drawings, technical literature, instruction manuals and as-built drawings.
- Testing of the installation, commissioning and handing over.
- Electrical installation for HVAC.

All electrical work shall be carried out in a neat, workman like and efficient manner, in accordance with the requirements of this specification and so that they're true meaning and intent are fulfilled.

It shall be clearly understood that this specification and the design drawings are complementary documents, intended for the selection of equipment having the general and specific characteristics as the detailed in the documents.

Unless otherwise specifically stated, the electrical installation shall be complete, ready for operation and fully integrated and co-ordinated with all other building items.

16-3 ACCESSIBILITY

All work shall be installed in a neat and workman like manner so as be readily accessible for operation, maintenance, repair and replacement.

Minor deviations from the drawings may be made to accomplish this but no changes shall be made without the approval of the Engineer.

16-4 DRAWINGS

16-4-1 Engineer's Drawings

The Engineer's drawing issued with this specification indicate the approximate location of all electrical apparatus. The exact and final location shall be subject to the prior approval of the Engineer.

The general wiring layout as shown on the Engineer's drawings shall be only used as a guideline defining the desired loading and switching arrangement. Actual routing of all circuits shall be as per the construction drawings to be submitted by the Contractor and approved by the Engineer.

The Contractor shall check Engineerural, structural, sanitary, heating and ventilating drawings to avert possible installation conflicts.

Should drastic changes from the original plans be necessary to resolve such conflicts, the Contractor shall secure the Engineer's approval on necessary adjustment before any installation work is started.

Discrepancies shown on different drawings or between drawings and actual field conditions, or between drawings and specification shall be brought to the attention of the Engineer for a decision.

16-4-2 Shop/ Construction Drawings

The Contractor shall submit shop drawing for the approval of the Engineer.

In preparing the shop drawings, the Contractor shall give the utmost importance to the co-ordination between the different trades forming the electrical installation.

No equipment or systems for which shop drawings are required shall be ordered or installed unless all such drawings are duly reviewed and approved by the Engineer.

16-4-3 As-Built Drawings

On completion of the Works, the Contractor shall supply three sets of prints of each applicable drawing for the electrical installation, showing the exact position of all apparatus, switchgear, conduit runs, sub-main wiring, main cable runs, switches and lighting points etc. to the Engineer's requirements.

All record drawings must conform in all respect to the pattern of the Contract drawings, and to the approval of the Engineer. The words (Record Drawing) shall be clearly indicated on all drawings adjacent to the title corner.

The said drawing to be submitted before 15 days of testing & commissioning in order to be checked by the Engineer. The final invoice shall be checked according to the approval of as built drawings.

16-5 INSTRUCTION MANUALS

The Contractor shall provide the Employer with three complete sets of instruction manuals covering operation, maintenance and ordering of spare parts for all electrical equipment. All documents shall be in English.

16-6 OPERATION OF DEFECTIVE EQUIPMENT

The Employer or his representative reserves the right to operate defective equipment until the Contractor can remove it from service for repair or replacement.

16-7 MANUFACTURERS

The list of approved manufactures appearing in the following sub-sections, indicate the minimum quality and standard of equipment to be accepted. Products of unlisted manufacturers having equivalent repute and standard shall be considered by the Engineer on an equal basis. In this respect the Engineer's decision shall be final and not subject to any justification whatsoever, and consequently no Contractor's claim shall be considered regarding time or financial as a result of the Engineer's decision.

Approval of a manufacturer does not necessarily constitute approval of his products as equal to that specified. It shall be the Contractor's sole responsibility to ascertain that the listed approved manufacturers are capable of supplying the required materials and/or equipment and in FULL conformity with the Engineer's specification.

Products similar to those used on other construction phases will be given priority.

16-8 BUILDER'S WORK

Builder's work shall be executed in accordance with the relevant section of these specifications. The following is a brief summary of the work included:

- The cutting away and forming of holes for conduits, cabled and fixing through walls, floors, ceilings, partitions, roofs,etc, and making good after the services are sufficiently advanced, tested and passed by the Engineer.
- The construction of concrete and/or block ducts in floors, walls, etc.
- The excavation, construction and backfilling of internal and/or external trenches including bedding materials and warning covers.
- The formation of concrete bases, plinths, etc. for plant and equipment.
- Fixing devices and supporting equipment and accessories.
- Formation of recesses for switchgear, lighting fittings, etc. and the Contractor shall be responsible under these clauses of the specification for executing all necessary builder's work of a similar nature.

16-9 SAMPLES

Samples of all materials and fittings, except where specifically mentioned, must be submitted to the Engineer, and his approval in writing obtained before purchasing it.

16-10 GENERAL DESIGN CONDITIONS

Electrical power will be available at 11 kv.50hz, stepped down & made available from the transformer's low voltage terminals at:

- 3 phases , 4 wires
- Earthing system
- 400 volts between phases 50 Hz.

Unless otherwise specifically indicated on the drawings, electrical power distribution system throughout the buildings shall be supplied from the above low voltage systems.

Unless otherwise specifically mentioned, all equipment, including circuit breakers, relays, contractors, cables, etc, shall be designed and derated for a continuous and trouble free service under the climatic conditions of the equipment location.

The component parts of each electrical system of piece of equipment shall be the latest standard product for a single manufacturer unless otherwise specified and provided such components, manufactured by different manufactures, are of standard design and dimensions and interchangeability is possible.

The climatic conditions on site are as follows:

- minimum temperature – 5C
- maximum temperature 60 C in the sun 45C in the shade
- altitude of site average 850 m above sea level
- relative humidity 20% to 80 %

16-11 TESTING AND COMMISSIONING

16-11-1 GENERAL

Each complete system shall be thoroughly inspected and tested on site before final placing in service under the full responsibility of the Contractor.

All tests shall be made in compliance with the Regulations and Standards.

Any modifications or repairs deemed necessary upon completion of the tests shall be executed at the Contractors expense. Further additional tests shall be carried out on any modified or repaired equipment until it is certified trouble free and acceptable for its intended service.

The Contractor must provide at no additional cost all testing equipment, labor and fuel. Tests must be carried out in the presence of an official representative of the Engineer.

16-11-2 WORKS TESTS

Inspect and test at the makers' works, during manufacture and after completion and in particular manufactured materials, apparatus or equipment for incorporation in the works, in order to prove that the material apparatus or equipment meets the requirements of the specification.
Upon completion of manufacture, or before dispatch in the case of stock items, all material apparatus and equipment intended for incorporation in the works shall be subjected to the tests, specified in the relevant National Standard, or elsewhere in this specification together with such additional tests as may be required in order to prove compliance with this specification. When no relevant British Standard exists, or the appropriate National Standard fails to specify tests, specify tests to provide compliance with the specification.

The results of each and every test carried out in accordance with the provisions of this specification shall be accurately and comprehensively recorded on a form of tests certificate.

Every test certificate shall include, in addition to all other requirements the date and time of the test, the ambient conditions, a fully detailed description of the test(S) carried out, the results obtained, and any relevant performance curves.

In case where the manufacturer or supplier of material, apparatus or equipment relies upon type tests to prove, either wholly or in part, the suitability of his product (S), then obtain copies of certificates giving the results of such type tests before the order is placed.

16-11-3 SITE TESTS

All necessary checks and tests shall be made to prove that the completed installations fully comply with specified requirements.

Upon completion of the electrical installation, or any substantial section therefor, the installation or that section and all of the associated electrical equipment shall be subjected to the tests specified in the relevant National Standard and in the IEE Wiring Regulations, together with such other tests as may be specified in order to prove compliance with the Specification.

Every test certificate shall include, in addition to all other requirements, the date and time of the test, the ambient conditions, a fully detailed description of the test (S) carried out, the results obtained, and relevant performance curves.

No apparatus, equipment, plant, or installations should be recognized as complete until all of the specified inspections and tests have been satisfactorily carried out.

Cable Testing

As soon as is practicable after the completion and jointing of the cabled specified herein, or of any usable group of such cables, the tests described below should be carried out together with such other tests and measurements to prove compliance with this specification and with the requirements of the IEE Wiring Regulations.

Specify an insulation resistance test, carried out with a Megger installation tester or other similar type of testing instrument, to measure the installation resistance between each conductor and the remaining conductors and between each conductor and the metallic sheath, if any, and armoring. The test voltage to be applied shall be as follows: -

Low Voltage Cables- 500 volts
High Voltage Cables- not less than 1000 volts.

The above tests shall be carried out both before and after any voltage tests and the installation resistance shall not be less than the figures in BS 6346, Table 6, for all cables up to 3.3 kV.

A voltage withstand test of 15 minutes duration shall be applied in accordance with the relevant British Standard, at the test voltage indicated in:

BS 5467, Table 7, of for cables with thermosetting installation
BS 6346, Table 5, for PVC insulated cables or
BS 6480, Table 6, for paper insulated cables
BS 7211, for LSF cables.

Fire resistance cables shall be subjected, on completion of installation and jointing, to a voltage test in accordance with BS 6387.

An earth continuity test shall be carried out to verify that the cable armoring and metal sheath, if any have been properly bonded to earth.

Phase - rotation and phase-correspondence shall be tested to prove that the cables have been correctly connected.

Low Voltage Switchboard Tests

Low voltage switchboard shall be thoroughly checked for correct functioning in every respect and shall be subjected to the following tests:

With all control circuits disconnected but with all isolators closed and power uses fitted, the panels shall be subjected to a voltage test across the following points:

Phase to phase
Phase to neutral
Phase to earth
Neutral to earth

The voltage levels and test direction shall be in accordance with the relevant National Standard for the equipment provided.

This shall be followed by an insulation resistance test with an approved type of 500 V test instrument. With all electronic components and time switches removed or isolated and with all main isolators closed and power fuses fitted, an insulation resistance of not less than 20 Megohms shall be obtained between each of the following points:

Phase to phase
Phase to neutral
Phase to earth
Neutral to earth
System and Equipment Earthling

Tests should be carried out on all systems and requirement earthling provisions in accordance with the requirements of the IEE Wiring Regulations.

The method of test and the section of suitable test instruments shall conform to the guidelines given in the IEE Wiring Regulations.

These tests shall be carried out on all systems and equipment earthling supplied, installed and connected.

The voltage levels and test direction shall be in accordance with the relevant National Standard for the equipment provided.

This shall be followed by an installation resistance test with an approved type of 500 V test instrument. With all electronic components and time switches removed or isolated and with all main isolators closed and power fuses fitted, an insulation resistance of not less than 20 Megohms shall be obtained between each of the following points:

Phase to phase
Phase to neutral
Phase to earth
Neutral to earth
System and Equipment Earthing.

Tests should be carried out on all the system and equipment earthing provisions in accordance with the requirements of the IEE Wiring Regulations.

The method of test and the selection of suitable test instruments shall conform to the guidelines given in the IEE Wiring Regulations.

These tests shall be carried out on all system and equipment earthling supplied, installed and connected.

16-11-4 COMMISSIONING

Following the satisfactory conclusion of inspections and tests on completed sections of the Works, each section of the electrical installation shall be commissioned and left in full working order. The term (commissioning) shall be deemed to include:

- The energizing of electrical distribution circuits and equipment's which have previously been inspected, tested, found to be satisfactory and capable of being energized with complete safety.
- The setting of electrical protective devices and systems.
- The starting up of all electrically powered plant and equipment.
- The verification of the performance of all such plant and equipment by the carrying out, where required, of further tests and the making of all necessary adjustments so as to obtains optimum performance.

Specify that all connections and adjustments are made correctly, and that the installations and equipment are left in a completely safe and satisfactory condition.

If considered necessary, set up a Commissioning panel to oversee all activities relating to commissioning of installations, plant and equipment.

No connections or adjustments should be made to plant or equipment, which has already been commissioned and set to work.

All commissioning procedures should be carried out in a safe and satisfactory manner and in accordance with the provisions of the Factory Acts, the Health and Safety at Work etc. Act, and the Electricity Regulations.

Following completion of commissioning, each item of equipment or, where several items of equipment are interdependent, the complete plant shall operate continuously and satisfactorily under normal operating conditions for a period of 72 hours without defect of any kind. In the event of any defect or mal-operation becoming apparent during this period it should be rectified by means or repair, replacement, adjustment or modification and the reliability run shall be re-commenced.

No plant, equipment or installation should be considered as complete until the prescribed commissioning procedures have been satisfactorily carried out and the reliability run has been completed without untoward incident.

End of Section

SECTION 2

HIGH VOLTAGE INSTALLATIONS

SECTION

SECTION 2

HIGH VOLTAGE INSTALLATIONS

16-12-1 HIGH VOLTAGE INSTALLATIONS

JEPCO will provide the indoor S/ station including HV cables, RMU,HV switchgear and transformer. The Contractor is requested to arrange the site conditions (trenches, footing, access, etc.) in full CO-ordination with JEPCO.

The Contractor will lay the LV cables from electrical switchroom up to transformer's terminals. Termination will be executed by JEPCO or by there (supervision and license) and to their requirements.