



GODAVARI GAS PRIVATE LIMITED

(A Joint Venture of M/s Andhra Pradesh Gas Distribution Corporation Ltd. and
M/s Hindustan Petroleum Corporation Ltd.)

TENDER DOCUMENT FOR MECHANICAL AND ELECTRICAL WORKS FOR CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS IN EAST & WEST GODAVARI GEOGRAPHICAL AREAS

DOMESTIC COMPETITIVE BIDDING

Tender No.: 05/51/E/0086/GGPL/001-iv

VOLUME – II OF II



**PREPARED AND ISSUED BY
MECON LIMITED**
(A Govt. of India Undertaking)
Delhi, India



**MECHANICAL AND ELECTRICAL WORKS FOR CONSTRUCTION OF CNG
DAUGHTER BOOSTER STATIONS AT EAST AND WEST GODAVARI
GEOGRAPHICAL AREA**



INDEX

S. No.	Description	Page Nos.
I.	Mechanical Works	03-102
II.	Instrumentation Data Sheets	103-107
III.	Structural Works	108-142
IV.	Electrical Works	143-456
V.	HSE Specification	457-533



**GODAVARI GAS PVT
LTD.**

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER
STATIONS AT EAST AND WEST GODAVARI
GEOGRAPHICAL AREA**

PARTICULAR JOB SPECIFICATION



MECON Ltd.

Page 1 of 8

PART-I MECHANICAL WORK



GODAVARI GAS PVT
LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER
STATIONS AT EAST AND WEST GODAVARI
GEOGRAPHICAL AREA**

PARTICULAR JOB SPECIFICATION



MECON Ltd.

Page 2 of 8

SCOPE OF WORK

CONTENTS

1. INTRODUCTION
2. SCOPE OF WORK (ACTIVITY-WISE)
3. DETAILED SCOPE OF WORK
4. GENERAL INSTRUCTIONS TO THE CONTRACTOR
5. REFERENCE SPECIFICATION, CODES AND STANDARDS
6. APPROVALS
7. STRUCTURES, SERVICES AND OTHER PROPERTY
8. SAFETY
9. PROGRESS OF WORK

 GODAVARI GAS PVT LTD.	MECHANICAL AND ELECTRICAL WORKS FOR CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA	 MECON Ltd. Page 3 of 8
	PARTICULAR JOB SPECIFICATION	

1. INTRODUCTION

M/s Godavari Gas Private Limited (GGPL) is planning to construct Daughter Booster Stations (DBS) to strengthen the CNG distribution network by facilitating the transportation, storage and efficient dispensing of CNG at daughter booster stations located away from the natural gas pipeline network. Aim is to enhance the availability and accessibility of CNG, support the expansion of clean fuel infrastructure, and meet the growing demand for environmentally friendly transportation fuel across the licensed geographical areas.

This tender pertains to the execution of Mechanical and Electrical (M&E) works associated with the construction of CNG Daughter Booster Stations (DBSs) /District Regulating Stations (DRSs) at selected locations in the East Godavari and West Godavari Geographical Areas (GAs) under GGPL for serving consumers of Domestic, Automobile, Commercial and Industrial sectors.

2. SCOPE OF WORK

The broad scope of work under “Mechanical Works” is essentially but not limited to the following

- I. Laying, testing and commissioning supplied by GGPL SS tubes supply and installation of associated SS fittings, valves, and U-clamps (galvanized) and other associated fixing arrangement complete with all support.
- II. Supply and Laying of SS (SS304) tube (within trenches) with all fixtures, fittings, isolation valves etc. as required as per P&ID and testing for instrument air application.
- III. Erection of mechanical equipment like dispenser, cascades etc. (as per Drawings enclosed elsewhere in the tender).

3. DETAILED SCOPE OF WORK UNDER THE PRESENT TENDER

Detailed scope of work is divided under different sub-heads. List of sub-heads along with different activities (with brief specification) is provided herein as well as in the SOR. The estimated quantities against the items are given in the SOR and the tenderer has to quote per unit rate against each sub-head as per the SOR.

Generally, the Contractor's scope of work shall constitute, but not be limited to the following:

3.1 SCOPE OF WORKS FOR LAYING, TESTING COMMISSIONING OF SS TUBING

- i. Receiving of materials from stores (only free issue items).
- ii. Laying of SS 316 tubes with SS ferrule fittings and SS ball valves (within trenches) supplied by GGPL as free issue items (or supplied by tenderer as per MECON specification no. MEC/TS/05/62/047A& MEC/TS/05/62/048) for CNG application.
- iii. Supply and Laying of SS 304 tubes (within trenches) with all ferrule fittings, isolation valves and reducers ($\frac{1}{2}$ " to $\frac{1}{4}$ " OD) etc. as required as per P&ID for instrument air application. These tubes shall be painted with blue colour for a bandwidth of 25 mm at every 300 mm apart to differentiate them from SS 316 main tubes (for CNG) running into the same trench.



GODAVARI GAS PVT
LTD.

MECHANICAL AND ELECTRICAL WORKS FOR CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA

PARTICULAR JOB SPECIFICATION



MECON Ltd.

Page 4 of 8

- iv. SS tubes shall be clamped to the existing MS Angle (within trench) at every 1000mm using U-clamps (galvanized) of any approved make. It is not permitted to flatten tubes for clamping purpose.
- v. MS Angle and U-clamps (galvanized) shall be isolated by rubber gaskets.
- vi. Carrying out pneumatic testing as per approved procedures; providing all tools, tackles, instruments, manpower and other related accessories for carrying out the testing of tubes.
- vii. Submission of final material appropriation statements for all the materials issued by OWNER/ENGINEER-IN-CHARGE, returning surplus material to Owner stores, reconciliation of free issue material/ consumables and obtaining 'No Objection Certificate' from Owner/Engineer-in-Charge

3.2 LOADING, UNLOADING, TRANSPORTATION ERECTION OF MECHANICAL EQUIPMENT

- I. Receiving of material from stores
- II. Loading of material / equipment on a truck from stores and Safe transportation to various sites.
- III. Unloading, placement and alignment on foundation—either on ground or above ground (+3.5m) on rooftop / platform top (cascades only).
- IV. Making Transit Insurance of equipment from stores to site.
- V. All equipment transported shall be securely boarded and transported without causing any damage to equipment. Any damage caused during loading, transportation & unloading shall be recovered from the contractor.

3.3 SUPPLY, ERECTION COMMISSIONING OF MISCELLANEOUS ITEMS

- I. Air compressor (Pump): Supply, erection (at location indicated by EIC), testing and commissioning of Air Compressor-cum-Pump with accessories such as dispensing stand, hose, nozzle, valves, connectors etc. complete with Automatic Intelligent Tyre Inflating M/C [AITIM] to supply compressed air for all type soft vehicles that visit the station for refueling of CNG or other purposes.
- II. Water Cooler: Supply, erection (at location indicated by EIC), testing and commissioning of a Water Cooler with Accessories such as dispensing fountain, filter, deodorizer, electronic purifier, drain tray, drain tube, drain valve, strainer stand etc. to supply cold/hot drinking water for drinking purposes.
- III. Fire Fighting Equipment: Supply and installation of (at location indicated by EIC) the following fire-fighting equipment in various CNG stations
- IV. 4.5kg capacity CO2 type fire extinguishers with steel cylinder with discharge valve conforming to IS: 16018. Extinguisher shall be painted with red enamel paint and hardware/bracket required for fixing to wall.



GODAVARI GAS PVT
LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER
STATIONS AT EAST AND WEST GODAVARI
GEOGRAPHICAL AREA**

PARTICULAR JOB SPECIFICATION



MECON Ltd.

Page 5 of 8

- V. 9kg capacity dry chemical powder (DCP) type fire extinguisher (Manufacturing code IS: 15683) with extinguishers cabinet suitable for inverted operation and fabricated from MS sheet internally protected with anticorrosive treatment and hydraulically tested. Extinguishers shall be externally painted with red enamel paint.
- VI. 75kg capacity trolley mounted dry chemical powder (DCP) type fire extinguisher (Manufacturing code IS: 16018) suitable for inverted operation fabricated from MS sheet internally protected with anticorrosive treatment and hydraulically tested extinguishers externally painted with red enamel.
- VII. Fire buckets, 9ltrs. capacity, made of galvanized mild steel (as per IS:2546) including supplying & fixing of MS angle iron stand to accommodate 4nos. of Fire buckets and first fill with sand/water all complete as per direction of Engineer In-charge. (Note: One set of Fire bucket consists of 4buckets with stand)
- VIII. Taking over the site from OWNER/ENGINEER-IN-CHARGE; carrying out pre-construction survey, making arrangement of safety, security, temporary water & electrical connections, traffic detour etc. setting out the piping GAD by laying out the plans at site.
- IX. Preparing QAP and taking approval from MECON including Welder's Qualification Test, Internal Test Plan, Hydrostatic Test Procedures, SS Tube & fittings testing & procedures.
- X. To carry out all tests at work site, approved laboratory and place of manufacture/fabrication; provide all test certificates from manufacturers & supplier and offer inspection at all stages of procurement/construction.
- XI. To maintain and observe all statutory requirements with regards to labour laws, taxation laws, local statutory rules and insurance requirements.
- XII. To hand over clear site to OWNER/ENGINEER-IN-CHARGE after removing all debris subsequent to completed works as per scope.
- XIII. To submit daily, weekly and monthly progress reports and to attend review meetings both at site and at project office and other discussions with Owner/Statutory Authorities.
- XIV. To transfer all Test Certificates, warranties /guarantees including maintenance/performance guarantees of various fittings/fixtures, equipment/material and indemnify MECON/OWNER of any liabilities of payments/ dues to its suppliers, manufacturers, agents etc.
- XV. Marking all as-built details on construction/fabrication drawings/datasheets issued by OWNER/ENGINEER-IN-CHARGE and submission of as-built details and drawings in three sets.

4. General Instructions to the Contractor

- I. Plan and prepare a schedule for execution and work implementation as per QA/QC plans to be approved by OWNER/ENGINEER-IN-CHARGE. Set out at site by carrying out a pre-construction survey; establishing the site deviations, requirement of site modifications in construction drawings, earth filling/cutting requirement etc.



GODAVARI GAS PVT
LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER
STATIONS AT EAST AND WEST GODAVARI
GEOGRAPHICAL AREA**

PARTICULAR JOB SPECIFICATION



MECON Ltd.

Page 6 of 8

- II. Get from OWNER/ENGINEER-IN-CHARGE the latest revision of all documents/drawings at the commencement of work/ during the course of construction and execution of work at site.
- III. In case any discrepancy is found between drawings & documents, the same shall be brought to the notice of the Engineer-in-charge be for execution of work and decision of the Engineer-in-charge shall be final and binding to the contractor without any extra cost implication to Owner.
- IV. The contractor has to make all shop drawings wherever necessary, at his own cost, and get it approved by OWNER/ENGINEER-IN-CHARGE be for commencement of that work at site.
- V. Specification and descriptions of various items are for identification of material and works to be carried out under them. No cost shall be quoted against these unless mentioned.
- VI. Quantities as mentioned are indicative and can have a variation from the quantities actually executed. The contractor is advised to work out the breakup of individual work items and quantities at his own be for quoting any rates. OWNER is not liable for any discrepancies in the quantities and no extra time or cost shall be granted on this pretext.
- VII. The contractor has to obtain all types of statutory approvals including 'C' form, D' form, completion certificate, approval from electrical inspector for electrical work and DG set, electrical connection, water connection, fire department etc. and all other approvals that might be required to commission the station, from various relevant authorities during the course of work and after completion of works in co-ordination with OWNER/ ENGINEER-IN-CHARGE without any cost implication to OWNER.
- VIII. The contractor has to arrange all tools and plants, site fencing material, lighting arrangements, store, electricity and water at his own cost.
- IX. The contractor should quote keeping this in mind that no request for escalation in the cost shall be entertained under any circumstances by Owner after placement of order
- X. The tender contain a set of key tender purpose drawings/ data. These information /details are for "Tender Purpose only". The tenderer should visit each location and acquaint himself with site conditions of each site. No deviations and/or claims what so ever of any kind and nature would be admissible
- XI. The work shall be carried out in city conditions and generally close to other roads and public services conveying a considerable volume of vehicular traffic and human activity. It is deemed necessary that the tenderer considers the "SAFETY" as the MOST IMPORTANT aspect of working conditions and is required to include in his of feral costs (direct and indirect) towards observance, compliance and provision of all safety appurtenances and norms.
- XII. Receiving SS tubes, fittings and other free issue items from OWNER stores and bringing it to site, keeping proper care of, storing the same till the yard used for construction and returning the unused material to the store.
- XIII. Installing site markers, warning signs, fencing etc. and cleaning all unserviceable materials, debris to designated disposal areas and obtain a No Dues Certificate from the concerned authorities.



GODAVARI GAS PVT
LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER
STATIONS AT EAST AND WEST GODAVARI
GEOGRAPHICAL AREA**

PARTICULAR JOB SPECIFICATION



MECON Ltd.

Page 7 of 8

- XIV. Handing over the completed works to OWNER for their operation/use purposes.
- XV. The Contractor has to prepare As-Built drawings, shop drawings, fabrication drawings and submit them a long-with test certificates, guarantee cards/warranty cards/service schedule any other purchase documents/literature for all equipment/fixtures/fittings installed at the time of completion of work.
- XVI. Any other activity(ies) not mentioned/covered explicitly above, but otherwise required for satisfactory completion/ operation/ safety/ statutory/ maintenance of the works shall also be covered under the Scope of Work and has to be completed by the Contractor within specified Schedule of Items of Works at no extra cost to OWNER.
- XVII. The contractor has to return all the drawings issued to him from time-to-time along with the final bill to OWNER/ENGINEER-IN-CHARGE after marking As-built dimension sand details. The contractor is not permitted to make copies of any drawing/document provided to him.

5. REFERENCE SPECIFICATION, CODES AND STANDARDS

- I. The contractor shall carry out the working accordance with this Specification, approved construction drawings issued by OWNER, MECON's Engineering Standards or relevant BIS code as might be required.
- II. Should the Contractor find any discrepancy, ambiguity or conflict in or between any of the Standards and the contract documents, then this should be promptly referred to the Engineer- in-charge (EIC) for his decision, which shall be considered binding on the contractor.

6. APPROVALS

- I. Approval in principle for all work should be obtained from EIC prior to execution. To ensure smooth execution of the work on a day-to-day basis it will be the Contractors responsibility to liaison with EIC/concerned engineer and obtain necessary approvals

7. STRUCTURES, SERVICES AND OTHER PROPERTY

I. Protection of Structures and Utilities

The Contractor shall at his own cost, support and protect all buildings, walls, fences or other structures and all utilities and property which may, unless so protected, be damaged as a result of the execution of the works. He shall also comply with the requirements in the specification relating to protective measures applicable to particular operations or kind of work.

II. Interference with Traffic, Street Drainage and General Public

The Work shall be executed in such a manner as to cause a minimum of in convenience to persons requiring to use public or private roads, lanes, thorough fares, walkways, rights of use or passages through which the works are to be executed. Closure of roads, etc. shall not be permitted without the approval of the EIC.

 GODAVARI GAS PVT LTD.	MECHANICAL AND ELECTRICAL WORKS FOR CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA	 MECON Ltd. Page 8 of 8
	PARTICULAR JOB SPECIFICATION	

The contractor shall conduct his operations at all times, with a view to minimizing as far as practicable noise from construction and other objectionable nuisances (e.g. oil leakage, smoke, fumes.)

8. SAFETY

The Contractor shall conform to the requirements outlined in Safety Codes under GCC. In addition, the Contractor shall observe safe working practices in the storage and handling of pipes, SS tubes, flammable fluids, etc. and ensure that smoking or naked

flames are not permitted in the vicinity when these works are being executed.

The Contractor shall also protect all work sites with warning signs, barricades and night lighting.

The contractor should ensure that the workers wear safety shoes and helmets while carrying out any work under the present scope.

Where the EIC determines that the Contractor is performing the working in an unsafe manner, he may suspend the work until the Contractor takes corrective action.

Since the work shall be carried out in city conditions and generally close to the highways/roads and public services conveying a considerable volume of vehicular traffic and human activity, it is deemed necessary that the tenderer considers the "SAFETY" as the MOST IMPORTANT aspect of working conditions and is required to include in his offer all costs (direct and indirect) towards observance, compliance and provision of all safety appurtenances and norms

9. PROGRESS OF WORK

The Contractor shall proceed with the Work under the Contract with due expedition and without delay.

The EIC may direct in what or at what time the various stages or parts of the work under the Contract shall be performed. If the Contractor can reasonably comply with this direction, the Contractor shall do so. If the Contractor cannot reasonably comply, the Contractor shall give the reasons in writing.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

CONTENTS

SECTION A-1:	Specifications for Supply of SS Tubes, SS Fittings, SS Valves & Thermoplastic Hoses for CNG Refilling Stations
SECTION A-2:	Specifications for SS Tube Laying and Testing.
SECTION B:	Specifications for Erection of Mechanical Equipment.
SECTION C:	Specifications for Supply, Erection & Commissioning of Miscellaneous items.
ANNEXURE – I	List of Suppliers of Major Bought-Out Items
SECTION D:	Specifications for Supply of SS Tubes, SS Fittings & SS Valves for instrument airline.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

MECHANICAL WORKS

SECTION A-1

**SUPPLY OF SS TUBES, SS FITTINGS, SS VALVES &
THERMOPLASTIC HOSES FOR CNG REFILLING STATIONS**

CONTENTS

- 1.0 SCOPE OF SUPPLY OF SS TUBES, VALVES & FITTINGS
- 2.0 TECHNICAL SPECIFICATION FOR SS TUBES FOR CNG
REFILLING STATIONS (TS No. MEC/TS/05/62/035)
- 3.0 TECHNICAL SPECIFICATION FOR SS FERRULE FITTINGS (TS No. MEC/TS/05/
62/047)
- 4.0 TECHNICAL SPECIFICATION FOR SS BALL VALVES (TS No.
MEC/TS/05/62/048)
- 5.0 TECHNICAL SPECIFICATION NO. FOR THERMOPLASTIC HOSES (TS
NO. MEC/TS/05/62/SO49)



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

1.0 Scope of supply of SS Tubes, SS Valves & SS Fittings

The contractor has to supply SS Tubes, SS Valves & SS Fittings strictly as per technical specification no. MEC/TS/05/62/035, MEC/TS/05/62/047 & MEC/TS/05/62/048 attached.

The SS Tubes, valves and fittings are to be laid, tested and commissioned as detailed in SECTION- B. The balance items are to be reconciled and submitted to Owner stores in good condition. The uncountable material beyond the permissible limits as specified in clause no. 6.0 of Section- B would not be paid.

The contractor is required to purchase SS Tubes, SS fittings & SS Valves as per the quantities given in Schedule of Rates (SOR) from the approved vendor list enclosed. The contractor shall take prior approval before placement of order and get the QAP approved by MECON / OWNER. The inspection of materials and / or scrutiny of documents would be carried out by OWNER/ENGINEER-IN-CHARGE / Third Party Inspection Agency.



GODAVARI GAS PVT LTD.

MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA



MECON LIMITED

1.0 TECHNICAL SPECIFICATION
FOR
SS TUBES FOR
CNG REFILLING STATIONS
(TS NO.: MEC/TS/05/25/035)



MECON LIMITED
(A Govt. of India Undertaking)
15th Floor, SCOPE Minar, North
Tower Laxmi Nagar District Centre,
DELHI -110092



GODAVARI GAS PVT LTD.

MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA



MECON LIMITED

Contents of TS No. MEC/TS/05/25/035

<u>Sl. No.</u>	<u>Description</u>
1.0	SCOPE OF WORK
2.0	CODE & STANDARD
3.0	PRECEDENCE
4.0	DEVIATION
5.0	SAFETY
6.0	SPECIFICATION
7.0	DOCUMENTATION
8.0	PACKING & SHIPMENT
9.0	GUARANTEE

PREPARED BY:

GURDEEP SINGH

CHECKED BY:

V.K. AGRAWAL

APPROVED BY:

A.K. JOHRI



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

1.0 SCOPE OF WORK

The scope of the tenderer will include manufacture/supply, inspection/ testing/marketing/ packaging/ handling and dispatch of SS Tubes, as indicated in the Bill of Quantities meeting all the requirements as per ASTM A269.

1.1 All codes and standards for manufacture, testing, inspection etc. shall be of latest edition.

1.2 Purchaser reserves the right to delete or order additional quantities during execution of order, based on unit rates and other terms & conditions in the original order.

2.0 CODES & STANDARD

Items	Applicable Codes and Standards
Tubes	ASTM A269, ANSI B31.3

3.0 PRECEDENCE

In case of any conflict between this job specification and other document, the following order of precedence shall apply:

3.1 Job Specification

3.2 International Standards/Codes Applicable

4.0 DEVIATION

Deviations if any required by Tenderer shall be separately furnished against each clause giving reasoning for each deviation. Tenderer to note that except the deviations furnished by them, Tenderer's offer shall be deemed to be in total conformity with the enquiry specifications.

5.0 SAFETY

5.1 All tubes shall be designed as per applicable code & standards.

5.2 All part/ component shall meet the requirement for the specified area's classification.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

- 5.3 Area classification shall be Class-I, Division-I; Group-D as per NEC or Zone-I Group IIA/ IIB as per IS/ IEC Specification or equivalent specifications.

6.0 **SPECIFICATION**

All the items shall be suitable for compressed natural gas service and meet following specifications.

- 6.1 Tube material shall be stainless steel as per ASTM A269 (Grade TP 316).
- 6.2 Tubing material shall have minimum molybdenum content 2.5%, carbon content of max. 0.030%.
- 6.3 Tube shall be bright annealed.
- 6.4 Tube shall be seamless.
- 6.5 Tube hardness shall be less than Rb 80. Tubes shall be NACE MR 0175 certified for hardness. Hardness test shall be carried out on each tube.
- 6.6 Each tube shall be hydro-tested as per requirement of ASTM A450 clause 22.3, at a hydro-test pressure of 350 kg/cm² (g). However, it shall be ensured that the test pressure does not result in stresses exceeding the yield strength at test pressure.
- 6.7 All S.S. tubes shall be online 100% eddy current Tested as per ASTM A450.
- 6.8 Tolerance on outer diameter shall be ± 0.005 ".
- 6.9 Tube shall be of 5 to 6 meter in length.
- 6.10 Minimum thickness shall be as per following table.

Tube OD	Minimum Wall Thickness	Maximum Allowable Working Pressure psig
1"	0.120"	4700
3/4"	0.095"	4700
1/2"	0.083"	4700
3/8"	0.065"	4800



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

Note: Bidder to reconfirm maximum allowable working pressure for each tube size.

6.11 Following documents/ certificates to be submitted.

- i) Chemical composition for heat
- ii) Chemical composition for products iii) Tensile test
- iv) Hardness test
- v) Flaring test
- vi) Leak test
- vii) Visual inspection and dimensional check

6.12 Tubing should be clearly marked with the specifications given in the inspection certificate with heat code, lot code, outer diameter and wall thickness with inspection certificate no.

6.13 Tubes should be supplied with both ends plugged.

7.0 DOCUMENTATION

7.1 All documents shall be furnished in English language only.

7.2 At the time of bidding, bidder shall submit following documents.

7.3 Reference list of previous supply for similar item, giving following details.

7.4 Name of the customer.

7.5 Specification of the item i.e., size and pressure & temperature rating.

7.6 Service

7.7 Quantity

7.8 Year of supply

7.9 Copy of ISO: 9000 certification for supplier/ manufacturer.

7.10 Manufacturer Quality Control Plan.

7.11 Clause-wise deviations to the specification.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

- 7.12 Following test certificates shall be furnished along-with shipment.
- 7.13 Test certificate of visual, chemical, mechanical testing (incl. tensile, hardness, flaring and leak test).
- 7.14 Manufacturers standard shop inspection & test report for all items.
- 7.15 The test report for specified tests.
- 7.16 Third party inspection report as applicable to meet the requirements of specified codes & standards as applicable.

8.0 PACKING & SHIPMENT

- 8.1 All the items shall be suitably wrapped and packaged to with stand rough handling during ocean shipment and inland journey. Tubes should be supplied with both ends plugged.
- 8.2 The item shall be properly tagged and package separately to facilitate easy identification.
- 8.3 Items shall be wrapped and packaged in such-a-way that they can be preserved in original as new condition.

9.0 GUARANTEE

- 9.1 Manufacturer shall guarantee that the design, materials, manufacturing and testing of tubes conform to the requirement of this specification. Manufacturer shall replace all tubes free of costs which fail during field pressure testing or do not perform satisfactorily due to inadequate engineering, substandard material and poor workmanship.
- 9.2 The manufacturer shall guarantee against any defect, failure or malfunctioning occurring during 12 months from the date of commissioning or 24 months from the date of supply whichever is earlier.



GODAVARI GAS PVT LTD.

MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA



MECON LIMITED

2.0 TECHNICAL SPECIFICATION

FOR

SS FERRULE FITTINGS FOR CNG REFILLING STATIONS

(TS NO.: MEC/TS/05/25/047A)



MECON LIMITED

(A Govt. of India Undertaking) 15th
Floor, Scope Minar, North Tower
Laxmi Nagar District Centre,
DELHI-110092



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

Contents of TS No. MEC/TS/05/25/047A

Sl. No.	Description
1.0	SCOPE OF WORK
2.0	CODE & STANDARD
3.0	PRECEDENCE
4.0	DEVIATION
5.0	SPECIFICATION
6.0	MARKING, PACKING & SHIPMENT
7.0	DOCUMENTATION
8.0	GUARANTEE

PREPARED BY:

GURDEEP SINGH

CHECKED BY:

V.K. AGRAWAL

APPROVED BY:

A.K. JOHRI

1.0 SCOPE OF WORK



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

The scope of this specification covers the requirement of design, manufacture/ inspection/ testing at works/ marking/ packaging/ and supply of high-pressure SS Ferrule Fittings.

2.0 CODES & STANDARD

The latest editions of the following standards are referred to in this specification.

Items	Applicable Codes and Standards
Bar Stock	ASME SA-479-316 or DIN 4401 or BS:970-316-S31
Forging	ASME SA-182-316 or DIN 4401 or BS:970-316-S31
Thread	NPT ANSI B 1.20.1

3.0 PRECEDENCE

In case of any conflict between this job specification and other document, the following order of precedence shall apply:

3.1 Job Specification.

3.2 International Standards/ Codes Applicable.

4.0 DEVIATION

Deviations if any required by Tenderer shall be separately furnished against each clause giving reasoning for each deviation. Tenderer to note that except the deviations furnished by them, Tenderer's offer shall be deemed to be in total conformity with the enquiry specifications.

5.0 SPECIFICATION

All the items shall be suitable for compressed Natural Gas service and meet following specifications.

5.1 Materials

5.1.1 Fittings shall be manufactured from the following materials: -

- i) Bar stock shall be as per BS: 970-316-S31, DIN 4401 or ASME 479-316 but with carbon content less than 0.05% to provide increased resistance to corrosion.



GODAVARI GAS PVT LTD.

MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA



MECON LIMITED

- ii) Forgings shall be as per BS: 970-316-S31, DIN 4401 or ASME SA-182-316.

5.1.2 The fittings end connections shall be compatible to tube of hardness Rb80.

5.1.3 All component parts of the fittings shall be of the same material.

5.1.4 The ferrule material shall be able to withstand an atmosphere of Natural Gas, oil and moisture without rusting.

5.2 **Design & Manufacture**

5.2.1 All fittings shall be designed in conformance with the requirements of ASME B31.3 and applicable standards. Area classification applicable for all items shall be Class-1, Division-1, Group-D as per NEC or Zone-1 Group- IIA/IIB as per IS/ IEC specification or equivalent specification. All fittings shall be designed so that all parts/ components meet the requirements for the specified area classification.

5.2.2 The SS fittings shall be of flare less design and four-piece construction, consisting of front and rear ferrules, nut and body suitable for use on SS tubes conforming to ASTM A269 TP316.

5.2.3 Fittings shall be rated for at least the design pressure as stipulated in the material requisition. The design of fittings shall ensure that they shall be capable of holding full tube burst pressure after only one and a quarter turn pull up of the nut.

5.2.4 The threaded ends of fittings shall be NPT as per ANSI B1.20.1.

5.2.5 The fittings shall hold the tube with collecting action producing a firm grip on the tube without substantially reducing the tube wall thickness.

5.2.6 Fittings shall not torque the tubing during original or subsequent make-up of the connection and should use geometry for inspection before and after makeup the fittings shall not require disassembly for inspection before or after makeup.

5.2.7 All tube fittings shall be gauge-able for sufficient pull up after one and a quarter turn. All tube fittings shall have a gauge-able shoulder and there will be no radius at the point where the shoulder meets the neck of the fitting body.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

- 5.2.8 The gap inspection gauge shall be easily insert-able at finger tight position of nut. The gap inspection gauge shall not be insert-able between the nut and shoulder of the fitting after completing only one and a quarter turn pull up of the nut.
- 5.2.9 The tube seat counter bore in the body shall be faced flat 90° to the axis of the tubing to minimize tube expansion and subsequent galling.
- 5.2.10 The sealing and gripping power of the fitting shall be controlled such that the action between ferrules will overcome commercial variations in tubing wall thickness, hardness, diameter and installer skill.
- 5.2.11 The seal contact of the fittings body shall have a machined finish of 32 Ra or better.
- 5.2.12 The fittings body shall have no machined stop or shoulder to preclude additional tightening in subsequent make-up.
- 5.2.13 Front Ferrule
- i) The front ferrule shall effect a long, smooth repeatable seal by contact with body and a grip hold on the tube surface.
 - ii) The front ferrule shall always remain in a sprung condition to compensate for thermal stresses and to accomplish repeated make and break.
- 5.2.14 Rear Ferrule
- i) The rear ferrule shall collect the tubing surface, improving the performance of the tubing in systems of high impulse or vibration.
 - ii) The rear ferrule shall have a machine recess on the inside diameter and shall have complete surface hardening so as to substantially reduce the required pull up torque. Both the requirements i.e. complete surface hardness and machined recess shall be met for all rear ferrules.
- 5.2.15 Nuts shall have silver plated threads to act as a lubricating agent to avoid galling and to reduce tightening torque.

5.3 Inspection and Testing

- 5.3.1 The manufacturer shall submit typical type test reports for the following test carrier out on random samples of two ferrule fittings: -
- i) Hydraulic burst pressure test.
 - ii) Helium leak test under 0.0002 PSIA negative pressure, leaks into assembly greater than 4.0×10^{-9} atm-cc/sec being



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

unacceptable.

- iii) Gas pressure test for 25 remarks at 5000 Psig. No leakage should be detectable even after 25 remarks.
- iv) Impulse & vibration testing by "rotary beam method" for 5,00,000 impulse cycles and 20 million vibration cycles with no detectable leakage at full working pressure throughout till the end of the test.

5.4 Test Reports and Certificates

5.4.1 The manufacturer shall supply material compliance certificates conforming that the raw material for fittings conforms to the requirements of ASME Section-II and ASME Section-III sub section NB, NC and ND.

5.4.2 The manufacturer shall furnish test procedure and typical test reports of all tests conducted on fittings as per the requirements of clause 5.3.

6.0 MARKING, PACKING & SHIPMENT

6.1 Heat code traceability number shall be stamped or etched on both body and nut of each fitting.

6.2 Replacement nuts and ferrules shall be packaged in a manner so as to allow safe and simple replacement.

6.3 All the items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.

6.4 Item shall be properly tagged and packaged separately to facilitate easy identification.

6.5 Items shall be wrapped and packaged in such-a-way that they can be preserved in original as new condition.

7.0 DOCUMENTATION

7.1 All documents shall be furnished in English language only.

7.2 At the time of bidding, bidder shall submit following documents:

- i) Reference list of previous supply for similar item, giving following details:
 - a) Name of the customer.
 - b) Specification of the item i.e., size and pressure & temperature rating.
 - c) Service
 - d) Quantity



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

e) Year of supply

- ii) Test procedure and typical certificates to be submitted as per clause 5.3 and 5.4 of this specification.
- iii) Manufacturer Quality Control Plan and sampling plan.
- iv) Copy of ISO:9000 certification for supplier/ manufacturer.

7.3 Following test certificates shall be furnished along-with shipment.

- i) Test certificate of chemical, mechanical testing.
- ii) Manufacturers standard shop inspection& test report.
- iii) The procedure and certificates to be submitted as per the requirements of clause 5.4 of this specification.

8.0 **GUARANTEE**

8.1 Manufacturer shall guarantee that the design, materials, manufacturing and testing of fittings comply with the requirement of this specification and applicable codes and standards. Manufacturer shall replace all fittings which should result defective or fail during field pressure testing or fail to perform satisfactorily due to inadequate engineering, substandard material and workmanship.

8.2 The manufacturer shall guarantee against any defect, failure or malfunctioning occurring during 12 months from the date of commissioning or 24 months from the date of supply whichever is earlier.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

3.0 TECHNICAL SPECIFICATION

FOR

**SS BALL VALVES FOR
CNG REFILLING STATIONS**

(TS NO.: MEC/TS/05/25/048)



MECON LIMITED

(A Govt. of India Undertaking)

**15th Floor, Scope Minar, North Tower
Laxmi Nagar District Centre,
DELHI-110092**



GODAVARI GAS PVT LTD.

MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA



MECON LIMITED

Contents of TS No. MEC/TS/05/25/048

<u>Sl.No.</u>	<u>Description</u>
1.0	SCOPE OF WORK
2.0	CODE & STANDARD
3.0	PRECEDENCE
4.0	DEVIATION
5.0	MATERIALS
6.0	DESIGN & MANUFACTURE
7.0	INSPECTION & TESTING
8.0	OTHER REQUIREMENTS
9.0	TEST REPORTS & CERTIFICATES
10.0	MARKING, PACKING & SHIPMENT
11.0	DOCUMENTATION
12.0	GUARANTEE

PREPARED BY: GURDEEP SINGH	CHECKED BY: V.K. AGRAWAL	APPROVED BY: A.K. JOHRI



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

1.0 SCOPE OF WORK

1.1 The scope of this specification include design, manufacture/ supply, inspection/testing/ marking/packaging/handling and dispatch of SS Ball Valves as per relevant codes.

1.2 Purchaser reserves the right to delete or order additional quantities during execution of order, based on unit rates and other terms& conditions in the original order.

2.0 CODES & STANDARD

Items	Applicable Codes and Standards
Valves	MSS-SP-99

3.0 PRECEDENCE

3.1 In case of any conflict between this job specification and other document, the following order of precedence shall apply:

3.1.1 Job Specification.

3.1.2 International Standards/ Codes Applicable.

4.0 DEVIATION

Deviations if any required by Vendor shall be separately furnished against each clause giving reasoning for each deviation. Vendor to note that except the deviations furnished by them, Vendor's offer shall be deemed to be in total conformity with the enquiry specifications.

5.0 MATERIALS

5.1 The valve body shall be made out of material conforming to ASTM A479 Type316.

5.2 Material of construction of ball shall conform to ASTM A276 Type 316.

5.3 Material of construction of seat springs shall be Alloy X-750.

6.0 DESIGN & MANUFACTURE



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

- 6.2 All ball valves shall be designed in conformance with the requirements of ASMEB31.3, MSS-SP-99 and other applicable code and standards. Area Classification applicable for all items shall be Class-1, Division-1, Group-D as per NEC or Zone-1 Group-IIA/ IIB as per I S / IEC specification or equivalent specification. All fittings shall be designed so that all parts/ components meet the requirements for the specified area classification.
- 6.3 Valves shall be rated for a maximum working pressure of 5000 psig and shall be capable of operation between a temperature range of (-40) ° to 250°F.
- 6.4 Valves shall have spring loaded PEEK seats allowing seal-ability over the full pressure range at any port and low operating torque over the full range of pressures and temperatures.
- 6.5 Elastomeric seals, which require no packing adjustment, shall be used.
- 6.6 Valves stem shall be of bottom loaded and blow out proof design.
- 6.7 Ball shall be blow out proof and trunnion mounted.
- 6.8 Valves shall have positive wrench/ handle stops, Phenolic black wrench/ handle shall be provided. Wrench/ handle shall indicate the direction to flow. In the case of three-way valves, the stem shall also provide the visual indication of flow direction if the handle is removed.

7.0 INSPECTION AND TESTING

- 7.1 The valve manufacturer shall submit typical type test reports for the following test carrier out on similar valves: -
- i) Hydrostatic seat leak test shall be carried out with de-ionized water. There shall be no detectable set leakage at 1.1 times the rated pressure of the valve.
 - ii) Gas pressure test for seat and shell shall be carried out with nitrogen at 1000 psig. There shall be no detectable external leakage. Maximum allowable seat leakage shall be 0.1 atm-cc/min.

8.0 OTHER REQUIREMENTS



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

8.1 Manufacturer should confirm that valves are approved by Rail Road Commission of Texas, LP Gas Division under regulation for compressed natural gas or ANSI/ AGA NGV 3.1 1995, CAN/ CGA-12.3-M95 "Fuel Systems Components for Natural Gas-Powered Vehicles" by "Canadian Standard Association".

8.2 Spares and Accessories

- i) If required, manufacturer shall furnish a list of recommended spares and accessories for valves required during start up and commissioning.
- ii) If required, manufacturer shall furnish a list of recommended spares and accessories required for two years of manual operation and maintenance of valves.
- iii) Manufacturer shall quote for spares and accessories as per the material requisition.

9.0 TEST REPORTS & CERTIFICATES

9.1 The manufacturer shall supply material compliance certificates.

9.2 The valve manufacturer shall provide test procedure and valve inspection and test report for type tests carried out on similar valves as per the requirements of clause 7.0.

10.0 MARKING, PACKING & SHIPMENT

10.1 Heat code shall be marked on valve body to facilitate tractability.

10.2 All the items shall be suitably wrapped and packaged to with stand rough handling during ocean shipment and inland journey.

10.3 Each item shall be properly tagged and packaged separately to facilitate easy identification.

10.4 All items shall be wrapped and packaged in such-a-way that they can be preserved in original as new condition.

11.0 DOCUMENTATION

11.1 All documents shall be furnished in English language only.

11.2 At the time of bidding, bidder shall submit following documents:



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

- i) Reference list of previous supply for similar item, giving following details:
 - a) Name of the customer.
 - b) Specification of the item i.e., size and pressure & temperature rating.
 - c) Service
 - d) Quantity
 - e) Year of supply
- ii) Test procedure and typical certificates to be submitted as per clause 5.3 and 5.4 of this specification.
- iii) Copy of ISO: 9000 certifications for supplier/ manufacturer.
- iv) Manufacturer Quality Control Plan and sampling plan.
- v) Technical descriptive catalogue of manufacturer.
- vi) General arrangement/ assembly drawing of valve showing all features.
- vii) Sectional drawing showing major parts with reference number and material specification.

11.3 Prior to shipment, manufacturer shall submit following test certificates and documents.

- i) Test certificate of chemical, mechanical testing.
- ii) Manufacturers standard shop inspection test.
- iii) Manufacturers standard shop inspection and test reports.
- iv) The procedure and certificates to be submitted as per the requirements of clause 8.0 of this specification.
- v) Manual for installation, erection, maintenance and operating instructions including a list of recommended spares for valves.

12.0 **GUARANTEE**

12.1 Manufacturer shall guarantee that the design, materials, manufacturing and testing of fittings comply with the requirement of this specification and applicable codes and standards. Manufacturer shall replace all fittings which should result defective or fail during



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

field pressure testing or fail to perform satisfactorily due to inadequate engineering, substandard material and workmanship.

12.2

The manufacturer shall guarantee against any defect, failure or malfunctioning occurring during 12 months from the date of commissioning or 24 months from the date of supply whichever is earlier.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

**4.0 TECHNICAL SPECIFICATION
FOR
THEMOPLASTIC HOSES**

(TS NO. MEC/TS/05/62/SO49)



MECON LIMITED

(A Govt. of India Undertaking)

15th Floor, SCOPE Minar, North Tower
Laxmi Nagar District Centre,
DELHI-110092



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

CONTENT

Sl.No.	Description
1.0	SCOPE OF WORK
2.0	CODE & STANDARD
3.0	PRECEDENCE
4.0	DEVIATION
5.0	SPECIFICATIONS
6.0	DESIGN & MANUFACTURE
7.0	INSPECTION AND TESTING
8.0	MARKING, PACKING & SHIPMENT
9.0	DOCUMENTATION



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

1.0 SCOPE OF WORK

- 1.1 The scope of this specification includes design, engineering, manufacturing, inspection/ testing, marking, packaging, handling and supply/ dispatch of Conductive Core Thermo plastic Flexible Hoses as per relevant codes.
- 1.2 Purchaser reserves the right to delete or order additional quantities during execution of order, based on unit rates and other terms & conditions in the original order.

2.0 CODES & STANDARD

Sr. No.	Description
1	3/8" ID HOSE HoseLength:1.5 meter with Breakaway coupling Hose end to end Connections:3/8" OD Tube adaptor with nut & ferrule.
1A	Breakaway coupling for 3/8" ID HOSE Material-SS316 Rated Pressure– 5000 PSI@70Deg.FMin . Flow rate–2000SCFM Temperature– 0 Deg.F to 400 Deg.F

Hose should conform to NFPA 52, AGA1-93 and ANSI / CSA NGV 4.2-2014/CSA12.52-2014 and end connection shall conform to ASTM A276; ASTM A479, ASMES A479.

3.0 PRECEDENCE

In case of any conflict between this job specification and other document, most stringent shall apply.

4.0 DEVIATION

Deviations, if any, required by Vendor shall be separately furnished against each clause giving reasoning for each deviation. Vendor to not that except the deviations furnished by them, Vendor's offer shall be deemed to be in total conformity with the enquiry specifications.

5.0 SPECIFICATIONS

- a) The core material shall be non-metallic, flexible incomplete conformity with the relevant standard as mentioned above.
- b) Electrical conductivity shall comply with AGA1-93
- c) End connections shall be 316 stainless steel materials conforming to relevant design standard as specified above.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

6.0 DESIGN & MANUFACTURE

- I. Hoses shall be designed in conformance with the requirements 52, AGA1- 93 and ANSI / CSANGV4.2-2014/CSA12.52-2014 and other applicable codes and standards. Area classification applicable for all items shall be Class-1, Division-1, Group-D as per NEC or Zone-1 Group-HA/ HB as per IS/ IEC specification or equivalent specification. All fittings shall be designed so that all parts/components meet the requirements for the specified area classification.
- II. End connections shall be designed in conformance with the requirement of ASTM A276; ASTMA479, ASMESA479.
- III. The whole assembly shall be rated for a working pressure of 5000 psi and shall be rated for temperature range of (-40) to 250°F.

7.0 INSPECTION AND TESTING

The manufacturer shall submit typical type test reports for the following test carried out:

- I. Hydrostatic test shall be carried out with de-ionized water. There shall be no detectable leakage at 1.5 times the rated pressure.
- II. Electrical conductivity test shall be carried out.
- III. Mechanical properties as a result of the test conducted and
- IV. Chemical analysis report

7.1 TEST REPORTS & CERTIFICATES

- I. The manufacturer shall supply material compliance certificates.
- II. Chemical Analysis report
- III. Mechanical properties test report
- IV. Hydrostatic test report
- V. Electrical conductivity test report
- VI. Warranty certificate

8.0 MARKING, PACKING & SHIPMENT

- 8.1 Heat code shall be marked to facilitate tractability.
- 8.2 All the items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.
- 8.3 Each item shall be properly tagged and package separately to facilitate easy identification.
- 8.4 All items shall be wrapped and packaged in such-a-way that they can be preserved in original as new condition.
- 8.5 Packing note shall carry easily identifiable name or code of the physical item



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

9.0 DOCUMENTATION

- 9.1 All documents shall be furnished in English language only.
- 9.2 At the time of bidding, bidder shall submit following documents:
- I. Reference list of previous supply for similar item, giving following details:
 - a) Name of the customer.
 - b) Specification of the item i.e., size and pressure & temperature rating.
 - c) Service
 - d) Quantity
 - e) Year of supply
 - II. Test procedure and typical certificates to be submitted as per clause 5.3, 5.4 and 5.5 of this specification.
 - III. Copy of regulatory compliance document/certification for similar product supplied earlier.
 - IV. Manufacturer Quality Control Plan and sampling plan.
 - V. Technical descriptive catalogue of manufacturer.
 - VI. General arrangement/ assembly drawing showing all features.
 - VII. Sectional drawing showing major parts with reference number and material specification.
- 9.3 Prior to shipment, manufacturer shall submit one set of all the documents and test certificates as specified above. And one set of the same documents and certificates along with the material in addition to the following documents:
- i. Manual for installation, erection, maintenance and operating instructions including a list of recommended spares.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

SECTION- A-2: SS TUBE LAYING AND TESTING

CONTENTS

- 1.0 SCOPE OF WORK AND TECHNICAL SPECIFICATION
- 2.0 INSTALLATION PROCEDURE
- 3.0 REMAKE OF FITTINGS
- 4.0 SS TUBE TESTING & COMMISSIONING PROCEDURE
- 5.0 REFERENCE SPECIFICATION, CODES AND STANDARDS
- 6.0 SCOPE OF SUPPLY
- 7.0 SCRAP AND EXCESS MATERIAL



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

**1.0 SCOPE OF WORK AND TECHNICAL
SPECIFICATION**

1.1 LAYING OF SS TUBE

Generally, the following shall constitute the Contractor's scope of work but not limited to as given herein:

- 1.1.1 Laying, testing and commissioning of SS tubes and fittings complete with all supports. The MS Angle and U-clamps (galvanized) / other fixing arrangement shall be procured and installed by the contractor. Payment shall be at the rate for the work set out in the agreed Schedule of Rates.
- 1.1.2 SS tubes shall be clamped to the MS Angle at every 1000 mm using U-clamps (galvanized) OR P-clamps of SWAGELOK make / any other approved make / SS-308 clamps with EPDM cushion. The practice of flattening tubes for clamping purposes shall not be permitted.
- 1.1.3 MS Angle and U-clamps (galvanized) shall be procured from approved manufacturers and through a QAP including stage inspection and pre-dispatch inspection of the materials by OWNER / MECON/TPI (To be isolated by rubber gaskets).
- 1.1.4 Tubes shall be bend using tube benders only and any hot bending will be totally rejected. Tubes shall be cut using pipe cutting device. Hot cutting is not allowed.
- 1.1.5 Carrying out pneumatic testing and purging with nitrogen as per approved procedures; providing all tools, tackles, instruments, manpower and other related accessories for carrying out the testing of tubes.
- 1.1.6 Start-up and commissioning assistance.
- 1.1.7 Handing over the completed works to OWNER for their operation/ use purposes.
- 1.1.8 Any other work not specifically mentioned herein but required for the satisfactory completion/ operation/ safety/ statutory/ maintenance of the works shall also be covered under the scope of work and has to be completed by the Contractor within specified schedule at no extra cost to OWNER.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

2.0 INSTALLATION PROCEDURE

2.1 TUBE END PREPARATION

- i) Cut the ends square with a hacksaw and a suitable guide. Tube cutters are satisfactory for most tube materials but tend to work harden stainless steel. As such proper care shall be exercised while cutting the SS tubes to avoid the hardening.
- ii) Burrs must be removed inside and outside for proper entry into fitting to prevent contamination and/ or restricted flow. 'Swagelok' / 'Parker' deburring tool shall be used.
- iii) Remove all fittings, chips, and grit before attachment of fittings.

2.2 ASSEMBLY

- i) Tube line fabrication must be accurate so that the tube end easily enters the fitting in proper alignment. Do not force an improperly fitted tube line into the fittings.
- ii) Ensure that the tube end is bottomed against the shoulder in the fitting body. This is necessary to prevent movement of the tube while the nut forces the ferrule to grip the tube and to seal through any imperfections that may exist on the outside tube surface.
- iii) Never permit the fitting body to rotate during tube end make-up, use two wrenches. Assemble port connectors to components first and hold with a wrench while making up the tube joint. All types of union bodies must be held while each of the tube ends is made up.
- iv) Never attempt to make up by torque.
- v) Always turn the nut the prescribed amount regardless of torque required. Fitting end plugs required only 1- ¼ turn from finger tight
make up in all sizes.

3.0 REMAKE OF FITTINGS

A disassembled joint can be remade, simply by retightening the nut to the position of the original make up. For maximum number of remakes, mark the fitting and nut before disassembly.

Before retightening, make sure the assembly has been inserted into the fitting until the ferrule(s) seats in the fitting.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

Retighten the nut by hand. Rotate the nut with a wrench to the original position as indicated by the previous marks lining up. (A noticeable increase in mechanical resistance will be felt indicating the ferrule is being re-sprung into sealing position.) Then snug the nut 1/12 turn (1/2 hex flat) past the original position.

**4.0 SS TUBE TESTING & COMMISSIONING
PROCEDURE**

- i. If any leak is found tube shall be depressurized and leak arrest shall be done. Leak arrest by using Teflon tape is not acceptable. Ensure leak arrest is done at 60 bar at all joints.
- ii. The tube shall be pressurized to 100 bar gradually and hold for 30 mins leak testing shall be carried out with soap solution at all points of valves regulators & fittings.
- iii. If any leak is found tube shall be depressurized and leak arrest shall be done. Leak arrest by using Teflon tape is not acceptable. Ensure leak arrest is done at 100 bar at all the joints.
- iv. The tube shall be pressurized to 200 bar gradually and hold 30 mins leak testing shall be carried out with soap solution at all joints of valves regulators & fittings.
- v. If any leak is found, tube shall be depressurized and leak arrest shall be done. Leak arrest by using Teflon tape is not acceptable. Ensure leak arrest is done at 200 bar at all joints.
- vi. The tube shall be pressurized to 280 bar gradually and hold for 240 mins. Leak testing shall be carried out with soap solution at all joints of valves, regulators & fittings. Pressure reading shall be noted down every 30 mins.
- vii. If any leak is found, tube shall be depressurized and leak arrest shall be done. Leak arrest by using Teflon tape is not acceptable. Tube shall be pressurized again and ensure leak arrest is done at 350 bar at all the joints and hold for 30 mins.
- viii. Final leak testing at 350 bar shall be witnessed by Mecon/client.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

ix. HIGH PRESSURE GAS LEAK TESTING PROCEDURE WITH NITROGEN

- Pressure testing of Gas Line to be started after completion of installation.
- All gas piping connection, valves and appliance connections are inspected visually for tightness and good condition.
- A gas pressure gauge is connected in the line. the calibration certificate of the gauge shall be submitted to Mecon/ client for review before start of the testing.
- The gas service valve is opened to permit gas to flow onto the gas piping distribution system and then the valve is closed again securely.
- The gas pressure gauge should read gradual increase in pressure.
- The tube shall be pressurized to 60 bar gradually and hold 30 mints leak testing shall be carried out with soap solution at all joints of Valves Regulators & Fittings

5.0 REFERENCE SPECIFICATION, CODES AND STANDARDS

The Contractor shall carry out the work in accordance with this specification, MECON's Engineering Standards, ASME B 31.8 - Gas Transmission and Distribution Piping Systems, Oil Industry Safety Directorate (OISD) norms.

Should the Contractor find any discrepancy, ambiguity or conflict in or between any of the Standards and the contract documents, then this should be promptly referred to the Engineer-in-Charge (EIC) for his decision, which shall be considered binding on the contractor.

6.0 SCOPE OF SUPPLY

SUPPLIED BY THE CONTRACTOR AT HIS OWN COST AS PART OF THIS SPECIFICATION:

The procurement and supply of MS Angle with U- clamps at the appropriate time of all the materials and consumables except for the materials specifically enlisted under Owner's scope of supply, shall be entirely the Contractor's responsibility and its rates of execution shall be inclusive for all these items, as follows but not limited to these:

- i) Bolts and nuts for supports, U-bolts with nuts, P-clamps for tubes, anchor bolts of various sizes for fixing to concrete structure.
- ii) Bitumen paints primer and solvents.
- iii) All material for minor civil works like grouting etc.
- iv) Minor structural steel for fabrication of tube/ tray supports like MS plates, GI plates, flats, pipe etc.,
- v) Pumps, compressor, Corrosion Inhibitor for water used for hydrostatic testing, including water for testing, inert gas for purging.



GODAVARI GAS PVT LTD.

MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA



MECON LIMITED

- vi) All items not expressly mentioned in the Contract but which are necessary for the satisfactory completion and performance of the Work under this Contract.

Note: Samples of all the consumables items / test certificates required to be approved by EIC.

7.0 SCRAP AND EXCESS MATERIAL

Every month the Contractor shall submit an account for all the materials issued to him by the owner in the standard Performa prescribed for this purpose by the Engineer-in-charge.

On completion of the work, the Contractor shall submit material appropriation statements for all the materials issued by the Owner in the standard Performa. The following scrap allowances are permissible.

ITEM	UNACCOUNTABLE	SCRAP
Tube	1 %	1% (Less than 0.3 m)
Valves	0 %	0%
Ferrule Fittings	0 %	0 %

All excess materials and scrap shall be returned after duly accounting for, to the OWNER stores. Where materials are to be weighed before return, the Contractor shall be responsible for making necessary arrangements for weighing etc. The contractor shall not use scrap sections obtained during the course of construction for fabrication of temporary supports or other items without prior written permission of Engineer-in-Charge.

If the Contractor fails to return the surplus material aforesaid, the Owner will charge the Contractor for such unreturned material at penal rates, which will be deducted from whatever amount is due to the Contractor. In case any material issued by the Owner deteriorates during storage by the Contractor, new material will be issued to him if available at penal rates, but delaying procuring such materials will be at the Contractor's account only. ***Any damaged valve and ferrule fittings should not be used and shall be returned to OWNER stores.***



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

SECTION –B: ERECTION OF MECHANICAL EQUIPMENT

CONTENTS:

1. SCOPE OF WORK FOR LOADING, UNLOADING, TRANSPORTATION & ERECTION OF EQUIPMENT.
2. EQUIPMENT WEIGHTS & SIZES.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

**LOADING, UNLOADING, TRANSPORTATION& ERECTION OF
MECHANICAL EQUIPMENT**

1.0 SCOPE OF WORK:

- 1.1 Generally, the following shall constitute the Contractor's scope of work but not limited to as given herein:
- i) Receiving of material from stores.
 - ii) Loading of material/ equipment on a trailer / truck from stores. Safe transportation to various sites.
 - iii) Unloading, placement and alignment on foundation -on ground or aboveground + 4.5 m at roof top (cascade only).
 - iv) Transit Insurance of equipment from stores to site.
 - v) All equipment transported shall be securely boarded and transported without causing any damage to equipment. Any damage caused during loading, transportation & unloading shall be recoverable from the contractor
 - vi) All the equipment shall be leak tested after erection as per instruction of engineer in charge and standard practice.

2.0 Equipment weight & sizes

Sl. No.	Equipment	Size	Weight/ Unit Approx.
1.	Cascade 4500/3000 L (water litre capacity)	5.3 M X 1.75M X 1.6M (H) Approx.	6.0 T

All excess, unutilized or defective materials and scrap shall be returned after duly accounting for, to the OWNER. stores. Where materials are to be weighed before return, the Contractor shall be responsible for making necessary arrangements for weighing etc. The contractor shall not use scrapped or defective materials obtained during the course of construction for fabrication of temporary supports or other items without prior written permission of Engineer-in-Charge.

If the Contractor fails to return the surplus material aforesaid, the Owner will charge the Contractor for such un-retained material at penal rates, which will be deducted from whatever amount is due to the Contractor. In case any material issued by the Owner deteriorates during storage by the Contractor, new material will be issued to him if available at penal rates, but delay in procuring such materials will be at the Contractor's account only.

Contractor to arrange all equipment & tools such as cranes, winch, lifting hook etc. and skilled & semiskilled manpower and consumables for erection of all the electro-mechanical equipment.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

**SECTION – C: SUPPLY, ERECTION & COMMISSIONING OF MISCELLANEOUS
ITEMS**

CONTENTS:

1. AIR COMPRESOR-CUM-PUMP
2. WATER COOLER
3. FIRE FIGHTING EQUIPMENT



GODAVARI GAS PVT LTD.

MECHANICAL AND ELECTRICAL WORKS FOR CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA



MECON LIMITED

SUPPLY, ERECTION & COMMISSIONING OF MISCELLANEOUS ITEMS

- 1.0 **Air Compressor (Pump)** : Contractor will supply, erect at prepared location, test and commission an Air Compressor-cum-Pump with Accessories such as dispensing stand, hose, nozzle, valves, connectors etc. complete with Automatic Intelligent Tyre Inflating M/C [AITIM].

Air compressor – cum- pump shall supply compressed air for all types of vehicles that visit the station for refueling of CNG or other purposes.

Details of air compressor

Type Drive	-V belt drive
Electrical Supply	- 415V/3ph/50Hz
Discharge pressure	- 12 kg/cm ²
Motor	- As per manufacturer
Make	- As per ISI Mark/standard manufacturer like Ingersoll Rand/Elgi.
Display	- Digital in both system [MKS & CGS]
Alarm	- Digital & Sound
Control	- To stop filling of air on alarm/set point.
Housing	- Steel/ Fiber glass - coated/painted in approved colors with OWNER's Logo.
Dispensing Hose	- Non –conductive.
AITIM	- Precision Testing Machines Pvt. Ltd, New Delhi/Instrument Research Association Pvt. Ltd, Bangalore or any other approved make.

Note- 1. Supply shall be made against a QAP, stage & pre-dispatch inspection.

2. One-year spares shall be supplied along with those for accessories.

- 2.0 **Water Cooler:** -Contractor will supply, erect at prepared location, test and commission a Water Cooler with Accessories such as dispensing fountain, filter, deodorizer, electronic purifier, drain tray, drain tube, drain valve, strainer, stand etc.

Water Cooler shall supply cold/ hot drinking water for drinking purposes.

Details of Water Cooler

Compressor	- Hermetic type
Capacity	- 40 litres/hr
Refrigerant type	- R-22.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

Electrical Supply	-	230V/Single phase/50Hz
Motor	-	Suction gas cooled/as per manufacturer
Condenser Fan	-	Propeller type
Make	-	As per ISI Mark/standard manufacturer like USHA/ VOLTAS/ SHRIRAM
Control	-	To start/stop dispensing of water-12.7 mm BSP connection
Housing	-	SS/ Fiber glass – coated/painted in approved colors.
Dispensing	-	SS fountain & tap.

Note-

1. Supply shall be made against a QAP, stage & pre-dispatch inspection.
2. One-year spares and refrigerant shall be supplied along with those for accessories.

3.0 **Fire Fighting Equipment:** Contractor will supply and erect at designated locations the firefighting equipment. The details of the firefighting equipment are given below.

1. Supply and installation of **4.5 kg** capacity **CO2 type fire extinguishers** with steel cylinder with discharge valve and conforming to **IS: 16018**. Extinguisher shall be painted with red enamel paint and hardware/ bracket required for fixing to wall.
2. Supply and installation of **9 kg** capacity dry chemical powder (**DCP**) type **fire extinguisher** with extinguishers cabinet suitable for inverted operation and fabricated from MS sheet internally protected with anticorrosive treatment and hydraulically tested. Extinguishers shall be externally painted with red enamel paint. Manufacturing code **IS: 15683**.
3. Supply and installation of **75 kg** capacity trolley mounted dry chemical powder (**DCP**) type **fire extinguisher** suitable for inverted operation fabricated from MS sheet internally protected with anticorrosive treatment and hydraulically tested extinguishers externally painted with red enamel. Manufacturing code **IS: 16018**.
4. Providing & installation of galvanized mild steel **fire buckets** of **9 liters**. capacity made as per **IS: 2546** including supplying & fixing of **MS angle iron stand** to accommodate **4 nos.** of fire buckets and first fill with sand/water all complete as per direction of Engineer In charge (One set consisting of 4 buckets with stand).

Note: The equipment is to be purchased from the vendor list enclosed.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

ANNEXURE – I

LIST OF SUPPLIERS OF MAJOR BOUGHT-OUT ITEMS

A. FIRE FIGHTING EQUIPMENT

Fire Extinguishers

1. Nitin Fire Protection Pvt. Ltd., Mumbai
2. Safex Fire Services, Bombay
3. Fire Safety Services, New Delhi
4. HD Fire Protect Co., Thane
5. Zenith Fire Services, Bombay
6. Steelage Industries, New Delhi
7. Atlas Fire tech Pvt. Ltd., Delhi

Note: Contractor shall select vendor/ agency from above list and clearly indicate name(s) as selected from the list, in his bid.

B. LIST OF PARTIES FOR LAYING OF SS TUBING

1. M/s Aadhar Projects, New Delhi – (Contact No. 8809724365)
2. M/s Khurana Engineering Works, New Delhi – (Contact No. 9810046779)
3. M/s Eco Technologies, New Delhi – (Contact No. 9313901100)
4. M/s Mass Gas Air Systems Pvt. Ltd., Delhi – (Contact No. 9810214452)
5. M/s Vaishnow National Corporation, Mayur Vihar, Delhi – (Contact No. 9311214431)
6. M/s Pervious Exim India Pvt. Ltd., New Delhi – (Contact No. 8368018797) E-Mail: ivecogasxinc@gmail.com

List of parties to be provided by bidder for approval from Client / MECON

C. VENDOR LIST FOR SS FITTINGS, VALVES&THERMOPLASTIC HOSES

1. **M/s Parker Hannifin India Pvt. Ltd.,**
Plot EL-26, MIDC, TTC, Industrial
Area, Mahape, Navi Mumbai – 400
701 Tel. No. : 022-55907081/ 82 Fax
No. : 022-55901080
E-mail: parker@vsnl.com / aoke@parker.com

Thru Delhi Representative:
M/s Parker Hannifin India Pvt. Ltd., C-105,
Mahindra Apartments, Vikas Puri, New Delhi
Tel. No.: 011-32591978; Fax No.: 011-25526858,25152718



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

Thru Representative:

M/s Super Technical (India) Pvt. Ltd.
501, Samarpan Complex, New Link Road,
Chakala, Andheri (E), Mumbai- 400099
Ph: 022- 2832 3760/ 61, Fax: 2832 3759,
E-mail: sales@supertechnical.in

2. M/s Swagelok, Singapore

Thru Delhi Representative:

M/s Delhi Fluid System Components Pvt. Ltd.,
F-7B, Okhla Industrial Area Phase-I, New Delhi -
110 020
Tel. No.: 011-51614144-47 Fax No: 011-51614148

Thru Bangalore Representative:

**M/s Bangalore Fluid System Components
Pvt. Ltd.,**

#1, Doddanakkundi Industrial area,
Mahadevapura Post, Bangalore- 560048
Tel No., 080-42669100
Mob- 91 9686700138
E-mail: bangalore@swagelok.com

3. M/s Circor Instruments Ltd. U.K.

Thru Indian representative

M/s Oil tech Consultancy Services,
11, Veena Beena, Guru Nanak Road, Bandra
(W), Mumbai – 400 050 (India)
Tel. No. : 022-56936500, 56964146 (D) Fax No.
: 022-26514429/26405644
E-mail: ashishn@oiltechconsultancy.com; oiltech@vsnl.com

4. M/s Flow Line Instrumentation Pvt. Ltd.

Vazhakala Complex, Next to #
460 4th Phase, Peenya
Industrial Area Bangalore 560
058
Telephone +91 (0) 80-4117-1802
Fax +91 (0) 80-4117-1801
E-mail sales@flowline.co.in



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

5. M/s Bangalore Fluid Systems Components (P) Ltd.,

(M/s Swagelok)
C-011 D, Super Mart
– 1 Commercial
Complex, DLF City,
Phase – IV Gurgaon -
122002
Ph No.: 0124 –
4045631/2/3 Fax No.:
0124 – 404563
E-mail:swagelokdel@gmail.com

6. M/s SSP .U.S.A

Thru Indian representative
M/s Oil tech Consultancy Services,
11, Veena Beena, Guru Nanak Road, Bandra (w), Mumbai- 400
050(India) Tel.No.:022-56936500, 56964146(D), Fax No.:022-
26514429/ 26405644
E-mail:ashishn@oiltechconsultancy.com ; oiltech@vsnl.com

7. M/s D-lokCorp., South Korea SS fittings and Valves

No. 94, 4th Floor, 2nd Cross, MLA Layout, R. T. Nagar, Bangalore,
Karnataka- 560032 Tel: + 91 8861200084 87, Fax: + 91 80 23535285
E-mail:contact@techsolengineers.com

Techsol Engineers

No. 94, 4th Floor, 2nd Cross, MLA Layout, R. T. Nagar, Bangalore,
Karnataka- 560032 Tel: + 91 8861200084 87, Fax: + 91 80 23535285
E-mail:contact@techsolengineers.com

8. M/s Hylok, South Korea for SS fittings and Valves

Thru Indian representative
M/s SSSP Technologies (Hy-Lok)
130, Sahid Dinesh Gupta Road, (29, Sahid Dinesh Gupta Road), Behala,
Jadu Colony, Kolkata- 700 034, India
Mob- 91 98306 88788
E-mail:spban1958@gmail.com,
phalgunibanerjee943@yahoo.in

9. Dawsons Tech Components LLP

Unit No. DD-6&7, Khan Real Industrial Estate,
N.H. 08, Pelhar, Vasai Phata, Vasai (East)



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

10. ASTEC VALVES & FITTINGS PVT LTD

Unit No. 10/11, Geeta Industrial Estate No. 7,
Near K T Industrial Park, Gorai Pada, Vasai (E),

Vasai, Maharashtra-401208

11. M/S FLUID CONTROLS PRIVATE LIMITED

J.V. PATEL ITI COMPOUND B MADHURKAR MARG
OPP ELPHINSTONE ROAD STN. (W),
Mumbai -400013.

D. VENDOR LIST FOR SS TUBE

1. M/s Sandvik Steel Asia Pvt. Ltd.

Steel Division, Mumbai-Pune Road, Dapodi, Pune-4110212, India
Tel. No. : 020-27104562, 27104568 Fax No.: 020-27145022, 27145339
E-mail:genny.dcruze@sandvik.com; siddarth.mittal@sandvik.com

2. M/s Ratnamani Metals & Tubes Ltd.

17/18, Rajmugat society, Naranpura Char Rasta, Ankur Road,
Naranpura, Ahemdabad-380013
Tel. No.: 079-7415501-4

Fax No.: 079-7480999

E-mail: ratnamani@ratnamani.com

**3. M/s Mitsubishi Corporation
(New Name: M/s Metal One Corporation)**

Vijya Building, 2nd floor, 17, Barakhamba Road New Delhi-
110001 Tel. No. : 011-23327317, 23322211 Fax No.: 011-
23738680

E-mail: gagan.arora@mitsubishicorp

4. M/s FAE S.A

Centro Atomico Ezeiza,
Pdo.de Ezeiza (1804) Prov. De Buenos Aires, Argentina
Tel. No. : (54-11)4480-9155/9028 Fax No.: (54-11)4480-0604

E-mail: fae@conuar.com.ar

Thru India Representative

Shubh Consulting (Oil & Gas Division) C-65, Greater
Kailash Part-I New Delhi – 110 048 (India)

Tel. No. : 011-26425817/26431499, Fax No.: 011-26230361, 25729329

E-mail: shubhcons@hotmail.com

5. M/s Sumitomo Corporation India Pvt. Ltd.,

4th Floor, DLF Centre, Sansad
Marg, New Delhi, Fax No. : 011-
23737111



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

6. M/s Parker Hannifin India Pvt. Ltd.

Plot EL-26, MIDC, TTC, Industrial Area, Mahape, Navi Mumbai –
400 701 Tel. No.: 022-55907081/ 82 Fax No. : 022-55901080
E-mail: parker@vsnl.com / aoke@parker.com

Thru Delhi

M/s Parker Hannifin India Pvt. Ltd., C-105, Mahindra Apartments,
Vikas Puri, New Delhi
Tel. No.: 011-32591978 FaxNo.: 011-25526858, 25152718

7. M/s Tubacex India,

402-A, Platina-G block, Bandra-kurla complex,
Bandra (E). Mumbai-400 051, Ph No. 022-40015
300, 022-40015 350
E-mail: sales@tubacexindia.com

8. M/s REMI EDELSTAHL TUBULARS LIMITED

Remi House Plot No 11 Cana Industrial Estate Goregaon (East),
Mumbai Boisar-401506

9. M/s Jindal SAW Ltd

12, Jindal Centre Bhikaji Cama Place,
Bhikaji Cam Delhi-110066

Notes:

1. For procuring the above listed bought out item(s) from the vendor/ supplier, whose name is not appearing in the above preferred make list, bidders can supply those item(s) from such vendors/suppliers who have earlier supplied same item(s) for the intended services and the offered item(s) is in their regular manufacturing/ supply range and the same may be accepted subject to following: -

- a) The Vendor/ Supplier of bought out item(s) is a Manufacturer/ Supplier of the said item(s) for intended services and the same are in their regular manufacturing/ supply range.
- b) The vendor/supplier should not be in the Holiday list of Client/ MECON/ Other PSU.
- c) For items to be purchased with measurement unit either in length or in weight: -

Should have supplied for intended services at least 15% of SOR quantity of same size, thickness, schedule, pressure & temperature ratings, SDR, etc. or higher (as applicable) as per technical details mentioned in SOR & Tender specification and in a single Purchase order (PO) and the same should have been supplied within last seven (07) year from the date of approval request made by the contractor.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



MECON LIMITED

d) For items to be purchased with measurement unit in number: -

Should have supplied for intended services at least 15% of SOR quantity of same size, thickness, schedule, pressure & temperature ratings, SDR, etc. or higher (as applicable) as per technical details mentioned in SOR & Tender specification in a single Purchase order (PO) and the same should have been supplied within last seven (07) year from the date of approval request made by the contractor.

2. For procuring any other item(s) {i.e., not listed above}, bidders can supply those item(s) from such vendors/suppliers who have earlier supplied same item(s) for the intended services and the offered item(s) is in their regular manufacturing/ supply range and the same may be accepted subject to following: -

a) The Vendor/ Supplier of bought out item(s) is a Manufacturer/ Supplier of said item(s) for intended services and the same are in their regular manufacturing/ supply range.

b) The vendor/supplier should not be in the Holiday list of Client/ MECON/ Other PSU.

c) For items to be purchased with measurement unit either in length or in weight: - Should have supplied for intended services at least 15% of SOR quantity of same size, thickness, schedule, pressure & temperature ratings, SDR, etc. or higher (as

d) applicable) as per technical details mentioned in SOR & Tender specification in a single Purchase order (PO) and the same should have been supplied within last seven (07) year from the date of approval request made by the contractor.

e) For items to be purchased with measurement unit in number: -

Should have supplied for intended services at least One (01) number of same size, thickness, schedule, pressure & temperature ratings, SDR, etc. or higher (as applicable) as per technical details mentioned in SOR & Tender specification in a single Purchase order (PO) and the same should have been supplied within last seven (07) year from the date of approval request made by the contractor.

Remarks for Note 1 & 2:

To meet the criterion mentioned above, the successful bidder/ contractor is required to submit documentary evidences such as copy of FOA/ Purchase Order (PO)/ sub purchase order and their supply record like Inspection certificates/report, Inspection release note, Tax paid invoice, performance certificates (if available), etc. from which it can be established that vendor have executed supplied the order. These documents shall require to be submitted by them within 30 days from date of Placement of Order for approval to CLIENT / MECON.



GODAVARI GAS PVT LTD.

**MECHANICAL AND ELECTRICAL WORKS FOR
CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS
AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA**



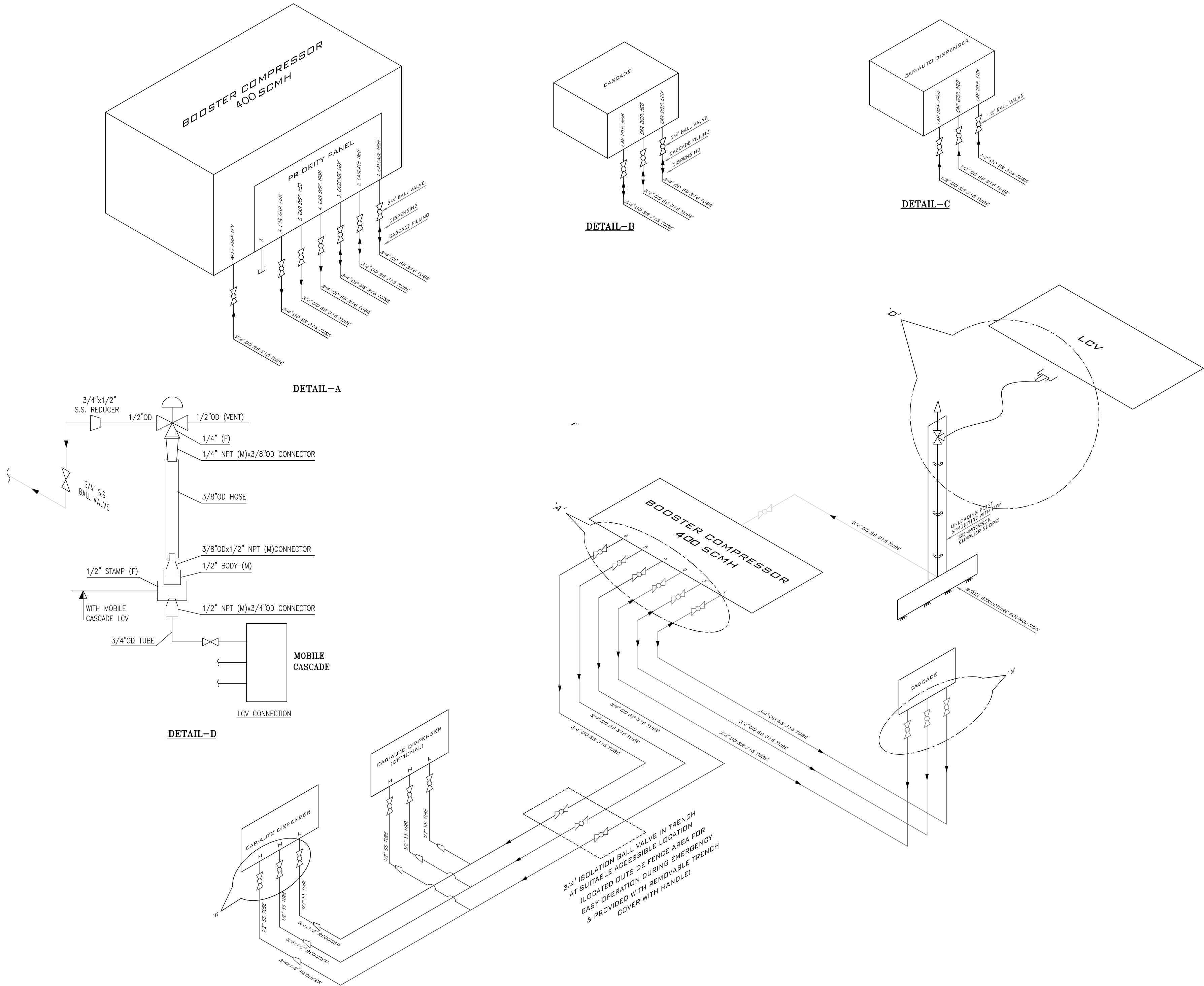
MECON LIMITED

3. The details of vendors indicated in this list are based on the information available with MECON, Contractor shall verify the capabilities of each vendor for producing the required quantity and the items are in their regular manufacturing range. MECON does not take any guarantee / responsibility on the performance of the vendor. It is the contractor's responsibility to verify the correct status of vendor and their quality control before proposing to CLIENT / MECON for approval of vendor name. It is also the responsibility of contractor to expedite the material in time.
4. For those vendors whose names are not appearing in the above list but are subsequently registered with MECON can also be considered for the supply of the items. Contractor has to propose the names of such vendors along with their valid vendor registration letters issued by MECON.

 GODAVARI GAS PVT LTD.	MECHANICAL AND ELECTRICAL WORKS FOR CONSTRUCTION OF CNG DAUGHTER BOOSTER STATIONS AT EAST AND WEST GODAVARI GEOGRAPHICAL AREA	 MECON LIMITED

LIST OF STANDARD DRAWINGS (MECHNICAL)

SL NO.	DESCRIPTION	DOCUMENT NO. / DRAWING NO.	REV. NO.	SHEETS
01	STANDARD DRAWING FOR SS TUBING AT DBS STATION	MEC/U999/05/25/M/STD-001	Rev 0	1



NOTES:-

1. TUBING LENGTH TO BE AS PER SITE CONDITION & TRENCH LAYOUT.
2. AIR TUBING TO BE LAID IN SAME TRENCH.
3. SS TUBING SHALL BE CLAMPED TO THE M.S. ANGLE USING PVC CLAMPS AT RVERY 1000 MM.
4. FOR BENDS IN SS TUBING, BENDING MACHINE TO BE USED.
5. FOUNDATION FOR LCV LOADING POINT IS UNDER THE SCOPE CIVIL WORK.
6. UNLOADING POINT STEEL STRUCTURE WITH MFM IS UNDER THE SCOPE OF COMPRESSOR SUPPLIER.
7. QUANTITY MAT VARY AT SITE AND TO BE EXECUTED AS PER WORK ORDER ITEMS.
8. TYPE & NO. OF DISPENSERS AS PER SITE REQUIREMENT.

LIST OF MATERIALS

S.No.	ITEM DESCRIPTION	UNIT
01.	3/4" SS 316 TUBE	Mtr.
02.	1/4" SS 304 TUBE (AIR)	Mtr.
03.	1/2" SS 316 TUBE	Mtr.
04.	3/4" SS UNION	Nos.
05.	1/4" SS UNION	Nos.
06.	1/2" SS UNION	Nos.
07.	3/4" 2 WAY SS BALL VALVE	Nos.
08.	1/2" 2 WAY SS BALL VALVE	Nos.
09.	1/4" 2 WAY SS BALL VALVE	Nos.
10.	3/4" 3 WAY SS BALL VALVE	Nos.
11.	3/4" SS UNION TEE	Nos.
12.	1/4" SS UNION TEE	Nos.
13.	3/4" SS END CAP	Nos.
14.	3/8" OD HOSE	Nos.
15.	3/8" x 1/2" SS CONNECTOR	Nos.
16.	1/2" QRC SET (SLEEVE & STEM)	Nos.
17.	3/4" x 1/2" SS REDUCER	Nos.
18.	PVC CLAMPS FOR 3/4" SS TUBE	Nos.
19.	PVC CLAMPS FOR 1/2" SS TUBE	Nos.
20.	3/4" x 3/8" SS CONNECTOR	Nos.
21.	3/4" SS END CAP	Nos.
22.	1/2" SS END CAP	Nos.

FOR TENDER PURPOSE ONLY

FOR ONE COMPRESSOR



मेकॉन लिमिटेड

MECON LIMITED

SECTION	CNG & CITY GAS	CITY GAS DISTRIBUTION NETWORK			
LOCATION	NEW DELHI				
DESIGNED	SURAJ	STANDARD DRAWING FOR SS TUBING AT DAUGHTER BOOSTER CNG STATION			
DRAWN	SUNIL				
CHECKED AND VERIFIED	VIKAS RAJORA				
APPROVED	SIG	(R.MALIK)	SCALE : NTS	SHEET (1 OF 1)	REV
	DATE	03.03.2021	DRG. NO. MEC/U999/05/25/M/STD-01		0

SECTION- D

TECHNICAL SPECIFICATION FOR SS TUBES, SS VALVES & SS FITTINGS FOR INSTRUMENTS AIR LINE

TS No.: MEC /TS/ 05 / ES/ CNG/ IA-01 ELECTRICAL &

INSTRUMENTATION SECTION



MECON LIMITED
DELHI - 110 092

**TECHNICAL / STANDARD
SPECIFICATION
FOR
INSTRUMENTATION WORKS**

SPECIFICATION

FOR

INSTALLATION OF INSTRUMENTS

SPECIFICATION NO.: MEC/S/05/26/01



ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092

0	15.10.2014			
Revision	Date	Ratnadeep Gupta Prepared By	Vikas Jain Checked By	Rakesh Kr. Shukla Approved By

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 1 of 21
			REVISION : 0
			EDITION : 1

AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 2 of 21
			REVISION : 0
			EDITION : 1

C O N T E N T S

- 1) SCOPE
- 2) STANDARDS OF MATERIALS
- 3) INSTALLATION OF INSTRUMENTS
- 4) TESTING
- 5) CALIBRATION OF INSTRUMENTS

PREPARED BY: (N.S.KANNAN)	CHECKED BY: (R.SANJAY BABU)	APPROVED BY: (PANKAJ SHIVASTAVA)	ISSUE DATE : 30.07.09

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 3 of 21
			REVISION : 0
			EDITION : 1

INSTALLATION, TESTING AND CALIBRATION OF INSTRUMENTATION AND CONTROL SYSTEM

1.0 SCOPE

- 1.1 The purpose of this specification is to define the general requirements for the installation, installation materials, testing and calibration of instruments and control system.
- 1.2 The work shall be carried out in accordance with the codes, standards and recommended practice listed in this specification and in accordance with local 'Statutory regulations'.
- 1.3 For installation of instruments and control system, of the new material where quality is of the prescribed standards and which is in every way fit for its intended purpose shall be used.
- 1.4 Unless otherwise specified all the materials shall be indicated in this specification except where it is not compatible with fluids being handled. In such cases the selection of the material shall be approved by MECON.
- 1.5 Only the best trade practices shall be used. All the work shall be carried out in a neat, workman like manner and to the satisfaction of MECON.

2.0 STANDARDS OF MATERIALS

- 2.1 Instrument process piping / tubing upto and including the first block valve and 'in-line' instrument equipment shall conform to the line class or vessel rating concerned instrument piping or tubing after the first lock valve may use alternate materials consistent with service conditions. In general they shall conform to the following specification as a minimum.
 - 2.1.1 Stainless tubes shall be fully annealed and cold drawn seam less as per ASTM A 269 TP316 with size 1/2"OD x 0.65" WT (wall thickness).
 - 2.1.2 Monel tubing shall be fully annealed seamless as per ASTM B165 with size 1/2" OD x 0.35"WT.
 - 2.1.3 Carbon steel pipe shall be 1/2" seamless and shall be as per ASTM A106 Gr B min of sch 80 & dimensions as per ANSI B36.10.
 - 2.1.4 Seamless stainless steel pipes shall be as per ASTM A 312 Gr TP 316L Sch 80S, dimensions as per ANSI B 36.19.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 4 of 21
			REVISION : 0
			EDITION : 1

2.1.5 Instrument air supply piping from the main instrument air header shall be galvanised heavy class pipes to IS 1239.

2.2 Individual pneumatic signal and air supply tubing shall conform to the following specifications:

2.2.1 Stainless tubes shall be used in general and shall be fully annealed and cold drawn seamless as per ASTM A269 TP 316 with 6mmOD x 1mmWT.

2.2.2 Copper tubing where specified shall be seamless 6mmOD x 1.0mmWT soft annealed as per ASTM 868.74a cd No. 122 (DHP) sheathed with PVC 1.0mm thick coloured Black.

2.3 All fittings shall be as a minimum of 100 rating except for tube fittings. The fittings shall have threading as per B2.1 and socket weld connections as per B 16.11. These shall conform to the following specifications in general.

2.3.1 Tube fittings shall be flare type compression fittings Swagelok or equivalents make double ferrule and pressure seat type.

All tube fittings in impulse lines shall be rated to 5000 PSIG at 38°C.

2.3.2 Carbon steel pipe fittings shall be forged as per ASTM A105 stainless steel pipe fittings shall be as per ASTM –182 Grf 316L

2.4 Valve shall have normally Globe body and shall be fabricated out of Bar-stock and rated to min. of 1500. These shall be screwed bonnet type with 13% GSS trim and plug shall be integral with the stem. Face to face dimensions shall be approx. 80mm. End connections shall be socket weld to ANSI 16.11 and threaded to B2.1

2.5 Multibore tubing shall have a maximum 19 single polyethylene tubes, 6mmOD x 1mm numbered for easy identification. The bundle shall be marked with inner and outer fire resistance PVC sheath. They shall carry a pair of telephone wire 0.6mm diameter flexible.

2.6 Single pair and multi pair extension cables for Thermocouples shall be matched and calibrated in accordance with ISA MC 96.1. Conductor size shall be AWG for single pair and 20 A for Multipair.

The cable shall be armoured, each twisted pair shall be individually shielded with aluminium Mylar tape and a tinned copper drain wire. The wires and the cable shall be colour coded as per ISA recommended practices.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 5 of 21
			REVISION : 0
			EDITION : 1

2.7 Instrument Electrical cables shall conform to the following specifications:

2.7.1 Instrument electronic signal cables single pair/ Multipair shall have copper conductor, twisted in pair and individually shielded with Aluminium Mylar tape with drain wire. In multipair cables, each pair shall be armoured with inner and cut PVC sheath. Minimum conductor size shall be 1.5 mm².

2.7.2 Control Cables for control signal, alarms actuating devices and solenoid valves of the interlock and shutdown valves shall generally be 1.5 mm² copper conductors armoured with inner and cut PVC sheath.

2.7.3 All power supply cables shall have copper/Aluminium conductor depending upon the conductor size. The cables shall be armoured with inner and cut PVC sheath. The cables shall be sized adequately. Minimum conductor size shall be 2.5 mm².

2.7.4 2-core armoured cable shall be used for illuminator on level gauges.

2.7.5 The material and construction of all electrical cables shall conform to IS- 1554 Part I or appropriate equivalent code and standard.

3.0 INSTALLATION OF INSTRUMENTS

3.1 Instrument Mounting

3.1.1 No instrument shall be installed in such a way that it bends for support on the impulse piping or electrical connection on it.

3.1.2 Pressure gauges and temperature indicator shall normally be mounted directly on line. However direct on line mounting shall be avoided where vibrations are likely to be present.

3.1.3 Local mounted instruments shall be mounted on brackets, panels or placed on a suitable pedestal. Transmitters shall be mounted on 2" pipe supports where practical. Instruments to be mounted on steel columns, masonry structure etc. These shall not be mounted on heating equipments, pipelines and structures.

3.1.4 Blind transmitters shall be mounted at 130mm above graded platform. Local controllers, indicating transmitters and indicating instruments shall be mounted at approximately 1500 mm.

3.1.5 All the instruments shall be accessible from grade, ladder or platform etc. Pressures gauges and other local indicating instruments shall be readable from grade or operating level and if used for manual control shall be visible from the related valve.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 6 of 21
			REVISION : 0
			EDITION : 1

All the instruments shall be located such that they don't impede the process operation.

- 3.1.6 Local mounted instruments which are not available in weather proof housing shall be mounted inside a weather proof case.
- 3.1.7 Items such as pilot valves, solenoid valves etc. shall be located local to its point of application or near to the device being actuated by them.
- 3.1.8 For blind transmitters output meters shall be mounted on instrument supports.
- 3.1.9 Filter regulators shall be mounted on the instrument supports below pneumatic transmitter or on the control valve yoke.
- 3.1.10 Instruments or instrument lines shall not be supported on hand rails, in general.
- 3.1.11 The use of process piping to support instrument lines shall be avoided as far as possible.
- 3.1.12 The instrument impulse piping shall be kept as short as possible.
- 3.1.13 Instruments and impulse lines shall be protected against mechanical damage.
- 3.1.14 In case of capillary tube instruments, capillary tube is to be supported and protected against mechanical damage.
- 3.1.15 Orifice meters shall not be installed on the top of orifice fittings. On horizontal lines orifice pressure taps shall be located as follows:
 - a) On top for air and gas service
 - b) Horizontal for liquid and condensable vapour service.
- 3.2 Instrument Piping & Tubing.
 - 3.2.1 Impulse Piping/tubing
 - 3.2.1.1 The primary instrument block valves for all instruments shall be as per piping specifications.
 - 3.2.1.23-Valve manifold in general shall be integral type. For pressure gauges, 2-valve manifolds shall also be acceptable instead of isolation valve, drain valve and pipe fittings.
 - 3.2.1.3 Differential or static pressure sensing lines shall not exceed 6 mtrs. (20 feet) in general for direct connected or locally mounted instruments.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 7 of 21
			REVISION : 0
			EDITION : 1

3.2.1.4 All impulse lines shall be run with a slope not less than 1 in 12 except where otherwise specified. Direction of slope is to be downward from the process for liquid service and upward from the process for gas service.

3.2.1.5 Tubing shall be joined by compression fittings.

3.2.1.6 Piping shall be joined by pipe fittings/flanges as per the piping specifications.

3.2.1.7 All instruments pipes and tubes shall run in horizontal and vertical planes only and shall run with minimum number of changes in direction, consistent with good engineering practices and neat appearance.

3.2.1.8 Tubing shall be bent with correct size tube bender as far as possible to avoid use of fittings. Hot bending shall be totally avoided.

Tube cutter shall always be used to cut tubing. The use of short lengths of tubing in long runs shall be avoided in order to avoid the fittings.

3.2.1.9 All tubing shall run in such a manner as to give the maximum protection against mechanical damage. Tubing runs shall be grouped together and clamped.

3.2.1.10 Tubing shall be arranged so that the unions can be tightened without distorting lines.

3.2.1.11 Instrument tubing or piping shall not run on trays intended for cables and shall not share the same transit.

3.2.1.12 No pipe or tube shall be left with mechanical strain on them.

3.2.1.13 A mechanical ferrule seater shall be used on tubing for 140 kg/cm² (2000 psi) or more.

3.2.1.14 Pipe bushings shall not be used.

3.2.1.15 Pipe plugs shall be fabricated out of bar stock and shall have hex-head.

3.2.2 Air/Signal Tubing

3.2.2.1 Signal Transmission tubes shall be laid on perforated trays prefabricated out of min 2.5 mm. thick steel plates. The width of the tray shall be selected as per the number of tubes to be laid.

3.2.2.2 Where tubing is run in permanent enclosures, it should be ensured that entry and exit of such enclosures is clean and smooth.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 8 of 21
			REVISION : 0
			EDITION : 1

- 3.2.2.3 Tubing run in permanent enclosures shall not have joints, except at special junctions boxes provided for this purpose.
- 3.2.2.4 Where permanent enclosures are left with space for instrument tubing to be laid at some later date, a galvanised pull wire of adequate size shall be left in the tray.
- 3.2.2.5 Where the length of transmission tubing exceeds 60 mtrs (200ft) necessity of installing signal booster relays shall be considered.
- 3.2.2.6 In case of 'Skidded' equipment or vessels with instrumentation, where off- skid alarms shutdown or control functions are provided the signal tubes shall be terminated on the control bulk head near the skid boundary.
- 3.2.3 All threaded pipe joints shall be joined after applying Teflon tape. It should be applied in a manner to ensure that the tape does not spill over the end of the male fitting. No other pipe joining compound shall be used except on high temperature service where graphite sealing compounds shall be used.
- 3.2.4 All reasonable precautions shall be taken to prevent foreign materials entering pipe lines or tubing before and during erection.
- 3.2.5 Pipes and tubes installed but not connected, shall have the ends clad in approved fashion to prevent the entry of foreign material. For a period upto one week adhesive tape may be used, for longer periods, caps or plugs shall be used.
- 3.2.6 Piping/Tubing supports
- 3.2.6.1 Piping and tubing shall be adequately supported and fixed at a distance not exceeding that in the following table:

Table

Single tubing/Piping	Max. distance between supports
3/8" OD or less	Continuous
1/2" to 3/4" Nom. size	2 meters (6ft.)
3/4" to 1" Nom. size	3 meters (9ft.)
Multitube bundle	3 meters (9ft)

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 9 of 21
			REVISION : 0
			EDITION : 1

3.2.6.2 All field mounted instrument air tubing shall be supported with galvanised steel angles or channels of minimum 1/8" thickness fabricated to present neat appearance.

3.2.6.3 All instruments tubing supports shall be galvanised prior to installation

3.2.6.4 Trays shall be properly supported either from any rigid steel structure or concrete member. In case of non-availability of above, a suitable support shall be fabricated.

3.3 Instrument Air Supply Distribution

3.3.1 Piping material for instrument main and branched air headers upto the isolation valve at each take-off from main or branch header shall conform to piping specification.

3.3.2 The air header size shall be established in accordance with the table below, unless otherwise specified, for a header pressure of 4 to 8.5 kg/cm²

Table – 2

Max number of users	Nominal pipe size
upto 5	1/2"
upto 10	3/4"
upto 25	1"
upto 80	1-1/2"
upto 150	2"
upto 500	3"

3.2.3 All take off for branch lines are to be from the top of the main header with block valves equal in size to the branch line. All low point shall have a 1/2" valve installed as a drain and blow down point.

3.3.4 A minimum size of 1/2" pipe shall be run to the instrument with a 1/2" valve for each user. Tubing from the isolation valve to the instrument shall be 6.0 mm.

3.2.5 Union shall be provided at convenient location in the air header.

3.3.6 Filter regulator shall be provided for individual field mounted consumer and shall be complete with an output gauge.

3.3.7 In case of skid mounted equipments or vessels which incorporate instrumentation requiring pneumatic supply, on skid supply piping shall terminate at the skid boundary location and size of the supply connections shall be noted on the vendor approval drawings.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 10 of 21
			REVISION : 0
			EDITION : 1

3.4 Installation of multitude and Multicore cables.

3.4.1 Multicore/ Multitube cables shall generally be installed on trays or ducts and properly clamped. At bends minimum radius shall be maintained as per cable manufacturer's standards.

3.4.2 All cables shall be rigidly supported on structural steel and masonry. Drilling of steel member should normally be avoided. However, if the drilling of steel must be resorted to, it must be drilled where minimum of weakening of structure will result cables shall be support at every 500 mm. At every vertical drop these shall be clamped at more frequent intervals max of 300 mm.

3.4.3 Directly buried cables shall be laid underground in excavated cable trenches. Trenches shall have sufficient depth and width to accommodate all cables correctly spaced and arranged with a view of heat dissipation and economy of design construction of trenches laying of cables and filling up of trenches shall be as per relevant standard.

3.4.4 Each underground cable shall be provided with identifying tag of load securely fastened every 30 M of its underground length with at least one tag at each end before the cable enters the ground.

Before cables are placed, the trench bottom shall be filled with a layer of sand. The cables shall be covered with 150 mm of sand on the top of the largest dia. cable tube and sand shall be lightly pressed. A protective covering of 75 mm thick second class red bricks shall be laid flat and the balance portion of the trench shall be filled with soil, compacted and levelled.

3.4.5 At each road crossing and other places where cables enter pipe sleeves, adequate bed of sand shall be given so that the cables don't slack and get damaged by pipe ends after back filling.

3.4.6 At the entry into concrete blocks loops shall be provided at either end to prevent any damage to cable.

3.4.7 The cable entry to control room shall be suitably filled and sealed after laying of cables so as to achieve a positive sealing against the entry of gas/water.

3.4.8 All wiring, tubing, cables, Junctions boxes and auxiliary equivalent shall be suitably identified as per applicable codes and practices. All piping and tubing shall be tagged with slip-on or clip on wire marker at both ends.

3.4.9 Jointing of cables is generally not permitted. Cables shall be cut after the exact site measurements at the cable drums shall be so selected before cutting the lengths as to avoid any unnecessary wastage.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 11 of 21
			REVISION : 0
			EDITION : 1

- 3.4.10 Low signal cables like alarms, analysers cables, special cables for turbine meter, thermocouple compensating cables etc. shall be layed separated from power supply cables in ducts/trenches/trays.
- 3.4.11 Electric signal lines for electronic transmitters to receive and to final control element shall be continuously shielded with the shield grounded at the same point as the signal circuit generally at the control instrument.
- 3.4.12 Separate junction boxes shall be used for intrinsically safe cables.
- 3.4.13 Different intrinsically safe system e.g., systems having different rounds shall not be run in the same multicore cable, in general.

Recommended minimum separation distance between twisted pair signal leads and AC Power Lines.

AC Power Cable		Minimum Distance to Signal Lead
Voltage (Volts)	Current (Am) in (cm)	
0 to 125	0 to 10	12" (30)
125 to 250	0 to 50	15" (38)
250 to 440	0 to 200	18" (46)
5KV & Up	200 Amp. & Up	24" (61)

Different intrinsically safe circuits e.g., circuits having different voltage levels, of the same intrinsically safe system shall not be run in the same cable unless each conductor insulation is at least 0.25mm or no hazard can result from interconnection.

- 3.4.14 The physical separation of power and signal cables shall be as per API 550 Part I Section VII. Cable in intrinsically safe circuits shall preferably be not run in the same tray where-- on intrinsically safe circuits cables are being run. If these are being run in the same tray, a metallic earthed separately shall be provided.
- 3.4.15 For temperature controllers, single pair thermocouple extension cable or cable for resistance thermometer, shall be layed directly from the element to the transducer in the control room without intermediate terminal blocks.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 12 of 21
			REVISION : 0
			EDITION : 1

3.4.16 In case of skid mounted equipment or equipment which incorporate skid instrumentation like alarms, shutdown or control function shall terminate signals or control junction box near skid boundary for connection of off skid equipment.

3.4.17 No wire shall be terminated or left with mechanical strain within any conductor.

3.4.18 Splices shall be made only at terminals, in instruments or approval equipment/ junction boxes using lugs and screwed connections. No intermediate splices shall be made in cable trays or in conduct. Number of junction boxes in any cable path shall be limited to only one.

3.5 Installation of Zener barriers

3.5.1 Zener barriers shall be installed in the circuit to make the system intrinsically safe provided:

- a) There is no energy storage system in excess to the minimum permitted by the barrier design on the hazardous side of the barrier. The same shall be met by taking intrinsically safe transmitters and selecting the cable electrical parameters like inductance L/R ratio & capacitance in accordance with the maximum parameters given in barrier specifications.
- b) No power source exceeding the voltage rating of Zener barrier shall be connected on safe side of the Zener barrier.
- c) No outside power source including other intrinsically safe circuits shall be connected to the hazardous side of the barrier.

3.5.2 Zener barriers shall be located as close as possible to the field wiring entry point in the control room.

3.5.3 Single barrier are bolted directly to copper bus bar and multiple barriers on the barrier mounting plates. Copper bus or barriers mounting plates shall be isolated from the panel frame.

3.5.4 The signal ground system for intrinsically safe system shall be separate from power ground system and shall be connected to the signal ground reference point. The maximum resistance allocable between the farthest point on intrinsically safe barrier ground bus and signal ground reference point shall be less than 1 ohm.

3.5.5 Field wires shall directly terminate at the barriers and not through intermediate terminals.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 13 of 21
			REVISION : 0
			EDITION : 1

3.6 Installation of Analyser / Gas Chromatograph

- 3.6.1 Installation of all analyser shall be in general, as per APIP 550 Part II.
- 3.6.2 The analyser housing at its installation shall meet all safety requirements as per classifications.
- 3.6.3 Sampled process fluid, if not returned to the process shall be disposed to a safe location. Piping shall be provided so that vapours can be vented to a safe location and liquids shall be drained in a clean and orderly fashion to a safe place. Toxic vapours shall not be vented to atmosphere.
- 3.6.4 Analyser shall be located as near to the sampling point as possible.
- 3.6.5 Analyser equipment must be protected from the following:
- Hot equipment
 - Severe ambient temperature changes
 - Shock
 - Mechanical damage
 - Vibration
- 3.6.6 If a separate vent for the analyser is used, the location of that vent shall be in area of minimum air Turbulence. If the vents of different analysers are vented into a common vent, a back pressure regulator shall be used.
- 3.6.7 Vent piping shall be designed to prevent condensate from accumulation in low point and obstruct a free vent flow.

3.7 Ducts, Trays and Supports

- 3.7.1 Main cable duct shall be of bottom open type with flat/angle --- construction with side sheet and top cover of 3.2 mm thickness.
- 3.7.2 The ducts and trays shall be properly supported at regular intervals. Wherever insert plates are not available, support on concrete structure or ceiling shall be fixed with a minimum of 10 mm expansion bolts Angle supports for ducts shall be fabricated from minimum of 40 mm angle.
- 3.7.3 All supports shall be neatly cut with hacksaw only and not with gas cutting. Free ends of angle supports shall not have sharp ends and shall be properly rounded off.
- 3.7.4 Ducts and supports shall be painted with one coat of Red oxide Zinc chromate primer conforming to IS-2074 after cleaning to remove scale and then painted with

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 14 of 21
			REVISION : 0
			EDITION : 1

2 coats of final enamel paint as given below:

- a) Duct - Dark admirately Grey as per IS0632.
- b) Supports - Black.

3.8 Instrument Steam Tracing

3.8.1 Steam for Tracking of instruments shall be taken from main steam header take of valve through carbon steel pipes supported at regular intervals.

3.8.2 Steam tracing around individual instrument shall be by copper tube of 1/8" diameter.

3.8.3 Piping or tubing for steam tracing shall be installed in such a way as to avoid condensate pockets.

3.8.4 After steam tracing, the line is connected to drain funnel through steam trap.

3.9 Identification of Lines and Instruments

3.9.1 All site mounted instruments, junction boxes, air headers, tubing and wiring terminations shall be labelled or tagged.

3.9.2 Instruments shall be furnished with stainless steel name tags containing Tag no., manufacturer's name, and model no. serial number. This tag number shall be approximately 3"x1" size and shall be attached to the instruments with -- gauge stainless steel wire.

3.9.3 Unused cable entries in junction boxes and field instruments are to be plugged.

4.0 **TESTING**

4.1 Instrument Impulse piping/Tubing

4.1.1 All process impulse lines shall be disconnected both from the instrument and vessel/piping end and flushed with water.

4.1.2 After thorough flushing the impulse lines shall be isolated from the instruments and pressurised hydraulically to 1.5 times the maximum working pressure corrected for ambient temperature. They shall then be isolated from the pressure source and the pressure reading on a test pressure gauge shall not fall at a rate exceeding one psig/hour.

In case no isolation valve is provided near the instrument, impulse piping/tubing shall be pressurised along with the instrument to the maximum pressure of scale in case of pressure transmitter and max. Operating pressure in case of differential

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 15 of 21
			REVISION : 0
			EDITION : 1

pressure instrument with equalising valve open

- 4.1.3 In special conditions where hydro- testing is not permissible due to service requirements, testing shall be carried out by using compressed air/nitrogen.
- 4.1.4 The external displacer type instruments and cage type level switches shall be tested to 1.5 times the operating pressure using air/nitrogen after thorough flushing.
- 4.2 Instrument Air lines/signal tubing.
- 4.2.1 Instrument air lines/signal tubing shall not be hydrostatically tested.
- 4.2.2 Instrument air tubing shall be disconnected upstream of all filter regulators and blown down to remove water, slag and mill scale, from lines at 7.0 kg/cm² G for fifteen minutes.
- Air filter shall be taken in line and tubing shall be disconnected at instrument end, and blown for 3 minutes to remove traces of dirt.
- 4.2.3 Testing of instrument air shall be carried out with instrument air at 7 kg/cm²G upto the upstream of the filter regulator after thorough flushing. All lines shall be checked with soap solution and bubbler unit for possible leak at joints.
- 4.2.4 All signal tubing shall be checked with 1.5 kg/cm² after proper flushing. After pressuring, source shall be cut off and rate of fall in pressure shall be less than IPSL for each 100 feet of tubing for a test period of 2 minutes as per instrument society of American RP 7.1 'Pneumatic Control Circuit Pressure Test'
- 4.3 Cables
- 4.3.1 All wiring shall be checked to ensure that it is correctly connected and properly grounded.
- 4.3.2 All cables shall be checked for continuity proper connection and insulation testing.
- Insulation test shall be carried out on all wiring with a certified magger after disconnecting the cables at both ends.
- 4.4 All the results of the above mentioned testing shall be recorded and submitted for check.
- 4.5 All the in line instruments like orifice plates, turbine meters, Rotameters, Target meters, vortex meters, control valves, safety valves etc. shall be removed and

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 16 of 21
			REVISION : 0
			EDITION : 1

spool pieces shall be provided prior to the flushing of the lines.

5.0 CALIBRATION OF INSTRUMENTS

5.1 All instruments shall be calibrated strictly as per manufacturer's instructions prior to the installation. In addition to calibration of instruments, setting of safety devices like process switches, safety valves etc. and simulation testing of all interlock and shutdown system shall be carried out.

5.2 In general, all tests shall simulate, as closely as possible, design process condition by the use of manometers, potentiometers, deadweight testers, test pressure gauges etc. Four point calibration shall refer to the input signal to an instrument equivalent to 0, 25, 50, 75, 100% of instrument range upscale (rising) and 75, 50, 25, 0% of instrument (downscale) (falling).

All instruments unless otherwise noted shall be calibrated in upscale and downscale direction and if necessary, adjusted until their accuracies conform to those limits state by the manufacturer.

Upon completion of these tests, the instruments shall be drained, completely.

5.3 Temperature Instruments

5.3.1 Temperature Gauges Filled type and Bi metallic dial type Thermometers shall be four point bench checked for proper operation and calibration using a temperature bath prior to installation.

5.3.2 Temperature Elements and Temperature Transmitters.

Temperature Elements and Transmitter shall be four point bench calibrated using a temperature bath precision meter or precision gauge prior to installation.

5.4 Pressure Instruments

5.4.1 Pressure Gauges

5.4.1.1 Direct connected bourdon type pressure gauges shall be dead weight tested or tested against a test gauges prior to installation.

5.4.1.2 Receiver type pressure gauges shall be four points calibrated using a precision gauge and precision air regulator.

5.4.1.3 Pressure and Differential Pressure Transmitters.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 17 of 21
			REVISION : 0
			EDITION : 1

Pressure and differential pressure transmitters shall be four points calibrated using a hydraulic or dead weight tester or a precision pneumatic calibrator prior to the installation. A precision output meter or gauge shall be used to monitor the output.

- 5.5.1 Orifice plates shall be checked visually for the name plate and for an upstream sharp edge. Bore dia. shall be checked for compliance with the specification.
- 5.5.2 Differential pressure type of flow instruments shall be four points calibrated using precision pneumatic calibrator or a manometer and precision regulator. A precision output meter or gauge shall be used to monitor the output of the transmitter.
- 5.5.3
- Rotameters shall be installed as received. A check shall be made to confirm that shipping stops have been removed and float has been installed.
 - Where rotameters have transmitting mechanism, the float shall be raised and lowered mechanically and output shall be checked. Vendor calibration data/ curve shall be checked.
 - A check shall be conducted with plumb for a vertical installation.
- 5.5.4 Turbine meters, Annubar, positive displacement meters, vortex meter, ultrasonic flow meter, etc. shall be installed as received.
- 5.5.5 Target meters shall be checked for calibration using calibration weights. Output shall be monitored using precision output meter.
- 5.6 Level Instruments
- 5.6.1 Level Gauge Glasses
- Gauge glasses shall be installed as received installation of illuminators, frost protectors and other accessories shall be checked.
- 5.6.2 Displacer Type, Level Transmitter
- Displacer type level transmitter shall be checked by raising and lowering mechanically the displacement and checking the pilot or transmitter action. Check transmitter with out put gauge or meter for smooth and full output change.
 - A check shall be conducted with plumb for a vertical installation.
- 5.6.3 Differential pressure type level transmitter Differential pressure type level transmitter shall be calibrated with pneumatic calibrator at four points prior to installation. A precision meter or gauge shall be used to monitor the output of the transmitter.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 18 of 21
			REVISION : 0
			EDITION : 1

- 5.6.4 Tank level gauges
- Tank level gauges shall be checked by raising and lowering mechanically the displacer and checking the indicator on the gauge board.
 - Check for proper liquid seal prior to installation in case of liquid seal tank gauges.
 - In case of servo type gauges, the displacer is hoisted from the tank into the calibration chamber.
- 5.7 Control Valves, shutdown valves and self actuated valves
- 5.7.1 All diaphragm and piston operated control valve shall be stroked pneumatically using a pressure regulator and pressure gauge against the spring range specified on the name plate of the valve.
- 5.7.2 Mechanical seating and travel of the valve stem shall be checked against the side indicator and the name plate
- 5.7.3 Valve positioner shall be calibrated with the control valve in accordance with the name plate data and specifications with the help of pneumatic calibrator or gauge with precision regulator. Zero position or fully close position of the valve shall be a live zero i.e., the plug shall be just off the seat at the minimum setting.
- 5.7.4 Volume bottles, where used shall be checked for proper filling. The signal line shall be bled to zero pressure and failure action shall be confirmed.
- 5.7.5 Control valve accessories such as handwheels, boosters, relays etc. shall be checked operationally. Declutch able handwheel shall be operable both with and without an air signal to the diaphragm.
- 5.7.6 Self actuated control valves shall be installed as received, checking inlet and outlet points and name plate data. Regulators with external pressure connections shall be inspected for proper installation.
- 5.7.7 Butterfly shall be checked carefully to see that the vane moves freely into the upstream and down stream piping. Proper vane movement to stroke shall be confirmed.
- 5.7.8 All control valves and regulators shall be removed from the line prior to flushing and during hydro testing.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 19 of 21
			REVISION : 0
			EDITION : 1

5.8 Safety Relief Valves

5.8.1 Safety relief valves shall be installed as received after carefully checking the name plate data. Pilots, if used, shall be checked carefully for installation on the proper safety valve.

5.8.2 Valves, which are installed in such a manner as to permit on line testing, shall be pressure tested after installation to determine proper operation and setting. Compressed air or nitrogen shall be used for testing of safety relief valves.

5.9 Switches

5.9.1 Level Switches shall be actuated mechanically for switch operation but shall not be calibrated for level setting.

5.9.2 Pressure switches shall be calibrated using hydorlic or dead weight tester or precision air regulator and gauge. The setting/trip point shall be checked using a continuity tester.

5.9.3 Temperature switches shall be calibrated using a temperature both prior to installation and set to the required alarm/ trip point using a continuity tester.

5.10 Receiver Instruments

5.10.1 Receiver Indicator/Recorders

5.10.1.1 Pneumatic indicators/ Recorders shall be calibrated using pneumatic calibrator/ precision pressure regulator and gauge.

5.10.1.2 Electronics indicators/ Recorders shall be calibrated using a current generator and a precision meter.

5.10.1.3 Chart drive assembly shall be checked for proper operation.

5.10.2 Controllers

5.10.2.1 Proper balancing of the controller shall be checked as per the manufacturers catalogues.

5.10.2.2 Controllers shall be checked for manual and Auto operation and Transfer. The transfer from manual to Auto and vice versa shall be bumpless and smooth.

5.10.3.1 Manual loader station Output of the manual loader shall be checked with a precision meter.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 20 of 21
			REVISION : 0
			EDITION : 1

5.10.4.1 Multipoint Temperature Recorders

Each point shall be calibrated using a temperature simulator/ decade box for RTD / voltage generator and precision meter for the thermocouples.

5.10.4.2 Point synchronisation shall be checked.

5.10.5 Pneumatic receiver switches shall be calibrated using precision air regulator and gauge. The setting/alarm/trip point shall be checked using continuity tester.

5.10.6 Trip Amplifiers Trip amplifiers shall be calibrated using a temperature simulators or voltage generator and precision meter for thermocouple or Resistance box for RTD's. The required setting/ alarm point/ trip point shall be checked using a continuity tester.

5.10.7 Receiver Switch module Receiver switch modules shall be calibrated using a current source and a precision meter. The required setting/alarm/trip point shall be checked using a continuity tester.

5.10.8 Alarm and Annunciator system

5.10.8.1 Alarm and annunciator system shall be checked for visual and audio alarm operation using dummy signals. Full alarm sequence of each alarm point shall be checked.

5.10.8.2 Each point shall be checked for proper engraving.

5.10.9 Shutdown System

5.10.9.1 Operation of final actuating elements shall be checked for proper operation using dummy signals.

5.10.9.2 All timers, push buttons and switches shall also be checked for their proper operation.

5.11 Analytical Instruments

5.11.1 Check the full analyser system including sample handling system for leakage.

5.11.2 Check the full sample handling system for its proper operation. Calibrate and check completely all analysers using zero and span samples as per vendor catalogues.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	INSTALLATION OF INSTRUMENTS	DOCUMENT NO. MEC/S/05/26/01	Page 21 of 21
			REVISION : 0
			EDITION : 1

5.12 Flow computer / Volume corrector

5.12.1 Corrected flow values shall be checked for various D.C. inputs and pressure and temperature variations for upscale and downscale ranges.

5.13 The list of test and calibration instruments with traceability certificates shall be submitted to MECON for approval before carrying out the tests / calibration of instruments at site.

5.14 The formats / description of tests / calibration of all instruments shall be submitted to MECON for approval.

5.15 Daily / weekly reports shall be submitted during execution of work at site.

SPECIFICATION FOR INSTRUMENT TUBING

SPECIFICATION NO.: MEC/S/05/26/02



**ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

0	15.10.2014			
Revision	Date	Ratnadeep Gupta Prepared By	Vikas Jain Checked By	Rakesh Kr. Shukla Approved By

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT TUBING	DOCUMENT NO. MEC/S/05/26/02	Page 3 of 6
			REVISION : 0
			EDITION : 1

AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT TUBING	DOCUMENT NO. MEC/S/05/26/02	Page 4 of 6
			REVISION : 0
			EDITION : 1

C O N T E N T S

- 1.0 GENERAL
- 2.0 CONSTRUCTION
- 3.0 TESTING
- 4.0 SHIPPING
- 5.0 REJECTION

PREPARED BY: (N.S.KANNAN)	CHECKED BY: (R.SANJAY BABU)	APPROVED BY: (PANKAJ SHIVASTAVA)	ISSUE DATE : 30.07.09

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT TUBING	DOCUMENT NO. MEC/S/05/26/02	Page 5 of 6
			REVISION : 0
			EDITION : 1

1.0 GENERAL

1.1 Scope

1.1 This standard specifications, together with the data sheets attached herewith, covers the requirements for the design, materials, testing and shipping of Instrument Tubing which includes the following types:-

- a) SS tubes
- b) Copper tubes

1.1.2 The related standards referred to herein and mentioned below shall be of the latest edition prior to the date of Purchaser's enquiry:

- ASTM A 269 - Specification for seamless and welded ferritic stainless steel tubing for general services.
- ASTM B 251 - Specification for general requirements for wrought seamless copper and copper alloy tube.
- ASTM B 251M - Specification for general requirements for wrought seamless copper and copper alloy tube (Metric)
- ASTM B 68 - Specification for seamless copper tube, bright annealed.
- ASTM B 68M - Specification for seamless copper tube, bright annealed. (Metric)

1.1.3 In the event of any conflict between these specifications, data sheets, related standards, codes, etc., the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture of the items in question.

1.2 Bids

1.2.1 Vendor's quotation shall include a detailed specification sheet for each type of tube which shall provide the following information:

- a) All the details regarding the type, construction, materials etc. of the items.
- b) Overall the dimensions in mm.

1.2.2 All the units of measurement and material specifications for various parts in the vendor's specification sheets shall be to same standards as in purchaser's data sheets.

1.2.3 Vendor shall attach a list of items, type wise, summing up all the deviations from this specification and purchaser's data sheets if there are any. Also vendor shall provide reasons for these deviations.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT TUBING	DOCUMENT NO.	Page 6 of 6
		MEC/S/05/26/02	REVISION : 0
			EDITION : 1

1.2.4 Vendor shall enclose catalogues giving detailed technical specifications and other information for each type of tube in the bid.

1.2.5 Vendor's quotation, catalogues, drawings etc. shall be in English language.

1.3 Drawings, Data and Certification

Detailed drawings, data, catalogues and manuals etc. required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducible and prints shall be despatched to the address mentioned, adhering to the time limits indicated.

2.0 CONSTRUCTION

2.1 Stainless Steel Tubes

2.1.1 SS tubes of the tubes shall be Rockwell RB 70-70. Tubes shall be free from scratches and to be suitable for bending.

2.1.3 Tube wall thickness shall be 0.049" for 1/2" OD and 1mm for 6 mm unless otherwise specified.

2.1.4 Maximum working pressure shall be 153.0 kg/cm² at 38°C for 1/2" OD Tube, unless otherwise specified and 80.0 kg/cm² at 38° for 6mm OD tube.

2.1.5 Tubes shall be supplied in minimum length of 6 metres without brazing in between.

2.1.6 Dimensional tolerances shall be as per ASTM A 269.

2.1.7 The following shall be marked on the tube:

- a) Name of manufacturer
- b) Type and material grade of tube
- c) Tube O.D. and wall thickness

2.2 Copper Tubes

2.2.1 Copper Tubes (PVC Jacket)

2.2.1.1 The tube shall be soft annealed copper with 6mm OD and a wall thickness of 1.0 mm as per ASTM B 68M Copper No.C12200.

2.2.1.2 The tube shall be jacketed with black PVC. The jacket thickness shall be 1.6mm. The PVC jacket shall confirm to ASTM D-1047.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT TUBING	DOCUMENT NO.	Page 7 of 6
		MEC/S/05/26/02	REVISION : 0
			EDITION : 1

2.2.1.3 The tube ends shall be plugged prior to transportation.

2.2.1.4 The tube shall be of continuous length without any brazing in between for 100 metres length.

2.2.1.5 Minimum length of single tube shall be 100 metres.

2.2.1.6 The dimensional tolerances shall be as per ASTM B 251M.

2.2.2 Bare Copper Tubes (For Steam Tracing)

2.2.2.1 The tube shall be soft annealed copper with 3/8" OD or 6mm OD with a wall thickness of 1.0 mm as per ASTM B68 copper No.C12200.

2.2.2.2 The tube ends shall be plugged prior to transportation.

2.2.2.3 The tube shall be of continuous length without any brazing in between for 100 metres length.

2.2.2.4 Minimum length of tube shall be 100 metres.

2.2.2.5 The dimensional tolerances shall be as per ASTM B 251.

3.0 TESTING

3.1 The following tests shall be done for SS tubes.

- Hardness test
- Hydrostatic test at 153.0 kg/cm² at 38° C for 1/2" tube and at 80.0 kg/cm² at 38° C for 6mm tube, unless otherwise specified.

3.2 PVC jacketed copper tubes shall be tested at 7.0kg/cm²g with dry air for leak check.

3.3 Bare copper tubes shall be hydrostatically tested at 80.0 kg/cm²g at 38°C.

3.4 Final test before delivery shall include ball test to ensure clear opening of the tube for copper tubes. The O.D of the ball shall be minimum 1mm for 6mm O.D tube and 2mm for 3/8" tube.

4.0 SHIPPING

4.1 The tubes shall be plugged at both ends to avoid entry of foreign matter. The tubes shall be packed carefully so as to avoid damage during transport.

5.0 REJECTION

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT TUBING	DOCUMENT NO. MEC/S/05/26/02	Page 8 of 6
			REVISION : 0
			EDITION : 1

Vendor shall make his offer in detail, with respect to every item of the purchaser's specifications. Any offer not conforming to this shall be summarily rejected.

SPECIFICATION FOR INSTRUMENT TUBE FITTINGS

SPECIFICATION NO.: MEC/S/05/26/04



**ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

0	15.10.2014			
Revision	Date	Ratnadeep Gupta Prepared By	Vikas Jain Checked By	Rakesh Kr. Shukla Approved By

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT TUBE FITTINGS	DOCUMENT NO. MEC/S/05/26/04	Page 1 of 5
			REVISION : 0
			EDITION : 1

AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT TUBE FITTINGS	DOCUMENT NO. MEC/S/05/26/04	Page 2 of 5
			REVISION : 0
			EDITION : 1

C O N T E N T S

1.0	GENERAL
2.0	CONSTRUCTION
3.0	TESTING
4.0	SHIPPING
5.0	REJECTION

PREPARED BY: (N.S.KANNAN)	CHECKED BY: (R.SANJAY BABU)	APPROVED BY: (PANKAJ SHIVASTAVA)	ISSUE DATE : 30.07.09

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT TUBE FITTINGS	DOCUMENT NO. MEC/S/05/26/04	Page 3 of 5
			REVISION : 0
			EDITION : 1

1.0 GENERAL

1.1 Scope

1.1.1 This standard specifications, together with the data sheets attached herewith, covers the requirements for the design, materials, testing and shipping of instrument tube fittings which includes the following types:-

- a) SS compression fittings (SS tube)
- b) Brass compression fittings (copper tube)

1.1.2 The related standards referred to herein and mentioned below shall be of the latest edition prior to the date of Purchase's enquiry:

- ANSI B 2.1 - Pipe Threads
- B16.11 - Forged steel fittings-socket welding and threaded.
- IS:319 - Specification for free cutting brass bars, rods and sections.
- ISA RP 42.1 - Nomenclature for instrument tubing - fittings.

1.1.3 In the event of any conflict between these specifications, data sheets, related standards, codes etc., the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture of the items in question.

1.2 Bids

1.2.1 Vendor's quotation shall include a detailed specification sheet for each type of tube fittings which shall provide the following information:

- a) All the details regarding the type, construction, materials, etc. of the items.
- b) Overall dimensions in mm.

1.2.2 All the units of measurement and material specifications for various parts in the vendor's specification sheets shall be to same standards as in purchaser's data sheets.

1.2.3 Vendor shall attach a list of items, typewise, summing up all the deviations from this specification and purchaser's data sheets if there are any. Also vendor shall provide reasons for these deviations.

1.2.4 Vendor shall enclose catalogues giving detailed technical specifications and other information for each type of fitting in the bid.

1.2.5 Vendor's quotation, catalogues, drawings, etc. shall be in English language.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT TUBE FITTINGS	DOCUMENT NO. MEC/S/05/26/04	Page 4 of 5
			REVISION : 0
			EDITION : 1

1.3 Drawings, Data and Certification

Detailed drawings, data, catalogues and manuals etc., required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducibles and points shall be despatched to the address mentioned, adhering to the time limits indicated.

2.0 CONSTRUCTION

2.1 SS Tube fittings:

2.1.1 Nomenclature of all tube fittings shall be as per ISA RP 42.1.

2.1.2 Fittings shall be flareless compression type and of three piece construction with ferrule, nut and body suitable for use on SS tubes conforming to ASTM A 269 TP316, hardness not exceeding RB80.

2.1.3 All parts shall be of SS 316.

2.1.4 Hardness of the ferrules shall be in the range of RB 85-90 so as to ensure a minimum hardness difference of 5 to 10 between tube and fittings, for better sealing.

2.1.5 Nuts and ferrules of particular size shall be interchangeable for each type.

2.1.6 Spanner hold shall be metric.

2.1.7 Threaded ends of fittings shall be NPT as per ANSI B 2.1.

2.1.8 Copper Tube Fittings

2.2.1 Nomenclature of all tube fittings shall be as per ISA 42.1.

2.2.2 Fittings shall be of flareless compression type and of three-piece construction consisting of ferrule, nut and body suitable for use on copper tubes conforming to ASTM B 68/B 68M hardness not exceeding RB 50.

2.2.3 All parts shall be manufactured from Brass as per IS 319 barstock and Nickel plated.

2.2.4 For better grip, vendor shall maintain hardness difference between tube & ferrule and indicate the same along with the offer.

2.2.5 Nuts & ferrules of particular size shall be interchangeable for each type.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT TUBE FITTINGS	DOCUMENT NO. MEC/S/05/26/04	Page 5 of 5
			REVISION : 0
			EDITION : 1

2.2.6 Threaded ends of fittings shall be NPT as per ANSI B 2.1.

2.2.7 Spanner hold shall be metric.

2.2.8 Vendor shall ensure that the ferrules and nuts supplied for fittings shall be suitable for sample tube which shall be supplied during manufacture.

3.0 TESTING

3.1 Random samples of SS tube fittings shall be hydrostatically tested as follows:-

For 6 mm fittings at 80.0 kg/cm², 1/2" fittings at 153.0 kg/cm² at 38°C unless otherwise specified.

3.2 Random samples of brass compression fittings shall be hydrostatically tested as follows:-

For 1/4" fittings, at 10 kg./cm², 3/8" at 80.0 Kg/cm² and all at 38°C.

4.0 SHIPPING

4.1 All thread/ends shall be protected with plastic caps to prevent damage/entry of foreign matter.

5.0 REJECTION

Vendor shall make his offer in detail, with respect to every item of the purchaser's specifications. Any offer not conforming to this shall be summarily rejected.

SPECIFICATION FOR INSTRUMENT VALVES AND MANIFOLDS

SPECIFICATION NO.: MEC/S/05/26/05



**ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

0	15.10.2014			
Revision	Date	Ratnadeep Gupta Prepared By	Vikas Jain Checked By	Rakesh Kr. Shukla Approved By

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT VALVES AND MANIFOLDS	DOCUMENT NO. MEC/S/05/26/05	Page 1 of 6
			REVISION : 0
			EDITION : 1

AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT VALVES AND MANIFOLDS	DOCUMENT NO. MEC/S/05/26/05	Page 2 of 6
			REVISION : 0
			EDITION : 1

C O N T E N T S

- 1.0 GENERAL
- 2.0 CONSTRUCTION
- 3.0 TESTING
- 4.0 SHIPPING
- 5.0 REJECTION

PREPARED BY: (N.S.KANNAN)	CHECKED BY: (R.SANJAY BABU)	APPROVED BY: (PANKAJ SRIVASTAVA)	ISSUE DATE : 30.07.09

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT VALVES AND MANIFOLDS	DOCUMENT NO.	Page 3 of 6
		MEC/S/05/26/05	REVISION : 0
			EDITION : 1

1.0 GENERAL

1.1 Scope

1.1.1 This standard specifications, together with the data sheets attached herewith, covers the requirements for the design, materials, testing and shipping of Instrument Valves & Manifolds which includes the following types:-

- a) Miniature instrument valves
- b) Instrument valve manifolds
- c) Instrument air valves

1.1.2 The related standards referred to herein and mentioned below shall be of the latest edition prior to the date of Purchaser's enquiry:

- ANSI B 2.1 - Pipe threads
- ANSI B 16.11 - Forged steel fittings-socket welding and threaded.

1.1.3 In the event of any conflict between these specifications, data sheets, related standards, codes etc, the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture of the items in question.

1.2 Bids

1.2.1 Vendor's quotation shall include a detailed specification sheet for each type of Valves & Manifolds which shall provide the following information:

- a) All the details regarding the type, construction, materials etc. of the items.
- b) Overall dimensions in mm.

1.2.2 All the units of measurement and material specifications for various parts in the vendor's specification sheets shall be to same standards as in purchaser's data sheets.

1.2.3 Vendor shall attach a list of items, typewise, summing up all the deviations from this specification and purchaser's data sheets if there are any. Also vendor shall provide reasons for these in the bid.

1.2.5 Vendor's quotation, catalogues, drawings etc. shall be in English language.

1.3 Drawings, Data and Certification

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT VALVES AND MANIFOLDS	DOCUMENT NO.	Page 4 of 6
		MEC/S/05/26/05	REVISION : 0
			EDITION : 1

Detailed drawings, data, catalogues and manual etc. required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducible and prints shall be despatched to the address mentioned, adhering to the time limits indicated.

2.0 CONSTRUCTION

2.1 Instrument Valves (Miniature)

- 2.1.1 The instrument valves shall be globe pattern-needle valves forged/ barstock with inside screwed bonnet.
- 2.1.2 Body and trim material shall be 316 SS unless otherwise specified.
- 2.1.3 The valve body rating shall be 3000 lbs unless specified in piping material specification which shall govern in case it is specified.
- 2.1.4 The end connection shall be 1/2" NPTF to ANSI B2.1.
- 2.1.5 The packing material shall be teflon unless otherwise specified.
- 2.1.6 The hand wheel material shall be carbon steel zinc plated.
- 2.1.7 Flow direction shall be marked on the body.
- 2.1.8 The valve dimension shall be as follows:
 - a) End to end dimensions 76 mm (approximately).
 - b) Height in fully open condition - 135mm maximum.

2.2 VALVE MANIFOLDS

2.2.1 3-Valve & 5-Valve manifolds:

2.2.1.13 Valve manifold shall be designed for direct coupling to differential pressure transmitters having 2 bolt flanges with 54 mm (2-1/8") centre to centre connections and 41.3 mm (1-5/8") bolt to bolt distance. The manifold shall contain two main block valves and an equalizing by-pass valve. The valves shall be needle valves. They shall use self aligning 316SS ball seats.

2.2.1.25 Valve manifold shall contain two main line block valves and a combination double block and bleed for the bypass line.

2.2.1.3 The manifold shall be suitably for mounting directly on the stanchion (2" pipe).

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT VALVES AND MANIFOLDS	DOCUMENT NO. MEC/S/05/26/05	Page 5 of 6
			REVISION : 0
			EDITION : 1

2.2.1.4 All bonnets shall have teflon packing unless otherwise specified.

2.2.1.5 The material of construction shall be 316 SS unless otherwise specified.

2.2.1.5 The material of construction shall be 316SS unless otherwise specified.

2.2.1.6 The flanges shall be integral part of the block.

2.2.1.7 The process connection shall be 1/2" NPTF to ANSI B2.1.

2.2.1.8 The manifolds shall be supplied alongwith mounting accessories. The bolts and nuts shall be alloy steel as per ASTM A 193 Gr B ASTM A 194 GR 2H respectively. Rings shall be teflon and other accessories shall be cadmium plated.

2.2.1.9 Vendor shall furnish the material certificate for body.

2.2.2 3 Way 2 Valve Manifold for pressure gauges.

2.2.2.1 The manifold shall be designed for use with pressure gauges.

2.2.2.2 The valve shall be a ball valve.

2.2.2.3 The body shall be either straight or angle as specified in data sheets.

2.2.2.4 The body and trim material shall be 316SS, packing material shall be teflon unless otherwise specified.

2.2.2.5 The inlet connection shall be 3/4" plain end (female) for socket weld as per ANSI B 16.11.

2.2.2.6 The gauge connections shall be with union nut & tail piece threaded 1/2" NPT (F).

2.2.2.7 The drain connection shall 1/2"NPTF.

2.3 Instrument Air Isolation Valves

2.3.1 The valves shall be full bore ball valves.

2.3.2 Body material shall be Nickel or Cadmium plated carbon steel.

2.3.3 Trim material shall be 316SS.

2.3.4 The end connection shall be 1/2" NPTF to ANSI B2.1 unless otherwise specified.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
TITLE	SPECIFICATION FOR INSTRUMENT VALVES AND MANIFOLDS	DOCUMENT NO. MEC/S/05/26/05	Page 6 of 6
			REVISION : 0
			EDITION : 1

2.3.5 The packing material shall be teflon.

2.3.6 The handle/wrench material shall be cadmium or nickel plated carbon steel.

2.3.7 The valve body rating shall be ANSI 800 lb.

2.3.8 End to end dimensions shall be 70mm (approximately).

3.0 TESTING

3.1 The instrument valves (miniature) shall be hydrostatically tested at 200kg/cm² g at 38°C.

3.2 All manifolds (3 valves, 5 valves and 3 ways, 2 valves) shall be hydrostatically tested at 200 kg/cm² at 38C.

3.3 The instrument air valves shall be hydrostatically tested at 15.0 kg/cm²g at 38°C and at 10.5 kg/cm²g with dry air.

4.0 SHIPPING

4.1 All threads/ends shall be protected with plastic caps to prevent damage/entry of foreign matter.

5.0 REJECTION

Vendor shall make his offer in detail, with respect to every item of the purchaser's specifications. Any offer not conforming to this shall be summarily rejected.

PART-II
Instrumentation Data Sheets

LIST OF DATASHEETS

Sl No.	DESCRIPTION	SPEC. No.
1	Datasheet of Pressure Gauges	MEC/ 05/E5/DS-PG
2	Datasheet of Temperature Gauges	MEC/ 05/E5/DS-TG
3	Datasheet of Resistance Temperature Detector	MEC/ 05/E5/DS-RTD

PRESSURE GAUGES							
Units:- Flow : Liquid-T/hr Gas-MMSCMD Steam- kg/hr Pressure- Kg/cm ² (G) Temperature- °C Level/Length-mm							
1	Type	Direct		Wetted parts material	---		
2	Mounting	Local		Element	---		
3	Dial size	150 mm		Lower body	---		
	Colour	White (Non rusting plastic with black engraving)		Non wetted parts	---		
4	Case material	SS 304		Process connection	---		
5	Bezel ring	Screwed		Size	---		
6	Window material	Shatter proof glass		Rating	---		
7	Enclosure	IP 55 / NEMA 4		Facing & Finish	---		
8	Pressure element	Bourdon tube		Capillary material	---		
9	Element material	SS 316		Capillary length	---		
10	Socket material	SS 316		Flushing & Filling	---		
11	Accuracy	± 1% FSD	16	Over range protection	130% of range		
12	Zero adjustment	Micrometer pointer (Internal)	17	Blow out protection	Required		
			18	Options			
13	Connections	½" NPT (M)		a)	Snubber		
	Conn. Location	Bottom		b)	Syphon		
14	Movement	SS 304		c)	Gauge saver		
15	Diaphragm seal	---		d)	Liquid filled casing		
	Type	---		e)	2 valve, 3-Way Manifold		
				f)	Dampener		
			19	Make & Model	*		
Tag No.	Range	Pressure		Design Temp.	Fluid	Location	Options
		Operating	Design				
PG_**	*	**	**	**	NATURAL GAS	**	e
PG_**	0 - 1	**	**	**	NATURAL GAS	**	c, e
NOTES: 1) '**' Information to be supplied by the Vendor / Contractor. 2) '***' As per P& ID 3) Make of the PG shall be from approved vendor list of Mecon /Client. 4) Quantities shall be as per SOR.							
0	DATASHEET OF PRESSURE GAUGES					 MECON LTD. DELHI	
Rev.						DS No: MEC/ 05/E5/DS-PG	

TEMPERATURE GAUGE									
Units:- Flow : Liquid-T/hr Gas -MMSCMD Steam - kg/hr Pressure - Kg/cm ² (G) Temperature - °C Level/Length -mm									
GENERAL						FILLED SYSTEM			
1	Type	FILLED SYSTEM				15	SAMA Class		V B
2	Well	REQUIRED					Compensation		CASE
3	Mounting	LOCAL				16	Bulb type		ADJUSTABLE UNION
4	Dial size	150 mm					Bulb material		316SS
5	Colour	WHITE (Non rusting plastic with black figs.)				17	Bulb union threaded to		½” NPT(M)
6	Case material	DIE CAST ALUMINIUM (EPOXY PAINTED)				18	Extension type		RIGID
7	Window material	SHATTER PROOF GLASS				19	Bulb dia		8 mm (Min)
8	Conn. Location	BOTTOM				20	Capillary material		
9	Accuracy	±1% FSD					Armour Flexible		
10	Enclosure	WEATHER PROOF TO IS2147					Armour material		
	Enclosure class	IP 55 / NEMA 4					Capillary length		
11	Zero adj. Screw	MICROMETER POINTER (Internal)				21	Overrange protection		130% OF RANGE
BIMETAL						THERMOWELL			
12	Stem:					22	Material		SS 316
	Type					23	Construction		DRILLED BAR STOCK
	Material					24	Process connection		1 ½” FLANGED
	Size					25	Gauge connection		½” NPT (F)
13	Stem diameter					26	Thermowell as per drg		Drg enclosed
14						27	Options a)		LIQUID FILLED
						28	Make & Model		*
Tag No.	Range	Temperature (°C)		Well Dimensions		Flange		Location	Remarks
		Operating	Design	U	T	Material	Rating/Face/Finish		
TG – ***	*	***	***	*	*	ASTM A 105	600 # / 300# / 150 # RF 125 AARH	***	
Note: 1. ‘*’ Information to be supplied by the Vendor / Contractor. 2. Vender shall furnish Make & Model No. with product catalogues along with the offer. 3. Make of the TG shall be from approved vendor list of Mecon /Client. 4. For installation of Temperature Gauge & Thermowell, vendor shall follow the MECON’s installation standards enclosed with tender. 5. ‘***’ shall be as per P & ID									
0	DATASHEET OF TEMPERATURE GAUGES							 MECON LTD. DELHI	
Rev.								DS No: MEC/ 05/E5/DS-TG	

RESISTANCE TEMPERATURE DETECTOR									
Units:- Flow : Liquid-T/hr Gas -MMSCMD Steam - kg/hr Pressure - Kg/cm ² (G) Temperature - °C Level/Length -mm									
GENERAL						THERMOWELL		TRANSMITTER	
1	Assembly as per drg.	Drg. enclosed	13	Cable entry	½" NPT (F)				
			14	No. of entries	Single				
			15	Enclosure type	Dual Chamber Weather proof to IP55				
ELEMENT			THERMOWELL						
3	No. of elements	Simplex	16	Material	SS 316				
4	Calibration	As per DIN 43760	17	Construction	Drilled bar stock				
5	Element material	Platinum (Pt 100)	18	Process connection	1 ½" Flanged				
6	Resistance at 0°C	100 ohms	19	Inst. connection	½" NPT (F)				
7	Leads	Standard	20	Thermowell as per drg	Drg. Enclosed				
8	Sheath								
	O.D.	8 mm							
	Material	SS 316	21	Quantity	-----				
9	Nipple & Union Material	SS 316	22	Input	-----				
10	No. Of wires	4 Wire	23	Output	-----				
HEAD			24	Power Supply	-----				
11	Head Cover type	Screwed cap & SS chain	25	Mounting	-----				
12	Material	Cast Aluminium	26	Enclosure class	-----				
			27	Make & Model No.	*				
Tag No.	Range	Temperature		Well Dimensions		Flange		Service	Option
		Nor.	Design	U	T	Material	Rating/Face/ Finish		
TE - ***	*	***	***	*	*	ASTM A 105	600# RF 125 AARH	Natural Gas	
NOTES 1) ‘**’ Information to be supplied by the Vendor / Contractor. 2) Make of the RTD shall be from approved vendor list of Mecon /Client. 3) RTD offered shall be of highest accuracy – TYPE – A. 4) ‘***’ shall be as per P & ID									
0	DATASHEET OF RESISTANCE TEMPERATURE DETECTOR							 MECON LTD. DELHI	
Rev.								DS No: MEC/05/E5/DS-RTD	

PART-III
Structural Works

01.00 STRUCTURAL STEEL WORKS

01.01 Steel Works

All finished steel unless otherwise specified shall be well and clearly rolled to dimensions and weight as specified by ISI subject to permissible tolerances as per IS 1852-2017.

Material shall be free from cracks, surface flaws, laminations, rough and imperfect edges and other harmful defects like excessive rust, scaling and pitting etc. Structural steel work shall conform to requirements depending upon the designation of steel that is being selected to be used for particular structural function as specified in drawings.

All structural steel channels, plates and rolled sections, etc. shall conform to IS:2062. Steel tubes shall conform to IS:1161-2014 (Grade Yst 310 MPa).

01.02 Electrodes required for metal arc welding shall be covered electrodes conforming to IS:814 – 2016.

01.03 Fabrication: Steel sections as required shall be straightened and cut to square and exact lengths. Cut ends exposed to view shall be finished smooth. No two pieces shall be otherwise welded or jointed to make up the required length of the number.

If straightening, flattening or bending is necessary, shall be done in a process that will not damage the material or impair its strength. Shearing, flame cutting or chipping shall be done carefully and accurately. Finished member shall be free from undue twists, bends, wrapping, distortion or other irregularities. Holes, where required, shall be drilled to required size and not made nor enlarged by burning. Holes shall have their axis perpendicular to surface bored through. Any fabricated assembly shall be without the member being strained or forced into position and components shall meet at perfect angles. Where practicable, welds should preferably be made in flat position. Welds shall be free from cracks, discontinuity in welding, or other defects categorized as such in relevant standards. Welds will be inspected and cost of the same shall be deemed to be included in the quoted rates. A defective weld, harmful to structural strength, shall be cut out and rewelded. All welds shall be cleaned of slag and other deposits after completion.

All structural steel works for canopy and other structures shall have butt welds between adjacent surfaces ground smooth. Items concealed from view need not require grinding of welds. Architectural metal work shall be well formed to shape and size with sharp lines, angles and true curves. Drilling and punches shall produce clean true line and surface.

**TENDER FOR
CONSTRUCTION OF CANOPY FOR
CNG STATION
Bid No.:**



MECON LIMITED

All site connections shall be preferably by permanent bolts. Welding at site shall be done with the prior permission of engineer-in-charge. Exposed weld shall be ground smooth, exposed surfaces shall have smooth finish. Joints shall be milled to close fit and corner joints shall be well formed and in true alignment. Work shall be accurately fastened in place.

Painting shall be as described under the head "Painting".

01.04 Roof Covering / Sheetting: Canopy roof sheeting shall be of 0.6mm Zinalume/ galvalume colour coated sheets and shall have trapezoidal profile with 28-32 mm deep crest and 186-250 c/c profile width with minimum two ribs at centre for stiffening. The sheet shall be of minimum fy = 345 MPa and shall be coated with hot dip metallic Zinc aluminum alloy @ 150 gsm coating mass total on both sides.

01.05 False Ceiling: False ceiling panels on the under-side of the canopy shall be of 0.6mm thk. cold rolled colour coated steel of profile as per drawings of approved colour and make. False ceiling panels shall be fixed with stainless steel screws in such a way that they are not visible from below after completion of work.

01.06 Painting on Metal Work: Painting shall be as done to meet the following specification for canopy:

A. ON COILS

SUBSTRATE :

- i) Cold Rolled Steel Coil
- ii) Galvanised Coil IS 227

COATING	NORMAL	MAXIMUM
Zinc Aluminium	150 gms/ sqm	8 microns
Epoxy Primer	5-7 microns	10 microns
Alkyd Backer	5-7 micron	10 micron
Polyster top-Coat	12-16 micron	15-22 micron
Normal Total Coatings	22-30 micron	40 micron

TYPICAL PROPERTIES

	PROPERTY	APPLICABLE SPECIFICATION	DATA
1	Normal organic coating thickness	IS:15965-2012	23 micron
2	Specular gloss (60 Deg.)	IS:15965-2012	10-40%
3	Pencil Hardness	IS:15965-2012	2H
4	Scratch Resistance	IS:15965-2012	1.5 Kg Min
5	Flexibility :		
5.1	Reverse Impact	IS:15965-2012	10 J or 1020 Kg min
5.2	Bend Test	IS:15965-2012	5T Max

B. ON ALL OTHER STEEL MEMBERS

- i) Surface preparation as per grade St-2 according to Swedish Standard SIS055900.
- ii) Two coats of zinc phosphate in phenolic alkyd medium (DFT 35μ/coat), one each at shop & site.
- iii) Two coats of synthetic enamel (DFT 25 μ/coat) at site conforming to IS: 2932-2018.
(Total DFT 120 microns)

01.07

Surface Preparation & Primer

One coat of primer shall be applied on shop. The shop coated surface shall be rubbed down thoroughly with abrasive paper to remove dust, rust, other foreign matters and degreased cleaned with warm fresh water and air dried.

Primer coat of zinc phosphate primer shall be applied by brushing / spraying over the shop coat in a manner so as to ensure a continuous and uniform film throughout.

01.08

Final Paint

After the primer is hard dry the surface shall be dusted off and one coat of synthetic enamel paint of approved color and shade (conforming to IS:2932) shall be applied by brushing/spraying to achieve the required DFT. Second coat will be applied after drying of previous one to give a uniform surface. Paints can be diluted by means of thinner as approved by paint manufacturer only.

**TENDER FOR
CONSTRUCTION OF CANOPY FOR
CNG STATION
Bid No.:**



MECON LIMITED

LIST OF APPROVED MAKES FOR STRUCTURAL WORK

Sl. No.	Items	Makes / Brands / Manufacturers
1	Structural Steel	SAIL / RINL / IISCO / TATA / ESSAR (AMNS) / JSPL / JSW / ISPAT
2	Sheeting	Tata Blue Scope, JSW Steel Ltd., Interarch, Lloyd Insulation, Multicolor
3	Electrodes	GEE, ADOR (Advani Orlikon), D&H India, D & H (Secheron), ESAB. Maruti MW Wiretec
4	Paint	Akzo-Nobel, Asian Paint, Kansai Nerolac Paint, Berger Paints
5	False Ceiling	Interarch, Lloyd Insulation, Tiger Steel, Metalex Engineering & Construction
6	Structural Steel Tubes ISI Marked	TATA / JINDAL / SURYA / SWASTIK

2.0 Preamble to Schedule of Rates For Canopy Works

Complete structural work for canopy is included in the scope. Brief description of major items shall be as follows:

- a. The tentative weight of structural steel shall be 85 kg/m² (only weight of Steel structures elements excluding sheeting and false ceiling) of canopy plan area. A variation of +/- 15% of structural steel weight shall be deemed included in the item. Any increase/decrease beyond this limit shall attract payment/deduction @ Rs.80000/- per Tonne weight of structural steel.
- b. Providing, cutting, fabrication and erection of canopy structure fabricated with in structural steel, fixed on RCC footing with base plates, permanent bolts with plane and spring washers.
- c. Providing, cutting, fabrication and installation of cold rolled 'Z' purlins in place.
- d. Providing, cutting, fabrication and installation of canopy roof covering with 0.6 mm thick (TCT) Zinalume / galvalume colour coated (fy =345 mpa)

**TENDER FOR
CONSTRUCTION OF CANOPY FOR
CNG STATION
Bid No.:**



MECON LIMITED

sheets having profile depth 28-32mm and pitch 186-250mm with zincalume coating 150gsm and 35 microns super polyester colorbond XRW quality (BHP make or equivalent) fixed with steel hex head self-drilling fasteners with integral washers and EPDM seals.

- e. Providing, cutting, fabrication and installation of canopy false ceiling with TRAC 150 F of (Interarch or equivalent as per Approved make) coil coated (Pre-painted) steel false ceiling system comprising of 150 mm wide x 17 mm deep roll formed out of 0.50 mm thick polyester coated galvanized steel panels, fixed on steel runner of 34.5 mm width x 48 mm deep manufactured out of 0.60 mm thick precoated galvanized steel with rigid suspension of 20x20x0.5 mm fixed with steel brackets/clips etc. The suspension system should be meant of exterior use. The carrier shall be suspended at 1mtr c/c supported from purlin and suspension angle at 500 mm c/c. panel shall be factory cut to provide minimum joints. The longitudinal joints shall have additional special G.I. Splice in between two panels. The carrier joint shall have a carrier splice maintaining a module of 150 mm. The ceiling shall be clipped on to the suspended carriers after they are aligned and leveled. Cutting for fixing of light fittings shall be done as per the cutout required to fit the fixture. The work shall be carried out under a specialized and experienced supervisor.
- f. Providing, cutting, fabrication and installation of gutters in 2.0 mm thick MS Sheet with stiffeners, laid to slope.
- g. Providing, cutting, fabrication and installation of flashing, fascia etc in 0.6 mm thick of the same material as of roof sheeting laid to slope.
- h. Providing and laying of 125 NB (4.8mm Thk.) MS Pipe conforming to IS:1161-2014 as rainwater pipe with bends etc. from gutter to nearest manhole including cowl
- i. Providing and laying 80 NB GI Pipe for electrical cable.
- j. Providing cutout in the false ceiling for the under lights as required. The under lights and wiring for the canopy, signage shall be payable as per electrical SOR and Technical specifications.
- k. Painting all structural members as per clause 01.06.b (above).

Note : 1. The **net plan area** of completed canopy shall be measured for payment purpose if canopy is rectangular in plan. Gross rectangular area shall be measured in case canopy is curved in plan (on sq. m. rate basis) for canopy structure only - including false ceiling, roofing, finishes etc. but excluding electrical and signage works.

2. The foundation work for canopy shall be covered under separate SOR item.

Canopy shall be erected as per approved fabrication drawings submitted by the successful tenderer & approved by MECON. Offer to be prepared by the tenderer based on the enclosed architectural drawings and on lump sum unit rate (per Sq.m) of canopy area constructed in plan.

TECHNICAL SPECIFICATION FOR FABRICATION,
ERECTION AND PAINTING OF STEEL STRUCTURES,
GATES AND MISCELLANEOUS WORK

SPECIFICATION NO.: MEC/S/05/12/01 (Rev-0)

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 1 of 29

CONTENTS

1.	General	Page - 2
2.	Section – 1 Fabrication of steel structures	Page – 3
3.	Section – 2 Erection of steel structures	Page - 11
4.	Section - 3 Fabrication and erection of miscellaneous structures	Page - 16
5.	Section – 4 Painting of Steel Structures	Page - 19

LIST OF ANNEXURES

Annexure - A Permissible Deviation in pitch and gauge of holes or bolts of normal accuracy

Annexure – B Tolerance of assembled components of steel structures

Annexure – C Tolerance in erected steel structures

Annexure – D Material of Construction

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 2 of 29

**TECHNICAL SPECIFICATION FOR FABRICATION, ERECTION AND PAINTING OF
STEEL STRUCTURES AND CHAIN LINK FENCING**

1.0 GENERAL

- 1.1 This specification shall apply to general steelwork, for CNG & CGD distribution works. The structures shall include canopies, loading unloading platforms, hoarding, crossovers, ladders, Fencing and Fencing Gates, staircases, pipe supports, skid supports, sheds, stockades/trestles, Boundary wall MS Gate etc.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 3 of 29

SECTION-1: FABRICATION OF STEEL STRUCTURES

2.0 SCOPE OF WORK

2.1 The scope of work under fabrication includes, but not limited to, the following:

- a) Preparation and supply of material indents, bolt lists, bought out items list, etc.
- b) Procurement and collection of all material from stockyards/stores, including loading, transportation, unloading and stacking and storing on skids or supports.
- c) Procurement and collection of all consumables like bolts, nuts, washers, electrodes, paints, shims, packs, etc., including allowance for spares and wastage.
- d) Preparation and submission of modification/rectification sketches, As-Built drawings, erection drawings, bill of materials, and shipping documents for approval of CLIENT.
- e) Cold straightening of section and plates, whenever they are bent and kinked.
- f) Fabrication of all steel structural components covered under tender drawings, design drawings and generally described under the scope of the project.
- g) Making arrangements for and conducting tests such as chemical analysis, physical and mechanical tests on raw materials where specified/as directed by CLIENT.
- h) Control Assembly of steel structural components at shop, wherever required.
- i) Preparation of steel structural surfaces for painting as provided in the specifications/drawings.
- j) Application for one primer coat of painting at shop, as specified in the design drawing/specifications.
- k) Loading, transportation from fabrication workshop to site of erection and unloading of all steel structural components/units/assemblies.
- l) Preparation of 'As-built' drawings.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 4 of 29	

3.0 MATERIALS

3.1 Structural Steel

3.1.1 Structural steel and other related materials for construction shall conform to Annexure-D.

3.1.2 Due to non-availability of specified materials, suitable substitutions may be provided with the consent of CLIENT. Such substitution shall be incorporated in the "As-built" drawings.

3.1.3 All the items are to be cut as per requirements of the drawing. If joints are to be provided in any item in order to meet requirements of size and shape, cutting plan showing locations of joints shall be prepared for consideration of purchaser. Joints provided shall be incorporated in "As-built" drawings.

3.1.4 Rolling and cutting tolerances shall be as per IS:1852-2017.

3.1.5 Only tested materials shall be used unless use of untested materials for certain secondary structural members is permitted by CLIENT. If test certificate for the material is not available from the main producer, the following tests shall be carried out at the discretion of CLIENT:

- a) Chemical Composition
- b) Mechanical Properties
- c) Weldability test

3.2 Bolts and Nuts

3.2.1 Black hexagonal bolts, nuts and lock nuts shall conform to IS:1363-2002.

3.3 Electrodes

3.3.1 Electrodes shall conform to IS:814-2019.

4.0 STORING OF MATERIALS

4.1 Materials shall be stored and stacked properly ensuring that place is properly drained and is free from dirt. It shall be ensured that no damage is caused due to improper stacking.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 5 of 29	

5.0 MATERIAL PREPARATION

- 5.1 Cut edges shall be finished smooth by grinding or machining wherever necessary. Sufficient allowance (3mm to 5mm) should be kept in the items incase machining is necessary.
- 5.2 Cutting may be affected by gas cutting, shearing, cropping or sawing.
- 5.3 Straightening and bending shall be done in cold condition as far as practicable.
- 5.4 If required, straightening and bending may be done by application of heat between 900°C and 1100°C. Cooling down of the heated item shall be done slowly.

6.0 DRILLING AND PUNCHING OF HOLES

- 6.1 Drilling and punching of holes for bolts shall be in accordance with IS:800-2007, unless otherwise specified by CLIENT.
- 6.2 Drifting of holes for bolts during assembly shall not cause enlargement of holes beyond permissible limit or damage the metal.
- 6.3 Holes for bolted connection should match well to permit easy entry of bolts. Gross mismatch of holes shall be avoided.
- 6.4 Permissible deviation in holes for mild steel bolts of normal accuracy and high strength bolts are given in the Annexure-A.

7.0 ASSEMBLY FOR FABRICATION

- 7.1 Fabrication of all structural steelwork shall be in accordance with IS:800-2007 and in conformity with various clauses of this Specification, unless otherwise specified in the drawings.
- 7.2 Fabrication of structures shall preferably be taken up as per the sequence of erection.
- 7.3 All erection units shall bear reference drawing no. at a prominent location on the structures for easy identification at site.
- 7.4 Fabricated structures shall conform to tolerance as specified in this Specification and in IS:7215-2016. In case of contradiction, tolerance specified in this Specification shall prevail.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 6 of 29

- 7.5 All the components of structures shall be free from twist, bend, damage, etc.
- 7.6 Splice joints shall generally be of full strength butt weld and wherever possible, shall be located at zones of minimum or substantially lesser stress.
- 7.7 Splice joints of flange and web should preferably be staggered.
- 7.8 Where necessary, washers shall be tapered or otherwise suitably shaped to give the heads of nuts and bolts satisfactory bearing.
- 7.9 The threaded portion of each bolt shall project through the nut at least by one thread.
- 7.10 Tolerance of assembled components of structures are given in Annexure-B.
- 7.11 Permissible deviations from designed (true) geometrical form of the despatch elements shall be in accordance with IS:7215-2016.
- 8.0 **WELDING**
- 8.1 The Contractor shall work out welding procedure for CLIENT's approval, considering the following factors:
- Specification and thickness of steel.
 - Specification of electrode or/and base wire.
 - Welding process (manual arc welding, submerged arc welding).
 - Type of structures to be welded (thickness of components meeting at a joint).
 - Sequence of welding.
 - Weather condition.
 - Inspection procedure to be followed
 - Design requirements of the joints.
- 8.2 All metal arc welding shall be carried out as per IS:9595-1996.
- 8.3 Electrode shall conform to Clause no. 3.3 of this Specification.
- 8.4 Electrodes shall be stored in a dry place. Electrodes whose coatings are damaged due to absorption of moisture or due any other reason shall not be used.
- 8.5 Recommendations of electrode manufacturer are to be strictly followed.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 7 of 29

- 8.6 Welding surface shall be smooth, uniform, free from fins, tears notches or any other defect which may adversely affect welding.
- 8.7 For multi-run weld deposit, the next run should be done only after thorough removal of slag and proper cleaning of surface.
- 8.8 Fillet weld shall have the correct profile with smooth transition into parent metal. Dressing of welds, if specified, shall be done by such method which does not cause grooving and other surface defects on the weld or on the parent metal.
- 8.9 Fillet welds shall not be stopped at corners but shall be returned round them.
- 8.10 Welding shall not be done under such weather conditions which might adversely affect the efficiency of the welding.
- 8.11 Ends of structural members and portions of gussets receiving welding at site shall be left unpainted.
- 8.12 Permissible deviation in assembly of weld joints shall be in accordance with Annexure-C.
- 9.0 INSPECTION & TESTING
- 9.1 CLIENT/Inspector shall have free access at all times to those parts of Contractor's or his Sub-contractor's works which are concerned with the fabrication of steel works and shall be afforded all reasonable facilities at all stages of preparation, fabrication and trial assemblies for satisfying himself that the fabrication is being undertaken in accordance with the provisions of relevant specification.
- 9.2 All gauges and templates, tools, apparatus, labour and assistance for checking shall be supplied by the contractor free of charge. CLIENT/Inspector may, at his discretion, check the test results obtained at the Contractor's works, by independent test at the Government Test House or elsewhere, and should the material so tested be found to be unsatisfactory, the cost of such test shall be borne by the Contractor.
- 9.3 Contractor shall make all necessary arrangements for stage inspection by CLIENT/Inspector during the fabrication at shop and incorporate all on-the-spot instructions/ changes conveyed in writing to the Contractor.
- 9.4 Material improperly detailed or wrongly fabricated shall be reported to CLIENT/Inspector and shall be made good as directed. Minor misfits which can be remedied by moderate use of drift pins, and moderate amount of reaming and slight chipping may be corrected in that manner, if

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 8 of 29

in the opinion CLIENT/Inspector, the strength or appearance of the structure will not be adversely affected. In the event CLIENT/Inspector directs otherwise, the items will be rejected and a completely new piece shall be fabricated. The cost of correcting errors shall be to the account of the Contractor.

9.5

- i) CLIENT/Inspector shall have the power:
 - a) To certify, before any structure is submitted for inspection, that the same is not in accordance with the contract, owing to the adoption of any unsatisfactory method of fabrication.
 - b) To reject any structure as not being in accordance with Specification and drawings.
 - c) To insist that no structure or parts of the structure once rejected is resubmitted for inspection/test, except in cases where CLIENT/ Inspector considers the defects as rectifiable.
- ii) If, on rejection of structure by CLIENT/Inspector, the Contractor fails to make satisfactory progress within the stipulated period, CLIENT/Inspector shall be at liberty to cancel the contract and fabricate or authorize the fabrication of the structures at any other place he chooses, at the risk and cost of the Contractor, without prejudice to any action being taken in addition to terms of General Conditions of Contract.
- iii) CLIENT/Inspector's decision regarding rejection shall be final and binding on the Contractor.
- iv) The Specifications prescribe various tests at specified intervals for ascertaining the quality of the work done. If the tests prove unsatisfactory, CLIENT/Inspector shall have liberty to order the Contractor to re-do the work, done in that period and/or to order such alterations and strengthening that may be necessary at the cost of the Contractor and the contractor shall be bound to carry out such orders failing which the rectification/redoing will be done by CLIENT through other agencies and the cost recovered from the Contractor.
- v) Notwithstanding any inspection at the workshop, CLIENT/Inspector shall have the liberty to reject, without being liable for compensation any fabricated members or materials brought to site that do not conform to specifications/drawings.
- vi) All rejected materials shall be removed from the site of fabrication by the Contractor at his own cost and within the time stipulated by CLIENT/Inspector.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 9 of 29

10.0 CONTROL IN WELDING

10.1 The extent of quality control in respect of welds for structural elements shall be as follows and shall be conducted by the contractor at his own cost:

- a) Visual Examination - All welds shall be 100% visually inspected to check the following:
 - i) Presence of undercuts
 - ii) Visually identifiable surface cracks in both welds and base metals
 - iii) Unfilled craters
 - iv) Improper weld profile and size
 - v) Excessive reinforcement in weld
 - vi) Surface porosity

Before inspection, the surface of weld metal shall be cleaned of all slag, spatter matter, scales etc. by using wire brush or chisel.

- b) Dye Penetration Test (DPT) - This shall be carried out for all important fillet welds and groove welds to check the following :
 - i) Surface cracks
 - ii) Surface porosity

Dye Penetration Test shall be carried out in accordance with American National Standard ASTM E165.

11.0 ACCEPTABLE LIMITS OF DEFECTS IN WELD

11.1 The limits of acceptability of defects detected during visual inspection and Dye Penetration Test shall be in accordance with clause 8.15.1 American National Standard ANSI/AWS D1.1-96.

12.0 RECTIFICATION OF DEFECTS IN WELDS

- 12.1 In case of detection of defects in welds , the rectification of the same shall be done as follows :
- i) All craters in the weld and breaks in the weld run shall be thoroughly filled with weld.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 10 of 29	

- ii) Undercuts, beyond acceptable limits, shall be repaired with dressing so as to provide smooth transition of weld to parent metal.
- iii) Welds with cracks and also welds with incomplete penetration, porosity, slag inclusion etc. exceeding permissible limits shall be rectified by removing the length of weld at the location of such defects plus 10 mm from both ends of defective weld, and shall be re-welded. Defective weld shall be removed by chipping hammer, gouging torch or grinding wheel. Care shall be taken not to damage the adjacent material.

13.0 DESPATCH INSTRUCTIONS

Each despatchable structure shall bear mark no. along with reference drawing number at two prominent locations.

- 13.1 "As-built" drawings shall be prepared after fabrication is completed to indicate additions/alterations made during the process of fabrication. (Refer clause 3.1.2 & 3.1.3.)
- 13.2 Center lines of column flanges and both sides of web shall be punched, preferably at top and bottom to facilitate alignment after erection.

14.0 COMPLETION DOCUMENTS

- 14.1 On completion of work, the Contractor shall submit to CLIENT the following documents:
 - a) The technical documents according to which the work was carried out.
 - b) Copies of the "As built" drawings showing thereon all additions and alterations made during fabrication.
 - c) Manufacturer's test certificates
 - d) Certificates/documents on control checking
 - e) Test of welds
- 14.2 Inspection Certificates shall be issued to the contractor for the structures found acceptable in all respects by CLIENT/Inspector.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 11 of 29

SECTION-2: ERECTION OF STEEL STRUCTURES

15.0 SCOPE OF WORK

In addition to provision of erection and transport equipment, the scope of work includes supply of tools and tackles, consumables, materials, labour and supervision and shall cover the following:

- a) Storing and stacking of all fabricated structural components/units/ assemblies at site storage yards till the time of erection.
- b) Transportation of structures from storage yard to site of erection, including multiple handling, if required.
- c) All minor rectification/modifications such as:
 - i) Removal of bends, kinks, twists etc. for parts damaged during transportation and handling.
 - ii) Reaming of holes which do not register or which are damaged, for use of next higher size bolt.
 - iii) Plug welding and re-drilling of holes which do not register and which cannot be reamed for use of next higher size bolt.
 - iv) Drilling of holes which are either not drilled at all or are drilled in incorrect position during fabrication.
- d) Fabrication of minor missing items as directed by CLIENT.
- e) Verification of the position of embedded anchor bolts and inserts w.r.t. line find levels, installed by others based on Geodetic Scheme/Bench mark/ Reference co -ordinates taken by the Contractor.
- f) Rectifying at site damaged portions of shop primer by cleaning and application touch-up paint.
- g) Erection of structures including making connections by bolts/welding as per drawing.
- h) Alignment of all structures true to line levels plumb and dimensions within specified limits of tolerance.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 12 of 29

- i) Application at site after erection, required number of coats of primer and finishing paint as per specification and drawing.
- j) Rectification of structures as per instructions of the Engineer-Incharge.

16.0 STORING AND HANDLING

- 16.1 Storage of structures shall be preferably be done in such a manner that erection sequence is not affected.
- 16.2 While storing, care shall be taken so that structures do not come in direct contact with the earth surface and accumulated water.
- 16.3 Stacking of the structures shall be done in such a way that, erection marks are visible easily and handling does not become difficult. Wherever required, wooden sleepers/grillage may be used.
- 16.4 Handling and storage of materials shall be as per IS:7969-2017, to ensure safety.

17.0 ERECTION

17.1 General

- 17.1.1 Erection shall be carried out in accordance with IS:800-2007 and other relevant standards referred to therein.
- 17.1.2 For safe and accurate erection of structural steelwork, staging, temporary support, false work, etc. shall be erected as required.
- 17.1.3 The fabricated materials received at erection site shall be verified with respect of marking on the key plan/marketing plan or shipping list.
- 17.1.4 Any material found damaged or defective shall be stacked separately and the damaged or defective portions shall be painted in distinct colour for identification and the same shall be brought to the notice of CLIENT.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 13 of 29	

17.2 Erection Drawings

17.2.1 The approved erection drawings and any approved arrangement drg, specification or instruction accompanying them shall be followed in erecting structures.

17.3 Erection of Structures

17.3.1 Erection work shall be taken up after receipt of clearance from CLIENT.

17.3.2 For safety requirements during erection, provisions in IS:7205-2016, IS:7969-2017 and other relevant Indian standards shall be followed.

17.3.3 Erection shall be carried out with the help of maximum mechanization possible.

17.3.4 Prior to commencement of erection, all the erection equipment, tools, tackles, ropes, etc. shall be tested for their load carrying capacity. Such tests may be repeated at intermediate stages also if considered necessary and frequent visual inspection shall be done of all vulnerable areas and components to detect damages or distress in the erection equipment, if any.

17.3.5 Following shall be taken care of during erection, whenever necessary:

17.3.5.1 Erected members shall be held securely in place by bolts to take care of dead load, wind load and erection load.

17.3.5.2 All connections shall achieve free expansion and contraction of structures wherever provided.

17.3.5.3 No final bolting or welding of joints shall be done until the structure has been properly aligned.

17.3.5.4 Instrumental checking of correctness of initial setting out of structures and adjustment of alignment shall be carried out in sequence and at different stages as required. The final levelling and alignment shall be carried out immediately after completion of each section.

17.3.5.3 The Contractor shall design, manufacture, erect and provide falsework, staging temporary support etc. required for safe and accurate erection of structural steelwork and shall be fully responsible for the adequacy of the same.

17.3.5.4 The Contractor shall also provide facilities such as adequate temporary access ladders, gangways, tools & tackles, instruments, etc. to CLIENT/Inspector for his inspection at any stage during erection.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 14 of 29

17.4 Field Connections

17.4.1 Assembly by permanent bolts.

17.4.1.1 The numbers of washers on permanent bolts shall not be more than two (and not less than one) for the nuts and one for the bolt head.

17.4.1.2 Wooden rams or mallet shall be used in forcing members into position in order to protect the metal from injury or shock.

17.4.1.3 Where bolting is specified on the drawing, the bolts shall be tightened to the maximum limit. The threaded portion of the each bolt shall be project through the nut by at least one thread. Tapered washers shall be provided for all heads and nuts to achieve uniform bearing on sloping surface.

17.4.1.4 To prevent loosening of nuts, spring washers or lock nuts shall be provided as specified in the design/shop drawings.

17.4.1.5 All machine fitted bolts shall be perfectly tight and the ends shall be checked to prevent nuts from becoming loose. No unfilled holes shall be left in any part of the structures.

17.4.2 Assembly by welding.

17.4.2.1 All field assembly by welding shall be executed in accordance with the requirements for shop fabrication. Where the steel has been delivered painted, the paint shall be removed before field welding for a distance of at least 50mm on either side of the joints to be welded.

17.4.2.2 All other requirements in welding shall be in accordance with clauses specified under Section-1 of this Specification

18.0 ACCEPTANCE STANDARD OF WELDING

18.1 Acceptance standard of welding shall be as specified in Section-1 of this Specification.

19.0 BEDDING AND GROUTING

19.1 Base plates shall be set to elevations shown on the drawings, supported aligned and levelled using steel wedges and shims or by other approved methods. Plates shall be levelled properly, positioned and the anchor bolts tightened.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 15 of 29

20.0 PAINTING AFTER ERECTION

20.1 The painting shall be as per painting specification (Section-4) of this Specification) and instruction given on drawings.

20.2 Site painting shall not be done in frosty or foggy weather or when humidity is such as to cause condensation on the surface to be painted.

21.0 ERECTION TOLERANCE

Maximum permissible tolerance in erected steel structures shall be as given in Annexure-C.

22.0 ACCEPTANCE OF WORK

22.1 Acceptance of erected steel structures shall be either after completion of erection of all the structures or in blocks.

22.2 Preliminary Acceptance will be done in the following cases:

- i) Any steelwork or part thereof embedded in concrete.
- ii) Steel structures which are to be covered in the process of carrying out further work.

23.0 DOCUMENTATION

23.1 The following documents shall be prepared at the time of acceptance of erected structures:

- i) Documents showing actual deviations made during execution of erection work and approval of competent authority.
- ii) Documents showing acceptance of embedded structures.
- iii) Certificate/documents on control checking and test of materials (if any) and weld.
- iv) Data and result of geodetic measurements obtained while checking the erection of the structures.

23.2 Copies of "As-Built" drawing showing thereon all additions and alternations which took place between approval of drawing and erection of structures.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 16 of 29

SECTION 3- FABRICATION AND ERECTION OF MISCELLANEOUS STRUCTURES

24.00 Roof and Side Cladding with Zincalume high tensile sheets. .

24.01 The scope of work shall cover:

- a. Preparation of drawings showing layout and size of sheets used, details of connections and flashing, Bill of Materials, etc.
- b. Procurement and supply sheets of all sizes, flashing and fittings like corner pieces, apron pieces, ridges, cutting and bending of sheets, wherever required, drilling of holes all as per Specification and Drawings.
- c. Procurement and supply of all fixtures and accessories such as self drilling, self tapping fasteners (galvanised with EPDM seals), washers, sealants, neoprene fillers etc.
- d. Procurement and supply of Rockwool insulation along with its fixing accessories such as cleats for fixing wire mesh, aluminium foil, metal/wire mesh etc(whenever applicable).
- e. Loading, transportation, unloading and delivery of sheeting with/without insulation material from place of procurement to erection site.
- e. Provision of all tools and tackles, equipment, labour supervision and services required for the satisfactory completion of the work specified herein and on the drawings.
- f. Erection in position of sheets and insulation where specified, for roofing, walling, louvers, erection of all flashing, fittings like ridges, valleys, gutters, corners, apron, etc. at all locations all work as per Drawings and Specifications.

24.02 Fixing of sheets

24.02.01 All fixing of the roof and side sheeting to purlins/insulations shall be by means of self drilling, self tapping screws.

24.02.02 Self Tapping screws shall be provided at all crest/valley at purlin locations for roof sheeting and at all valleys of the corrugations for side sheets.

24.02.03 All sheets shall be stitched together by self drilling/self tapping screws at spacing not more than 500mm.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 17 of 29	

24.03 Laps

24.03.01 All roofing shall be provided with two corrugations side lap and 200mm end lap.

24.03.02 All side/gable end sheets shall be provided with single corrugation side lap and 100mm end lap.

24.03.03 Overhang of sheets on the roof and side cladding shall not exceed 300mm.

24.04 Erection

24.04.01 Erection is to be carried out with the lay of the side laps such that under the prevailing wind, rain is not driven into the lap. The sheets shall be laid so that side lap in any two consecutive rows is staggered.

24.04.02 Broken or otherwise damaged sheeting shall not be erected.

24.04.03 Cutting, framing and trimming of all openings required shall be carried out at site.

25.0 CHAIN LINK FENCING

The scope of work shall cover:

- Procurement and supply mesh, line wire, stretcher bar, barbed wire (if shown in the drawings) and other accessories for chain link fencing and gate all as per specifications and drawings.
- Loading, transportation, unloading and delivery of material for fencing and gate from place of procurement to erection site.
- Provision of all tools, tackles, equipment, labour, supervision and services required for the satisfactory completion of the work specified herein and on the drawings.
- Erection in position of the fencing and gate at all locations, all work as per specification and drawings.

25.1 Erection

25.1.1 The height of chain link fencing shall be 3.0/2.5m top of vertical post. Punch Tap Concertina coil is to be provided over chain link fencing.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 18 of 29

- 25.1.2 Straining posts shall be provided at all ends and corners of fences, at changes in direction or acute variations in levels and at intervals not exceeding 66m on straight lengths of the fence. Intermediate posts shall be spaced at regular intervals not exceeding 1.5m.
- 25.1.3 Struts shall be fitted to all straining posts behind the chain link fabric in the direction of the fence.
- 25.1.4 There shall be four evenly spaced rows of line wire. The top wire shall be doubled, making five line wires in all. The bottom wire shall be close to the ground. Each line wire shall be strained lightly by means of eyebolt strainer at each straining point. The eyebolt strainer shall consist of bolt with welded eye. The bolt shall be sufficiently threaded and fitted with a nut and washer. Each line wire shall be secured to each of the intermediate posts by a wire stirrup passing through holes in the posts and secured to the line wire by three complete turns on each side of the post. Two-way eyebolt strainers shall have suitable ring nuts fitted after wires have been strained on one side.
- 25.1.5 The mesh shall be strained between each pair of straining posts and shall be secured to each straining post by means of a stretcher bar. One of the top line wires shall be threaded through the appropriate adjacent rows of mesh, care being taken that no meshes in the rows are by-passed by the line wire except where deviation is necessary at the straining posts. The second top line wire shall be strained in front of the fencing. The mesh shall be attached to top and bottom line wires by wire ties spaced 150mm apart and to other line wires by wire ties spaced 450mm apart. Bottom row of the mesh shall be threaded to the foundation concrete using staples spaced 500mm apart and set in concrete to a depth of 150mm. The top of concrete shall be 50mm above G.L. and 50mm below the fencing.
- 25.2 **Chain link fencing Gate**
- 25.2.1 A gate of suitable width shall be provided in the direction of the chain link fabric. The mesh and barbed wire used for the fabrication of gate shall be identical in all respects to that of chain link fencing. The gate may be single leaf or double leaf depending on the width of the gate.
- 25.2.2 The gate frame shall be a pipe frame with stiffeners at mid-height and mid-width.
The mesh shall be welded to the gate frame/stiffeners.
- 25.2.3 Each leaf of the gate shall be supported on a pivot in the foundation for the straining post and shall be laterally held at two points, one near the top of the straining post and second near the middle of the straining post. The free end of each leaf shall be provided with a tower bolt at the base of the frame. An aldrop shall be provided at the mid-height of the frame.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 19 of 29

SECTION-4: PAINTING OF STEEL STRUCTURES

26.0 SURFACE PREPARATION FOR PAINTING

26.1 General

The steel surface which is to be prepared shall be cleaned of dirt and grease and the heavier layers of rust shall be removed by grinding prior to actual surface preparation to a specified grade.

Surface preparation to be followed prior to painting shall be based on the requirement of a particular painting system as per Clause 28.0.

26.2 Mechanical Cleaning

Manual/ power tool cleaning shall be done as per grade St-2 or St-3, of Swedish Standard Institution SIS 055900.

- i) Grade St-2: Thorough scraping and wire- brushing, machine brushing, grinding etc. This grade of preparation shall remove loose mill scale, rust and foreign matter. Finally the surface is to be cleaned with a vacuum cleaner or with clean compressed air or with clean brush. After preparation, the surface should have a faint metallic sheen. The appearance shall correspond to the prints designated St-2.
- ii) Grade St-3: very thorough scraping and wire brushing, machine brushing, grinding etc. The surface preparation is same as for grade St-2 but to be done much more thoroughly. After preparing the surface, it should have a pronounced metallic sheen and correspond to the prints designated St-3.

26.3 If no grade of surface preparation is specified, Grade St-2 shall be followed.

27.0 PAINTS AND PAINTING

27.1 For use of specific painting system as mentioned in the Specification, the paint manufacturer's specification shall prevail.

27.2 General compatibility between primer and finishing paints shall be established through the paint manufacturer supplying the paints.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 20 of 29	

- 27.3 Before buying the paint in bulk, it is recommended to obtain sample of paint and establish "Control Area of Painting". On control area surface preparation and painting shall be carried out in the presence of manufacturer of paint.
- 27.4 In order to ensure that the supplied paint meets the stipulation in design drawing/specification, if required, samples of paint shall be tested in laboratories to establish quality of paint with respect to viscosity, adhesion/bond of paint in steel surfaces, adhesion/simulated salt spray test, chemical analysis (percentage of solids by weight), normal wear resistance as encountered during handling & erection, resistance against exposure to acid fumes, etc.
- 27.5 Whole quantity of paint for a particular system of paint shall be obtained from the same manufacturer.
- 27.6 Thinners, wherever used, shall be as per recommendation of the paint manufacturer.
- 27.7 Areas which become inaccessible after assembly of structures shall be painted before assembly, after cleaning the surfaces as specified.
- 27.8 Wherever shop primer painting is scratched, abraded or damaged, the surfaces shall be thoroughly cleaned using emery paper and power driven wire brush wherever warranted, and touched up with corresponding primer. Touching up paint shall be matched and blended to eliminate conspicuous marks.
- 27.9 If more than 50% of the painted surface of an item requires repair, the entire item shall be mechanically cleaned and new primer coats shall be applied followed by finishing coats as per painting specification.
- All field-welded areas on shop painted item shall be mechanically cleaned (including the weld area proper, adjacent areas contaminated by weld spatter or fumes and areas where existing primer. intermediate / finishing paint is burnt). Subsequently, new primer and finishing coats of paint shall be applied as per painting specification.
- 27.10 Application of paint shall be by spraying or brushing as per IS:487-1985 and in uniform layers of 50% overlapping strokes. Painting shall not be done when the temperature is less than 5°C or relative humidity more than 85%, unless manufacturer's recommendations permit. Also painting shall not be done in frosty or foggy weather. During application, paint agitation must be provided wherever such agitation is recommended by the manufacturer.
- 27.11 Paint shall be applied at manufacturer's recommended rates. The number of coats shall be such that the minimum dry film thickness (DFT) specified is achieved. The dry film thickness

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 21 of 29	

of painted surfaces shall be checked with elcometer or measuring gauges to ensure application of specified DFT.

- 27.12 All structures shall receive appropriate number of primer and finishing coats in order to achieve overall DFT as per design drawings/specifications. First coat of primer paint shall be applied not later than 2-3 hours after preparation of surface, unless specified otherwise.
- 27.13 The finishing paint as specified shall be of approved colour and quality. The under coat shall have different tint to distinguish the same from the finishing coat.
- 27.14 Edges, corners, crevices, depressions, joints and welds shall receive special attention to ensure that they receive painting coats of the required thickness.
- 27.15 Parts of surfaces embedded in concrete shall be thoroughly cleaned of grease, rust, mill scale etc. and shall be given a protective coat of Portland cement slurry immediately after fabrication. No paint shall be applied on this part.
- 27.16 Zinc-rich primer paints, which have been exposed several months before finishing coat is applied, shall be washed down thoroughly to remove soluble zinc salt deposits. In similar circumstances, the surfaces of paint based on epoxy resin should be abraded or lightly blast cleaned to ensure adhesion of next coat.
- 27.17 Surfaces which cannot be painted but require protection shall be given a coat of rust inhibitive grease according to IS:958-1975 or equivalent international standard.
- 28.0 PAINTING SYSTEM

The recommended painting system for general service requirement of steel structures covering surface preparation, application of primer coats, intermediate coats (if necessary) and final coats to develop the required minimum dry film thickness on steel surface is indicated as below

- a. Surface preparation: St 2 according to Swedish Standard SIS055900.
- b. Primer paint: Two coats of zinc phosphate in phenolic alkyd medium (DFT 35μ/coat).
- c. Finishing paint: Two coats of synthetic enamel (DFT 25μ/coat) conforming to IS: 2932-2018.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 22 of 29	

29.0 MEASUREMENTS

29.1 Structural Steel

Structural steelwork will be measured by the metric tonne and as per IS:1200(Part-8)-2017 and IS:1200(Part-9)-2017 subject to provisions outlined below:

- The calculation of quantities shall be based on unit weights for structural sections as given in IS Handbooks. In the case of mild steel plates, the calculated weights shall be based on 78.5 kg/m²/centimeter thick plate. The payments will be made on the basis of weights of members as per drawings. However, any changes on the above weights during fabrication erection, payment shall be based on sketches approved by CLIENT.
- In the event the IS does not specify any mode of measurement for a particular item of work, the same shall be measured as per any other relevant international standard or as directed by CLIENT.
- The weight of all plates and sections shall be calculated from the approved drawing using the minimum overall square or rectangular dimensions and theoretical weight, no deduction being made for skew cuts, holes etc. In the case of plates, other than gussets, the actual dimensions shown on approved drawings will apply unless approved otherwise by the purchaser based on cutting diagram of mother plates.
- The weight of all welding runs, bolt, stanchion base packing, cuttings to waste and rolling margins, and coatings of paint, will be excluded from the measured weight and shall be deemed to have been allowed for in the rates for structural steelworks quoted by the Contractor.
- Temporary works and all other materials not included in the permanent works shall be excluded from any measurement for payment.
- Chain link fencing shall be measured in running meter basis, as specified and shown on the drawings.

29.2 Sheets

29.2.1 Sheets for roofing and side cladding shall be measured by lump sum or the square meter of net laid area, as specified and shown on the drawings or scope of work.

29.2.2 No allowance shall be made for wastage, cutouts, overlaps, etc., in the measurement.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 23 of 29	

- 29.2.3 The unit rate shall include all fasteners, flashing and fitting such as ridges corners, aprons and other accessories.
- 29.2.4 No deduction will be made for openings for area less than a single sheet. Also no extra payment will be made for making openings.
- 30.0 ACCEPTANCE OF WORKS
- 30.1 After completing the erection of a unit or portion thereof, the Contractor shall give a notice in writing stating that the job is complete in all respects and ready for preliminary acceptance. The job shall be jointly inspected visually by representatives of Contractor and CLIENT. All observed defects and omissions as per drawing and specification shall be noted down.
- 30.2 The Contractor shall make good all these defects, deficiencies and omissions and shall inform in advance CLIENT/Inspector for inspection. The Engineer-Incharge shall satisfy himself that all the defects, deficiencies and omissions noted down during preliminary acceptance have been rectified.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 24 of 29	

Annexure-A

Permissible deviations in pitch and gauge of holes for bolts of normal accuracy

Sl. No.	Description	Hole Diameter (mm.)	Permissible deviations in spacing (mm.)	Permissible deviations in each group of holes	
				Carbon steel	Low alloy steel
a.	Deviation in hole diameter.	Upto 17	+1.0	No limits	
		Above 17	+1.5		
b.	Ovality (Difference between the biggest and the smallest diameters).	Upto 17	+1.0	No limits	
		Above 17	+1.5		
c.	Curves exceeding 1mm. and cracks on the hole edges.	-	-	Not permissible	
d.	Non-coincidence of holes in separate details of the assembled unit:				
	Upto 1mm.	-	-	Upto 50%	Upto 50%
	Above 1mm. upto 1.5mm.	-	-	Upto 10%	Upto 10%
e.	Slope of axis.	-	Upto 30% the thickness of unit.	No limits	No limits

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 25 of 29	

Annexure-B

Tolerance of Assembled Components of Structures

Sl. No.	Description of components in structures	Deviation ($\pm$) mm. for elements of structures						
		Upto 1m.	1m. to 5m.	5m. to 10m.	10m. to 15m.	15m. to 20m.	20m. to 25m.	Over 25m.
1.								
i.	Deviations from the dimensions assembled. Length and width of the details cut:							
a.	Manual gas cutting as per marking	3.0	3.5	4.0	4.5	5.0	-	-
b.	With shears or with saw as per marking.	2.0	2.5	3.0	3.5	4.0	-	-
c.	With shears or with a saw with a stop.	1.5	2.0	2.5	3.0	3.5	-	-
d.	Machine gas cutting.	2.0	2.5	3.0	3.5	4.0	-	-
ii.	Length and width of planed processed on edge planing machine.	1.0	1.5	2.0	2.5	3.0	-	-
2.								
i.	Distance between centers of the end holes:							
a.	Drilled according to marking.	2.0	2.5	3.0	3.5	4.0	-	-
b.	Drilled according to a gauge with bushing.	1.0	1.5	2.0	2.5	3.0	-	-
ii.	Distance between centers of adjacent holes:							
a.	Drilled according to marking or a gauge..	1.5	-	-	-	-	-	-
b.	Drilled according to a gauge with bushing.	0.5	-	-	-	-	-	-

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 26 of 29	

Annexure-C

Tolerances in Erected Steel Structures

Sl. No.	Description	Tolerance
1.	Deviation of structure at foundation top level w.r.t. true axis	
a.	in longitudinal direction.	$\pm 5\text{mm.}$
b.	In lateral direction.	$\pm 5\text{mm.}$
2.	Deviation in the level of bearing surface of structures at foundation top w.r.t. true level.	$\pm 5\text{mm.}$
3.	Out of plumb of structure from true vertical axis and measured from structure top.	$\pm \frac{H}{1000}$ or $\pm 25\text{mm.}$ Whichever is less.

Note: 'H' above is the structure height in mm.

Notes:

- The tolerances do not apply to steel structures where deviations from true positions are intimately linked or directly influenced by technological processes. In such cases, tolerances on erected steel structures shall be as per recommendations of process technologists/equipment suppliers.
- The observed or calculated values of deviations of steel structures from their true positions shall be rounded off in accordance with IS:2-1960 for comparison with permissible tolerances specified in this table. The number of significant places retained in the rounded off value shall be the same as that specified in this table.

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)	Page 27 of 29	

Annexure-D

Material of construction (as applicable)

- 1.0 Unless otherwise specified in the drawing, all rolled sections and plates shall conform to IS: 2062-2011.
- 2.0 Steel sheets shall conform to IS:1079-2009.
- 3.0 Steel tubes for structural purposes shall conform to IS: 1161-2014 (Grade YST-310).
- 4.0 Gutters and down comers shall be of copper bearing steel conforming to IS: 2062-2011.
- 5.0 Crane rails shall conform to IS: 3443-1980.
- 6.0 Roof Covering/ Sheetting: Canopy roof sheeting shall be of 0.6mm Zincalume/ galvalume colour coated sheets and shall have trapezoidal profile with 28-32 mm deep crest and 186-250 c/c profile width with minimum two ribs at centre for stiffening. The sheet shall be of minimum $f_y = 345$ MPa and shall be coated with hot dip metallic Zinc aluminum alloy @ 150 gsm coating mass total on both sides.
- 7.0 Providing, cutting, fabrication and installation of canopy false ceiling with TRAC 150 F (of Interarch or equivalent as per Approved makes) coil coated (Pre-painted) steel false ceiling system comprising of 150 mm wide x 17 mm deep roll formed out of 0.50 mm thick polyester coated galvanized steel panels, fixed on steel runner of 34.5 mm width x 48 mm deep manufactured out of 0.60 mm thick precoated galvanized steel with rigid suspension of 20x20x0.5 mm fixed with steel brackets/clips etc. The suspension system should be meant of exterior use. The carrier shall be suspended at 1mtr c/c supported from purlin and suspension angle at 500 mm c/c. panel shall be factory cut to provide minimum joints. The longitudinal joints shall have additional special G.I. Splice in between two panels. The carrier joint shall have a carrier splice maintaining a module of 150 mm. The ceiling shall be clipped on to the suspended carriers after they are aligned and leveled. Cutting for fixing of light fittings shall be done as per the cutout required to fit the fixture. The work shall be carried out under a specialized and experienced supervisor.
- 8.0 All black hexagonal bolts, nuts and lock nuts shall conform to IS: 1363-2002 and IS: 1364-2002 (for precision and semi-precision hexagonal bolts). Washers shall conform to IS: 1148-1982.
- 8.0 Covered electrodes for arc welding shall conform to IS: 814-2016. Coding of electrodes shall be as follows:
 - a. ER 421 'C' x for mild steel of Grade A and Grade B as per IS: 2062-2011.
 - b. EB 542 'C' x H3X for:

MECON Limited, Regd. Office: RANCHI	STRUCTURAL SECTION, NEW DELHI.	STANDARD SPECIFICATION	
FABRICATION, ERECTION AND PAINTING OF STEEL STRUCTURES	MEC/S/05/12/01 (Rev.-0)		Page 28 of 29

mild steel of Grade B as per IS: 2062-2011 for dynamically loaded structures (arising out of crane, vibratory screen, equipment, etc.),

SAIL-MA micro alloyed steel 350 HYA/HYB and

when combined thickness (CT) for steel conforming to IS:2062-2011 exceeds 40mm.

where 'C' is the value of current as recommended by the electrode manufacturer.

- 9.0 Material for chain link fencing shall conform to IS:2721-2003. Mesh for chain link fencing shall be of 3.15mm hot dip galvanized steel mesh wire, the diameter being measured over zinc coating. The diameter of mesh wire shall not vary from the specified diameter by more than 0.05mm. The material for mesh wire and line wire of chain link fencing shall conform to IS:280-2015. Stretcher bar for erection of mesh shall consist of mild steel flats 25mmx4.75mm. The stirrup wire for securing the line wires to the intermediate post shall be of 2.5mm mild steel wire. Hairpin staples for fastening the bottom line wire to the foundation concrete shall be of 6mm mild steel wire with ends of staples bent outwards for adequate anchorage. The cleats for eyebolts shall be of mild steel plate 10mm thick.
- 10.0 Material for barbed wire shall conform to IS:278-2015. Line wire for the barbed wire shall be made from two strands of galvanized steel wire of nominal dia 2.5mm twisted together. Barbs shall be made of point wire of galvanized steel of nominal dia 2.5mm in such a way that four points of the barbs are set and located or locked as far as possible at right angles to each other. Droppers for barbed wire shall be of mild steel flat 25mmx4.75mm with 38mmx4.85mm half round staples for fastening the barbed wire.

PART-IV
Electrical Works

TABLE OF CONTENT

Sl. No.	Description	Document No./ Drawing No.	Rev. No.	Pages
SCOPE OF WORK				
1	Scope of Work	MEC/E0086/05/E1/E/GGPL/SOW	Rev. 0	11
2	Electrical Check List	MEC/E0086/05/E1/E/GGPL/ECL	Rev. 0	1
3	Particular Job Specification for 11kV HT Works	MEC/E0086/05/E1/E/GGPL/PJS	Rev. 0	17
4	List of Suppliers of Major Bought-Out Items-Electrical	MEC/LOPM/05/E9/01	-	27
QAP (Quality Assurance Planning)				
1	Quality Assurance Plan	MEC/E0086/05/E1/E/GGPL/QAP	Rev.0	2
2	Inspection Categorization plan for Electrical Items	MEC/E0086/05/E1/E/GGPL/ICP	Rev.0	2
STANDARD DATA SHEETS				
1	UNINTERRUPTED POWER SUPPLY (UPS)	MEC/DS/05/E9/071	Rev. 1	12
2	LV SMALL POWER DISTRIBUTION BOARD	MEC/DS/05/E9/076A	Rev.0	4
STANDARD SPECIFICAITONS				
1	Power and Distribution Transformer	MEC/05/E9/TS/03A	Rev. 0 Ed:3	
2	Mv Switchboard	MEC/ TS/05/E9/06	Rev. 0 Ed:3	
3	Power and Control Cables	MEC/TS/05/E9/09	Rev. 0 Ed:3	
4	AC UPS	MEC/TS/05/E9/10A	Rev. 0 Ed:3	
5	Electrical Bulk Material	MEC/TS/05/E9/11	Rev. 0 Ed:3	
6	High Mast	MEC/TS/05/E9/12	Rev. 0 Ed:3	
7	Earthing and Lightning Protection	MEC/TS/05/E9/13	Rev. 0 Ed:3	
8	Installation of Electrical Equipment	MEC/TS/05/E9/14	Rev. 0 Ed:3	
9	Field Inspection, Testing & Commissioning	MEC/TS/05/E9/15	Rev. 0 Ed:3	
10	Ni-Cd Battery	MEC/TS/05/E9/17	Rev. 0 Ed:3	
STANDARD DRAWINGS				
1	Marking of trenches for electric cables	MEC/SD/05/E9/01/01		
2	Typical section of cable trench in unpaved areas	MEC/SD/05/E9/01/02		
3	Earth Electrode in Test Pit	MEC/SD/05/E9/02/01		
4	Copper Plate Electrode in Test Pit	MEC/SD/05/E9/02/02		
5	Typical earth connection for street light pole	MEC/SD/05/E9/02/03		
6	Earthing of tanks and vessels	MEC/SD/05/E9/02/04		
7	Earthing method for	MEC/SD/05/E9/02/05		

	processing equipment			
8	Typical Installation of Pole Mounted Street Lighting Fixture for safe area (without rungs)	MEC/SD/05/E9/03/01		
9	Typical installation of flood lighting pole (with rungs)	MEC/SD/05/E9/77/02		
10	Flame proof lighting fixture Mounting details	MEC/SD/05/E9/77/03		
11	General Arrangement for Octagonal Pole	MEC/SD/05/E9/77/04		
12	Block Diagram for UPS System, Charger and ACDB	MEC/SD/05/E9/071-D		
TENDER DRAWINGS				
1	Single Line Diagram of Power Distribution Board for Daughter Booster Stations	MEC/E0086/05/E1/E/1081A		
2	Single Line Diagram of 10 KVAR APFC panel	MEC/E0086/05/E1/E/1081B		



GODAVARI GAS PRIVATE LIMITED

**ELECTRICAL SCOPE OF WORKS
FOR
MECHANICAL & ELECTRICAL WORKS TENDER
FOR DAUGHTER BOOSTER CNG STATIONS IN
EAST GODAVARI & WEST GODAVARI DISTRICTS**

DOCUMENT NO. - MEC/E0086/05/E1/E/GGPL/001



**(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
SCOPE OF WORK (ELECTRICAL)		MEC/E0086/05/E1/E/GGPL/SOW	Page 4 of 32

Index

Sl. No.	Description
1	General.
2	Scope
3	Other Miscellaneous Work
4	Area Classification.
5	Job Specification.
6	Statutory approval of works.
7	Makes of equipments and materials.
8	Inspection, testing and commissioning.
9	Drawings, standard specifications and Installation standards.

PREPARED BY:	CHECKED BY:	APPROVED BY:	ISSUE DATE:
(Shifa Jindal)	(Quasim Ahmad)	(P Shrivastava)	July, 2026

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
SCOPE OF WORK (ELECTRICAL)		MEC/E0086/05/E1/E/GGPL/SOW	Page 5 of 32

1.0 GENERAL

1.1 INTRODUCTION

M/s. Godavari Gas Private Limited (GGPL) is developing City Gas distribution network at Geographical Area of East Godavari & West Godavari Districts based on PNGRB authorization.

M/s. Godavari Gas Private Limited (GGPL) has awarded MECON Limited Project Management Consultancy services for developing CGD Network in East Godavari & West Godavari Districts.

1.2 WORK TENDERED

The present tender envisages supply, construction, erection and commissioning of mechanical and electrical works for Daughter Booster Stations in East Godavari & West Godavari Districts of GGPL.

The intent of this specification is to define the requirements for the supply of equipment and materials (as required), erection, testing and commissioning of the electrical power distribution system of CNG stations.

The work shall be carried out in the best workmanship – like manner, in conformity with these specifications, approved drawings and the instructions of the Engineer-in-charge from time to time.

The contract shall include clearing of temporary construction, waste materials and loose earth, which might get collected in and nearby the work site consequent of the execution of work under this contract.

1.3 STANDARDS

The work shall be performed in conformity with, standard specifications and installation standards enclosed and code of practices of the Bureau of India Standards. In case of any conflict, the stipulations under this specification shall govern.

In addition, the work shall also conform to the requirements of the following:

The Indian Electricity Act, and the rules framed there under

The fire Insurance Regulations

The regulations laid down by the Chief Electrical Inspector of the state government / Central Electricity Authority (CEA).

The regulations laid down by the Factory Inspector.

The regulations laid down by the Chief Inspector of Explosives.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
SCOPE OF WORK (ELECTRICAL)		MEC/E0086/05/E1/E/GGPL/SOW	Page 6 of 32

Any other regulations laid down by the Central, State or Local Authorities from time to time during the pendency of this contract.

1.4 GUARANTEE

The contractor shall guarantee the installation against any defects of workmanship and materials (supplied by the contractor) for a period of 12 months from the date of issue of the completion certificate. Any damage or defects connected with the erection of materials, equipments or fittings supplied by the contractor that may be undiscovered at the time of issue of the completion certificate, or may arise or come to light thereafter, shall be rectified or replaced by the contractor at his own expense as deemed necessary and as per the instruction of the Engineer-in-charge within the time limit specified by the Engineer-in-charge.

The above guarantee shall be applicable for the quality of work executed as well as for the equipment / cable / fittings/ other material supplied by the contractor.

1.5 SITE CONDITIONS

The equipment offered and the installation shall be suitable for continuous operation under the following site conditions.

Max. / Min temperature	:	50°C/5°C
Max. relative humidity	:	90 %
Altitude	:	Less than 1000 m above MSL
Atmosphere	:	To withstand site conditions (Dry, dust storms during summer, Humid & Heavy Rainfall during Monsoon)

1.6 POWER SUPPLY PARAMETERS :

i) For CNG Stations

NORMAL POWER	415V AC, 3 Phase & Neutral
LIGHTING DISTRIBUTION (Normal)	230 V AC, 1 Phase
INSTRUMENTATION (UPS)	230 V AC, 1 Phase

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
SCOPE OF WORK (ELECTRICAL)		MEC/E0086/05/E1/E/GGPL/SOW	Page 7 of 32

2.0 SCOPE

2.1 SCOPE OF DESIGN & ENGINEERING

- 2.1.1 Submission of electrical equipment drawings for review, preparation of site engineering drawings and details for installation works wherever applicable or required by the Engineer-in-charge, and submits to the Engineer-in-charge for review.
- 2.1.2 Correction, updating and submission of all Owner's drawings for as-built status.
- 2.1.3 Obtaining clearance for energizing the complete electrical facilities covered under this tender and approval of installation and drawings from the Chief Electrical Inspector of the State Government/Central Electricity Authority and other statutory authority as required. This includes equipments installed or commissioned by others within the battery limit. This is for the purpose of obtaining a comprehensive approval in one go.

2.2 SCOPE OF SUPPLY

This document covers the minimum requirements for the design, manufacturing, procurement of materials and bought out components, assembly at shop, inspection, testing, supply, packing, shipment and delivery to site. Any items not listed in this document, but considered necessary for safe and smooth operation of the equipment shall be provided by the Vendor.

The scope of supply shall be in accordance with the latest revision of Data sheets, Specifications along with documents specified herein and applicable codes and standards.

Following electrical equipment and material are in the contractor's scope of supply in this tender

- 2.2.1 Double pole structure with AB Switch, Lightning arrestors, horn gap fuse, copper wire jumpers upto transformer HT terminals.
- 2.2.2 ACSR conductor, 11m MS joint/pole, Pin insulator and GI hardware etc. as required from respective state electricity board battery limit upto double pole structure inside cng Station.
- 2.2.3 11/0.433 kV, copper wound Distribution Transformer with Double Pole, Gang switch, overhead Conductor of suitable rating and all necessary accessories for completion of work including tapping from existing HT line etc. complete as per specification, SOR and requirement of approval from respective electricity/statutory authority. All electrical work i.e. charging of transformer, pole mounted substation, tapping from battery limit of electricity board shall be carried out in supervision of respective authority including necessary approval, if required.
- 2.2.4 TPN, AC-23 duty MCCB in outdoor type dust & weather proof steel enclosure.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
SCOPE OF WORK (ELECTRICAL)		MEC/E0086/05/E1/E/GGPL/SOW	Page 8 of 32

- 2.2.5 415V, LT Switchboards/ Panels (PDB) to receive and distribute power to all the loads of the CNG stations.
- 2.2.6 Cables between LT terminals of transformer & MCCB unit, PDB, LDBs and to different loads including cable supports, double compression cable glands, lugs etc. as required.
- 2.2.7 UPS system, Rectifier, Battery Bank, ACDB / DCDB & interconnecting cables as per SOR/TS. Contractor scope of work also includes incoming cables for UPS & all outgoing cables & cabling work from various ACDB & DCDBs.
- 2.2.8 MV power and control cable (XLPE – insulated armoured Al/Cu conductor 1/2/3/3.5/4 core cables).
- 2.2.9 FLP (CMRI, PESO approved) type double-compression nickel-plated brass cable glands, tinned- copper lugs, clamping material etc. for cable termination.
- 2.2.10 Flameproof type welding receptacles etc.
- 2.2.11 FLP/Non-FLP Outdoor lighting fixtures complete with mounting bracket, control gear box as per the type of fixture, lamps etc. including civil work with pipe inserts for cables and connecting work, with all material and labour.
- 2.2.12 Illumination system, including lighting fixtures, lighting and power panels, switches, sockets, wiring, PVC conduit to be laid in the concrete slab / other civil construction etc. in safe and hazardous area.
- 2.2.13 Inverter for emergency critical lighting.
- 2.2.14 2T, 5 star Split Air Conditioners with stabilizer.
- 2.2.15 GI pipes, GI Cable-trays and accessories, cable markers, identifier tags, GI saddles and all other associated accessories for cable-laying.
- 2.2.16 Earthing and lightning protection system, including earthing pits, earth electrodes, earthing strips, grounding conductor of various sizes, Cu strip for flange jumper and Cu earth plates etc.
- 2.2.17 Safety equipment in the stations/terminals, like shock treatment charts, caution boards, first aid equipment, rubber mats, portable fire extinguishers, sand bucket etc.
- 2.2.18 Fabrication and supply of MS frames, supports, canopies and brackets for miscellaneous electrical equipments, including welding, supply of bolts, nuts etc for mounting and

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
SCOPE OF WORK (ELECTRICAL)		MEC/E0086/05/E1/E/GGPL/SOW	Page 9 of 32

other necessary supplies, all inclusive of painting as specified.

- 2.2.19 Cable gland plate of suitable size & of min 3mm thickness shall be provided for cable termination, wherever required, for all the electrical panels (PDB/LDB/OLDB/UPS etc)

2.2.20 CO-ORDINATION WITH OTHER CONTRACTORS

Contractor shall be entirely responsible for Co-ordination with other contractors of & it should be ensured that the terminal work should be timely executed.

If the contractor fails to timely execution of the terminal work, necessary penalty clause shall be applied as per the direction of the Engineer-in-Charge.

Note: SLDs attached with tender documents are for tender purpose only. Detailed SLD shall be furnished by the bidder as per the requirements of the system. Any change, Modifications, Addition/deletion occurs later due to system requirements shall deem to be inclusive in the price quoted by the bidder, No extra cost shall be paid for the same.

2.3 SCOPE OF INSTALLATION, TESTING & COMMISSIONING

Electrical Contractor shall be responsible for installation and commissioning & testing of all the items as per the site requirement, overall checking and final charging of the system.

The Contractor shall provide qualified and experienced supervision personnel for the supervision of installation, site testing, pre- commissioning, commissioning and hook up.

- 2.3.1 Installation, testing & commissioning of Double pole structure with AB Switch, Lightning arrestors, horn gap fuse, copper wire jumpers upto transformer HT terminals.
- 2.3.2 Installation, testing & commissioning of ACSR conductor, 7m MS joint/pole, Pin insulator and GI hardware etc. as required from respective state electricity board battery limit upto double pole structure inside CNG Station.
- 2.3.3 Installation, testing & commissioning of Distribution Transformer (11/0.433 kV, copper wound) with Double Pole structure, Gang switch, overhead Conductor of suitable rating and all necessary accessories for completion of work including tapping from existing HT line etc. complete as per specification & SOR.
- 2.3.4 Installation, testing & commissioning of TPN, AC-23 duty MCCB in outdoor type dust & weather proof steel enclosure.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
SCOPE OF WORK (ELECTRICAL)		MEC/E0086/05/E1/E/GGPL/SOW	Page 10 of 32

- 2.3.5 Installation testing & commissioning of 415 V switch boards/PDBs/MLDBs/LDBs.
- 2.3.6 Installation, testing & commissioning of Cables between transformer, LT terminals of transformer & MCCB unit, PDB, LDBs and to different loads cable supports, double compression cable glands, lugs etc as required.
- 2.3.7 Installation testing & commissioning of UPS system, Rectifier, Battery Bank, ACDB / DCDB & interconnecting cables.
- 2.3.8 Laying & termination of all MV/HV power and control cables laid in concrete-lined trenches, buried cable trenches, pipes, road crossings, pipe-racks etc.
- 2.3.9 Installation, testing and commissioning of lighting system in buildings.
- 2.3.10 Installation testing & commissioning of Inverter for emergency power
- 2.3.11 Installation testing & commissioning of 2T, 5 star Split Air Conditioners with stabilizer
- 2.3.12 Installation, testing and commissioning of outdoor street lighting system & lighting system for process area.
- 2.3.13 Installation, testing & commissioning of earthing system & complete lightning protection system.
- 2.3.14 Installation, testing and commissioning of the contractor supplied materials.
- 2.3.15 All works relating to statutory approvals of the complete installation, from competent authority like CEA, DGMS, State electricity authority/Board etc, shall be in the scope of contractor

3.0 OTHER MISCELLANEOUS WORKS

- 3.1 Preparation of buried cable trenches, including, back filling, compacting providing of brick protection by second-class bricks, spreading of fine river sand, including all supplies.
- 3.2 The job includes repairing of all civil works damaged during installation of electrical facilities.
- 3.3 The scope of work under this contract shall be inclusive of breaking of walls, floors and chipping of concrete foundations necessary for the installation of equipment, materials, and making good of the same.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
SCOPE OF WORK (ELECTRICAL)		MEC/E0086/05/E1/E/GGPL/SOW	Page 11 of 32

- 3.4 Minor modifications wherever required to be done in the owner free supplied equipments / devices to enable cable entry, termination, etc.
- 3.5 Sealing of opening made in the walls / floors for cables trays, cables, bus ducts, etc using acceptable practice and standards.
- 3.6 Supply and installation of all other accessories not specifically mentioned herein, but never the less necessary for completion of the job.

4.0 AREA CLASSIFICATION

Hydrocarbon handling areas have been generally classified as zone 1, gas group IIA/IIB as per IS: 5572, API RP-500, OISD - 113 and IP Rules. All equipments to be installed in these areas shall be suitable for the area classification with temperature class T3 (200°C), CMRI testing and approved by CCOE, DGFAS and having BIS license.

5.0 JOB SPECIFICATION

Various electrical works covered under this contract like equipment erection, cabling, lighting and grounding works, etc. shall be performed in accordance with specifications attached with this tender. (Certain clauses of specifications, which are applicable to equipments or system not covered under this contract, shall not be applicable).

Erection and commissioning of certain special equipments shall be performed in accordance with supplier's instructions and directions of the Engineer-in-charges under supervision by equipment supplier/s.

The equipments/materials to be supplied by the contractor shall conform to the requirements of the applicable specifications enclosed in the tender document.

6.0 STATUTORY APPROVAL OF WORKS

All works relating to statutory approvals of the complete installation, from competent authority like CEA, DGMS, State electricity Authority/Board etc, shall be in the scope of contractor.

The application on behalf of the owner for submission to Electrical Inspector / DGMS etc. along with copies of required certificates and drawings, complete in all respects, shall be prepared by the contractor and submitted to the Engineer-in-charge for onward transmission well ahead of time so that the actual commissioning of equipment are not delayed for want of inspection by the Electrical Inspector / DGMS. The actual Liaison work shall be arranged by the Contractor and necessary coordination and liaisons work in this

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
SCOPE OF WORK (ELECTRICAL)		MEC/E0086/05/E1/E/GGPL/SOW	Page 12 of 32

respect shall be responsibility of the contractors. However, the Owner on submission of bills along with documentary evidence shall reimburse any fee paid to the statutory Authority in this regards.

7.0 MAKES OF EQUIPMENTS AND MATERIALS

All equipments / materials supplied by the contractor shall be as per the list of approved makes enclosed with this document subject to submission of Certification and approvals.

8.0 INSPECTION, TESTING & COMMISSIONING

- a. All the equipment supplied and installed by the contractor shall be tested and commissioning as required and no separate payments shall be made. Any damage or defect noticed shall be brought to the notice of the engineer-in-charge and will be rectified without any delay and no payments shall be made for rectification.
- b. Any work not conforming to the execution drawings, specifications or codes shall be rejected forthwith and the contractor shall carry out the rectification at his own cost.
- c. The contractor shall carry out all the tests as enumerated in the technical specifications and as per applicable codes and standards.
- d. Before the electrical system is made live, the electrical contractor shall carry out suitable tests to establish to the satisfaction of engineer-in-charge that the installation of equipments, wiring and connections have been correctly done and are in good working condition and that it will operate as intended.
- e. All the tests shall be conducted in the presence of Owner/ Engineer-in-charge or his authorized representative unless he waives this requirement in writing. The contractor shall arrange all testing equipment necessary to carry out the test. The tests shall be recorded on approved Performa and certified records of the tests shall be submitted to Owner/ Engineer-in-charge.
- f. After the completion of all tests and rectification of all defects pointed out during final inspection, plant start-up trials would be commenced. During the start-up trials contractor shall provide skilled / unskilled personnel and supervision round the clock at his cost. The number and category of workmen and duration up to which required, will be decided by the Engineer-in-charge. Any defects noticed during the start-up trial relating to the equipment supplied and work carried out by the Contractor, will be rectified by the contractor at his own cost.
- g. Engineer-in- charge shall have the right to get these defects rectified at the risk and cost of the contractor if he fails to attend to these defects immediately as desired.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
SCOPE OF WORK (ELECTRICAL)		MEC/E0086/05/E1/E/GGPL/SOW	Page 13 of 32

- h. After the operating conditions are fully achieved in the plant and the other requirements as stated in the General Conditions of Contract are fulfilled, the contractor would be eligible for applying for a completion certificate.

9.0 DRAWINGS, STANDARD SPECIFICATIONS & INSTALLATION STANDARDS

- 9.1 The equipments / materials to be supplied by the contractor shall conform to the requirements of the applicable specifications. Also the installation of various material / equipment shall conform to the installation standards /norms.
- 9.2 The drawings accompanying the tender documents when read with specification shall depict the electrical system of the Terminal. These are indicative of the nature of work and issued for tendering purposes only. Purpose of these drawings is to enable the tendered to make an offer in line with the requirements of the Owner. Construction shall be as per drawings / specifications issued / approved by the Engineer-in-charge during the course of execution of work.
- 9.3 Conduit layout drawing in ceiling, wherever required, to be prepared by the contractor and shall be submitted for approval.
- 9.4 After the job completion, contractor shall prepare AS-BUILT drawings and documents, submit catalogues/manuals (O&M) of major brought out items like UPS, Inverter, HT Substation, Lighting fixture etc. Final certified as built drawings, documents and manuals etc shall be submitted by the contractor to owner in bound volume with one set in soft copy (CD) plus five sets of prints.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
ELECTRICAL CHECKLIST		MEC/E0086/05/E1/E/GGPL/ECL	Page 14 of 32

ELECTRICAL CHECK LIST - TO BE FILLED-UP BY TENDERER

Sl. No.	Description	Remarks
1.	No deviation from the Electrical Specification/ SOR	
2.	Filled up Data Sheets	
3.	Un priced schedule of rate (SOR) enclosed.	
4.	List of similar electrical job undertaken during last three years has been enclosed with the offer.	
5.	List of electrical personnel employed, with their qualification & experience, has been enclosed with the offer.	
6.	Credential of electrical sub-contractor, enclosed with the offer.	
7.	Photocopy of Electrical Contractor's license – grade A has been enclosed with the offer.	

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 15 of 32



GODAVARI GAS PRIVATE LIMITED

PARTICULAR JOB SPECIFICATION FOR 11kV HT WORKS

MECHANICAL & ELECTRICAL WORKS TENDER
FOR DAUGHTER BOOSTER CNG STATIONS IN
EAST GODAVARI & WEST GODAVARI DISTRICTS



(ELECTRICAL SECTION)
MECON LIMITED
DELHI 110 092

Document No.	Revision No.	Date
MEC/E0086/05/E1/E/GGPL/001	0	July, 2026
Copyright MECON Limited – All rights reserved. THIS DOCUMENT IS THE SOLE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED HEREIN. THIS IS NOT TO BE COPIED OR USED FOR ANY OTHER PROJECTS UNLESS EXPLICITLY PERMITTED BY MECON.		

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 16 of 32

CONTENT

SL. NO.	DESCRIPTION
1	GENERAL.
2	SCOPE
3	11KV GANG OPERATED AIR BREAK SWITCH
4	DROP OUT FUSES
5	LIGHTNING ARRESTORS
6	AREA CLASSIFICATION
7	JOB SPECIFICATION
8	STATUTORY APPROVAL OF WORKS
9	MAKES OF EQUIPMENTS AND MATERIALS
10	QUALITY ASSURANCE, INSPECTION & TESTING
11	TESTING AND COMMISSIONING
12	DRAWINGS, STANDARD SPECIFICATIONS AND INSTALLATION STANDARDS

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 17 of 32

1.0 GENERAL

1.1 Introduction

The intent of this specification is to define the requirements for the supply of equipment and materials (as required), erection, earthing, testing and commissioning of the double pole mounted 11/0.433kv substation with transformer.

The work shall be carried out in the best workmanship – like manner, in conformity with these specifications, approved drawings and the instructions of the Engineer-in-charge from time to time.

The contract shall include clearing of temporary construction, waste materials and loose earth, which might get collected in and nearby the work site consequent of the execution of work under this contract.

1.2 Standards

The work shall be performed in conformity with, standard specifications and installation standards enclosed and code of practices of the Bureau of India Standards. In case of any conflict, the stipulations under this specification shall govern.

In addition, the work shall also conform to the requirements of the following:

The Indian Electricity Act and the rules framed there under

The fire Insurance Regulations

The regulations lay down by the Chief Electrical Inspector of the state government / Central Electricity Authority (CEA).

The regulations lay down by the Factory Inspector.

The regulations lay down by the Chief Inspector of Explosives.

IS-9920 Part-I to V

IS-2544/1973- Porcelain post insulators

IS-2633- Galvanization of ferrous parts

IS-9921 Part I to IV

IS-5340 Part-III

M.B.Lal committee recommendations for electrical installations.

PNGRB guidelines (as applicable)

OISD standard (as applicable)

Any other regulations lay down by the Central, State or Local Authorities from time to time during the pendency of this contract.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 18 of 32

1.3 Guarantee

The contractor shall guarantee the installation against any defects of workmanship and materials (supplied by the contractor) for a period of 12 months from the date of issue of the completion certificate. Any damage or defects connected with the erection of materials, equipments or fittings supplied by the contractor that may be undiscovered at the time of issue of the completion certificate, or may arise or come to light thereafter, shall be rectified or replaced by the contractor at his own expense as deemed necessary and as per the instruction of the Engineer-in-charge within the time limit specified by the Engineer-in-charge.

The above guarantee shall be applicable for the quality of work executed as well as for the equipment / cable / fittings/ other material supplied by the contractor.

1.4 Site Conditions

The equipment offered and the installation shall be suitable for continuous operation under the following site conditions.

Max. / Min temperature	:	50°C/ 2°C
Max. Relative humidity	:	95 %
Altitude	:	Less than 1000 M above mean sea level.
Atmosphere	:	To withstand site conditions (Dry during summer, Humid & Heavy Rainfall during Monsoon)

1.5 Power Supply Parameters :

11kV Power supply is considered available at IP terminal, SV terminal & Receiving terminals.

NORMAL POWER	11kV, 3Ph
VARIATION	As per SEB
FREQUENCY	50 Hz $\pm$ 5%
FAULT LEVEL HT SIDE OF TRANSFORMER	26.3 kA for 3 sec or As per SEB(Whichever is higher)
FAULT LEVEL LT SIDE OF TRANSFORMER	10kA for 1 sec for Single Phase 30kA for 1 sec for Three Phase

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 19 of 32

2.0 SCOPE

2.1 SCOPE OF DESIGN & ENGINEERING

- 2.1.4 Submission of electrical equipments selection criteria & respective design calculations, inspection & test plan, installation & commissioning procedures, drawings for Review/Approval, preparation of site engineering drawings and details for installation works wherever applicable or required by the Engineer-in-charge & final commissioning reports, submit to the Engineer-in-charge for Review/Approval.
- 2.1.5 Selection & design of all HT electrical equipment shall be as per relevant Indian & International standards & contractor shall submit installation & commissioning drawings for 2-Pole structure & associated equipments approval.
- 2.1.6 Correction, updating and submission of all Owner's/Tender's drawings for as-built status.
- 2.1.7 Obtaining clearance for energizing the complete electrical facilities covered under this tender and approval of installation and drawings from the Chief Electrical Inspector of the State Government/Central Electricity Authority and other statutory authority as required. This includes equipments installed or commissioned by others within the battery limit. This is for the purpose of obtaining a comprehensive approval from competent authority.

2.2 11KV GANG OPERATED AIR BREAK SWITCH

This section covers Design, manufacturing, testing at manufacturer works and supply of 11 KV, 200 Amps, 50HZ triple pole gang operated, outdoor type, single throw, single break tilting type manually operated AB Switches suitable for vertical mounting. The A. B. Switches offered shall be complete with all components necessary for its effective and trouble-free operation along with associated equipment etc. such components shall be deemed to be within the scope of supplier's supply, irrespective of whether those are specifically brought out in the specification and/or in order or not. Also similar parts particularly removable ones shall be interchangeable.

2.3 Description of the materials

The 11KV A.B. Switch (3 Pin Type) sets shall confirm to the following parameters

a. Number of poles	3
b. Number of Post insulator per pole	3 nos. 12KV post insulator.
c. Nominal system voltage	11KV
d. Highest system voltage	12KV
e. Rated frequency	50Hz
f. System earthing effectively	Unearthed.
g. Rated nominal current	200 amps
h. Altitude of installation	Not exceeding 1000M

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)	MEC/E0086/05/E1/E/GGPL/PJS	Page 20 of 32	

The post insulators used in the A.B. Switches shall have the following ratings:-

a) One minute power frequency withstand voltage between

I)	Earth & poles	28 KV (rms)
II)	Across terminal of open switch	32 KV (rms)

Rated lightning impulse withstand voltage between

b)	Poles & Earth	75 KV (Peak)
c)	Across terminal of open switch	85 KV (Peak)

Short time current 26.2 KA for 1 second

2.4 General

The 11 KV A.B. Switch Set shall be the gang operated rotating single air break type having 3 post insulators per phase. The operating mechanism shall be suitable for manual operation from the ground level and shall be so designed that all the three phases shall open or close simultaneously. The Switches shall be robust in construction, easy in operation and shall be protected against over travel or staining that might adversely affect any of its parts. The required base M.S. Channel (hot dip galvanized) phase coupling rod, operation rod with intermediate guide braided with flexible electrolytic copper, tail piece of required current carrying capacity and operation mechanism with 'ON' & 'OFF' positions shall be provided. The operation rod shall be medium gauge of 32mm diameter nominal bore G.I. pipe single length 6 meters. The phase coupling rod for gang operation shall be of medium gauge 25mm dia nominal bore G.I. pipe. The Rating post insulators shall be provided with suitable bearing mounted on a base channel with 8mm dia thrust collar and 6mm split pin made out of stainless steel. The operating down rod shall be coupled to the spindle (minimum dia – 32mm) for gang operation through another suitable bearing by two numbers 10mm dia stainless steel bolts with double nuts. All the bearings shall be provided with grease nipple. All metal (ferrous) parts shall be galvanized an polished. The pipe shall be galvanized in accordance with IS-4736/1968. The post insulators should be fixed with the base channel using Galvanized Nuts and Bolts.

2.5 Mounting

The A.B. Switches shall be suitable for Vertical mounting in double pole sub-station structures.

2.6 Switching Blades

It shall be made out of electrolytic copper with silver plated. Contractor shall submit its size for approval. The Switch shall have such a spring mechanism so as to ensure that the speed of the opening of contact is independent of speed of manual operation.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 21 of 32

2.7 Fixed Contracts

The Fixed Jaw type female contacts shall be made of electrolytic copper (minimum 99% copper composition) duly silver coated controlled by stainless steel high pressure spring housed in robust G.I. Cover. It is essential that provision shall be made in fixed female contracts to take the shock arising from the closing of move contract blade without the same being transmitted to the post insulator.

The male and female contacts assemblies shall be of sturdy construction and design to ensure

- I) Electro dynamic withstand ability during short circuits.
- II) Thermal withstand-ability during short circuits.
- III) Constant contact pressure even when the live parts of the insulator stacks are subject to tensile stresses due to linear expansion of connected bus bar of flexible conductors either because of temperature variation or strong winds.
- IV) Self-wiping action during closing and opening.
- V) Self-alignment assuring closing of the switch without calling for any adjustment.

2.8 Arcing Horn

A set of adjustable arcing horns made from 2 SWG G. I. Wire shall be mounted on each insulator stack of G.O. Switch. The supplier shall supply a graph showing impulse and power frequency spark over voltage for various gap settings of arcing horns.

2.9 Terminal Connectors

Terminal connectors shall be robust in design. The fixed connector & movable connector shall be shall be of copper casting with uniform machine finishing duly silver plated made out of minimum 95% copper composition with 2 nos. 12mm dia holes provided with suitable brass bolts and double nuts, flat washers & 2 nos. bimetallic solder less sockets suitable upto 80 mm² conductor.

Contractor shall submit size of fixed connector & movable connector for Approval.

2.10 Spacing

The minimum clearance between phases to the switch shall be 760mm. The operation down rod shall be at a transverse distance of 300mm from the outer limb of the switch. The centre spacing between two post insulator of the same phase shall be 380mm. In the open position of the A.B. switches the moving blade shall rotate through 90°. This shall be exhibited in the drawing.

2.11 Name Plates

The switches shall be provided with a nameplate, which contains the information in accordance with IS-9921 (part I to V). The name plates will be weather & rust proof.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 22 of 32

2.12 Completeness of Equipment

All fittings, accessories or apparatus which may not have been specially mentioned in this specification but which are otherwise necessary for satisfactory working of G.O. switches shall be deemed to have been included in the scope of supply.

2.13 Packing & Transportation

The supplier shall be responsible for suitable packing of all the material and marking on the consignment to ensure correct dispatch to the destination. All G.O. Switches shall be packed suitably capable of withstanding rough handling for transportation to the various consignees so as to avoid any shortage and damage occurring during transit. Separators shall be fixed between the post insulators and other breakable parts of GO Switch and also between individual GO Switches so as to prevent relative movement to avoid damage. All the labels used on each packing shall be of tin securely bounded with wire and shall have the descriptive marking stamped thereon. All GO Switches damaged during transportation shall be to the suppliers account.

2.14 TEST & TEST CERTIFICATE

Type Test

Certificate for the following type tests conducted on a prototype set of A.B. Switch in a NABL approved test house/CPRI shall have to be submitted along with offer.

Dielectric Test (impulse and one minute were power frequency withstand voltage test.)

- Temperature rise test (for contracts and terminals)
- Shorts Time current and peak withstand current test.
- Mainly active load breaking capacity test.
- Transformer off-load breaking capacity test.
- Line charging breaking capacity test.
- Cable charging breaking test.
- Operation and mechanical endurance test.
- Mechanical strength test for post insulator, as per IS-2444/1937 shall be furnished.
- Test for galvanization of metal (ferrous) parts.

Routine /Acceptance Test

The following routine tests shall have to be conducted on each set by Owner/Third Party agency of the materials at the works of the manufacturer as per relevant IS/IEC. The supplier shall give fifteen days advance intimation to the Purchaser to enable him to depute his representative for witnessing the tests.

1. Power frequency voltage dry test.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 23 of 32

2. Measurement of resistance of main circuit.
3. Tests to prove satisfactory operation.
4. Dimension Check
5. Galvanization test.
6. Operational test.

3.0 DROP OUT FUSES

The D.O. Fuses are intended for use on Distribution transformers for protection/isolation of the same during overload or fault conditions of lines. The drop out fuse shall conform to IS: 9385 (Part-I to III) as amended from time to time.

The drop-out fuses shall be expulsion type. The equipment offered by the tenderer shall be suitable for 11KV, 3 Ph 50 Hz solidly grounded earthed neutral systems. It shall be designed for a normal current rating of 200 Amps.

The drops out fuses are required with Post Insulators. These shall be suitable for mounting on the structure. The bracket/channel hardware's for D.O. Fuses shall be provided with adequate sizes of nuts, bolts and washer for mounting on the structures of the purchaser.

3.1 POST INSULATORS

Each 11 KV D.O. Fuse shall have two nos. 11 KV Post Insulators. The insulators shall conform to IS: 2544 of 1973 with latest amendments. The porcelain used for manufacture of D.O. Fuse shall be homogeneous, free from flaws or imperfections that might effect the mechanical or dielectric strength adversely. They shall be thoroughly vitrified tough and impervious to moisture. The glazing of the porcelain shall be of uniform brown colour free from blisters, burns and other similar defects. Insulators of the same rating and type shall be interchangeable.

The porcelains and metal parts shall be assembled in such a manner that any thermal expansion differential between the metal and porcelain parts through range of temperature variation shall not loosen parts or create undue internal stresses which may affect the electrical or mechanical strength and rigidity. Each cap and base pin shall be made of high grade cast steel or malleable steel casting and they shall be machine faced and smoothly galvanized. The cap and base shall be properly cemented with insulators to give perfect grip. Excess use of cement shall be avoided.

Each 11KV Post Insulators should have technical particulars as detailed below:-

	11KV
(i) Nominal system voltage KV (rms)	11
(ii) Highest system voltage KV (rms)	12
(iii) Dry Power Frequency one KV (rms) minute Withstand voltage	35
(iv) Power Frequency puncture KV (rms) Voltage 1.3 times the actual dry	

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 24 of 32

		Flashover voltage
(v)	Impulse withstand voltage KV (rms)	75
(vi)	Visible discharge voltage KV (rms)	9
(vii)	Creepage distance in mm (minimum)	320
(viii)	Cantilever strength (KN)	6.60

As stated above unless otherwise modified in this specification the drop out fuse shall conform to IS: 9385 (Part-I to III) and as amended from time to time.

The rated lightning impulse withstand voltage for positive and negative polarities shall be as given below:-

11KV

a) To earth and between pole	75 KV Peak
b) Across the isolating distance of fuse base	85 KV Peak

Rated one minute power frequency withstand voltage (dry and wet) values for the fuse base-
11KV

a) To earth and between pole	28 KV Peak
b) Across the isolating distance of fuse base	32 KV Peak

3.2 RATED BREAKING CAPACITY

The rated breaking capacity shall be 8KA (symmetrical). Bidder shall submit type test reports/certificates of DO fuses along with offer.

3.3 MAIN CONTACTS

The main contacts of the D.O. Fuse shall be suitable for heavy duty, properly aligned, made from Brass material. These shall have good finish and smooth surface and shall be silver plated. All the sharp edges shall be rounded off. These contacts shall be so designed to withstand highest short circuit breaking current that may be encountered during service. In nut-shell the contact assembly shall ensure:-

- Electrodynamics withstand ability during short circuit without any risk of repulsion of contact.
- Thermal withstand ability during short circuits.
- Constant contact pressure even when the lower parts of the insulator stacks are subjected to tensile stresses due to linear expansion of connected bus bar or flexible conductors either because of temperature variation or strong winds.
- Proper alignment to ensure smooth operation of D.O. Fuse without adjustment.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 25 of 32

3.4 CONNECTORS

The connectors shall be made from Brass suitable for ACSR/AAAC Squirrel/Weasel & Rabbit, Raccoon & Dog. The connectors should be bolted type having 4 bolts & groove to hold the conductor. All brass parts should be silver plated for corrosion resistance and efficient current flow. All ferrous parts should be hot dip galvanized as per the latest version of IS: 2633. Nuts and bolts shall conform to IS: 1364 and should be hot dip galvanized. Spring washer should be electro galvanized.

3.5 FLY NUTS

These shall be provided at both the ends of Epoxy Resin Fiber Glass (ERFG) tube for tightening the fuse element. The nut shall be provided with one flat washer of 1 mm thickness. The arrangement shall be made to ensure that the fuse wire runs centrally inside the ERFG tube after tightening. The fly nuts should have at least 4 threads with adequate wall thickness.

3.6 SPRING STRIPS

The spring strips shall be of phosphor bronze multi line brush type having a high pressure contacts and should retain its tension under minimum continuous service current of 200 Amps at 90° C.

3.7 Completeness of Equipment

All fittings, accessories or apparatus which may not have been specially mentioned in this specification but which are otherwise necessary for satisfactory working of DO fuses shall be deemed to have been included in the scope of supply.

3.8 D.O. BARRELS (CARRIER TUBES):-

The carrier tube made of Epoxy Resin Fibre Glass (ERFG) and conforming to the following specification shall be used for 11KV D.O Sets:-

GENERAL:-

This specification governs the requirement for an electrical grade tube with good mechanical and high heat resistance properties, made from fine woven glass fibre cloth, impregnated with epoxy resin. Tube shall be well consolidated of circular cross section and uniform wall thickness with ends trimmed smoothly at right angles to the axis of the tube. The external surfaces shall be brown in colour and shall be uniformly finished with polyuret and varnish or epoxy resin. The tube has a temperature index of at least 155°C.

APPLICATION- Used as fuse carrier in 11KV Drop out Fuses.

COMPLIANCE WITH- Indian Standard Specification no.10192

4.0 LIGHTNING ARRESTOR

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)	MEC/E0086/05/E1/E/GGPL/PJS	Page 26 of 32	

The section covers the design, manufacture, shop testing before dispatch, supply, delivery, erection, testing & commissioning of 9 KV, static class heavy rating, gapless, metal (zinc) oxide lighting arrestors complete along with clamps, complete fitting and accessories for installation on outdoor type 11 kV Double pole structure.

System parameters

(i)	Nominal system voltage	11Kv
(ii)	Highest system voltage	12Kv
(iii)	System earthing	Effectively earthed system
(iv)	Frequency (Hz)	50
(v)	Lightning Impulse withstand Voltage (kVP)	75
(vi)	Power frequency withstand Voltage (kv rms)	28
(vii)	Arrestors duty	
	-Connection to system	Phase to earth
	-Type of equipment to be protected	11 KV transformers & Switchgear

4.1 Lighting Arrestors

(i)	Type	Gapless Metal oxide – outdoor
(ii)	Arrestor rating (KV rms)	9
(iii)	Continuous Operating voltage (kv rms)	7.65
(iv)	Nominal discharge Current:	5 Rating (KA)
(v)	Long Duration discharge class	Distribution Class
(vi)	Degree of protection	IP 55
(vii)	Maximum residual voltage at 5 KA (KV peak)	32
(viii)	Maximum switching lighting residual	24 Voltage (kVp) at 1Ka
(ix)	Partial discharge at 1.05 COV not greater than (PC)	50
(x)	High current impulse withstand voltage	100 at 65 kA (kVp)

4.2 Insulator Housing

(i)	Power frequency withstand test voltage (Wet) (kv rms)	28
(ii)	Lighting impulse withstand / tests voltage (kVP)	75
(iii)	Creep age distance not less than	320
(iv)	Pressure relief	class B

4.3 General Requirement

The equipment along with all accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system as specified in the bid documents.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 27 of 32

The lighting arrestor shall be provided with line and earth terminals of suitable size & lightning counter. The line side terminal shall be suitable for AAA conductor or ACSR weasel / rabbit conductor.

- i) The metal oxide gap less Lighting Arrestor without any series or shunt gap shall be suitable for protection for 11KV side of Distribution Transformers, associated equipment from voltage lightings resulting from natural disturbance like lightning as well as system disturbances.
- ii) The lighting arrestor shall draw negligible current as operating voltage and at the same time offer least resistance during the flow or lighting current.
- iii) The lighting arrestor shall consist of non-linear resistor elements placed in series and housed in electrical grade porcelain housing / silicon polymeric of specified creep age distance.
- iv) The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.
- v) The lighting arrestor shall be provided with line and earth terminal of suitable size. The ground side terminal of lighting arrestor shall be connected with 25x6 mm galvanized strip.
- vi) The lighting arrestor shall not operate under power frequency and temporary over voltage conditions but under lighting conditions, the lighting arrestor shall change over to the conducting mode.
- vii) Lighting arrestors shall have a suitable pressure relief system to avoid damage to the porcelain / silicon polymeric housing and providing path for flow of rated fault currents in the event of arrestor failure.
- viii) The reference current of the arrestor shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.
- ix) The Lighting Arrestor shall be thermally stable and the supplier shall furnish a copy of thermal stability test along with the bid.

4.4 Arrestor Mounting

The arrestors shall be suitable for mounting on 4 pole/2 pole structure used for plinth mounted transformer and for incoming and outgoing lines.

4.5 Fittings & Accessories

- x) The lighting arrestor shall be complete with insulating bases, fasteners for stacking units along with clamp & terminal connectors and inbuilt disconnecter.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)	MEC/E0086/05/E1/E/GGPL/PJS	Page 28 of 32	

- xi) The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The top metal cap and base of lightning arrestor shall be galvanized. The line terminal shall have a built in clamping device, which can be adjusted for both horizontal and vertical take off.

4.6 Drawings, Documents and Design Calculations

Bidder to submit followings along with the bid:

- i) Sectional drawings
- ii) Mounting arrangement

4.7 Completeness of Equipment

All fittings, accessories or apparatus which may not have been specially mentioned in this specification but which are otherwise necessary for satisfactory working of Lightning Arrestor shall be deemed to have been included in the scope of supply.

4.8 Name Plate

The nameplate attached to the arrestor shall carry the following information:

- Rated Voltage
- Continuous Operation Voltage
- Normal discharge current
- Pressure relief rated current Manufacturer Trade Mark
- Year of Manufacture
- Name of Scheme

DANGER CAUTION BOARDS: The danger of caution boards shall have to be displayed on pole and transformer

4.9 Tests

Test on Lighting Arrestors

The lighting Arrestors offered shall be type tested from NABL accredited laboratory. Copies of test certificates shall be furnished by the bidder for scrutiny. Routine and Acceptance tests shall be carried out in accordance with IS: 3070 (Part-3)-1993. The purchaser representative will witness the acceptance test at the works of manufacturer. The suitability of the Lighting Arrestors shall also be established from the following:

- Residual voltage test
- Reference voltage test
- P.D. test

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)	MEC/E0086/05/E1/E/GGPL/PJS	Page 29 of 32	

- Sealing test
- Thermal stability

Metal oxide block shall be tested for guaranteed specific energy capability in addition to routine / acceptance test as per IEC / IS.

- i) The maximum residual voltages corresponding to nominal discharge current of 5 kA for steep current, impulse residual voltage test, lightning impulse protection level and switching impulse level shall generally conform to relevant IS.
- ii) The suppliers shall furnish the copies of the type tests and the characteristics curves between the residual voltage and nominal discharge current of the offered lighting arrestor and power frequency voltage v/s time characteristic of the lighting arrestor subsequent to impulse energy consumption as per clause 6.6 of IS ; 3070 (Para-3) offered along with the bid.
- iii) The lighting arrestor housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS: 2071.

5.0 AREA CLASSIFICATION

Hydrocarbon handling areas have been generally classified as zone 1&2, gas group IIA/IIB as per IS: 5572, API RP-500, OISD - 113 and IP Rules. All equipments to be installed in these areas shall be suitable for the area classification with temperature class T3 (200°C), CMRI testing and approved by CCOE, DGFAS and having BIS license.

6.0 JOB SPECIFICATIONS

Various electrical works covered under this contract like equipment erection, cabling and grounding works, etc. shall be performed in accordance with specifications attached with this tender. (Certain clauses of specifications, which are applicable to equipments or system not covered under this contract, shall not be applicable).

Erection and commissioning of certain special HT equipments shall be performed in accordance with supplier's instructions and directions of the Engineer-in-charges under supervision by equipment supplier/s.

The equipments/materials to be supplied by the contractor shall conform to the requirements of the applicable specifications enclosed in the tender document.

7.0 STATUTORY APPROVAL OF WORKS

All works relating to statutory approvals of the complete installation, from competent authority like CEA, DGMS, State Electricity Authority/Board etc, shall be in the scope of contractor.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 30 of 32

The application on behalf of the owner for submission to Electrical Inspector / DGMS etc. along with copies of required certificates and drawings, complete in all respects, shall be prepared by the contractor and submitted to the Engineer-in-charge for onward transmission well ahead of time so that the actual commissioning of equipment are not delayed for want of inspection by the Electrical Inspector / DGMS. The actual Liaison work shall be arranged by the Contractor and necessary coordination and liaisons work in this respect shall be responsibility of the contractors. However, the Owner on submission of bills along with documentary evidence shall reimburse any fee paid to the statutory Authority in this regards.

8.0 MAKES OF EQUIPMENTS AND MATERIALS

All equipments / materials supplied by the contractor shall be as per the list of approved makes enclosed with this document subject to submission of Certification and approvals.

9.0 QUALITY ASSURANCE, INSPECTION AND TESTING

- 9.1 The equipment shall be inspected by the Owner and/or their inspection agency at the manufacturer's works prior to despatch. The equipment will be inspected as per the tests pre-identified in the approved QAP to ensure conformity of the same with relevant approved drawings, data sheets, specifications, National/International standards.
- 9.2 Performance tests of any equipments which cannot be conducted/demonstrated either partially or wholly at the manufacturer's work, shall be conducted after erection at site in the presence of Owner & their inspection agency. In all the cases, prior approval of the approval shall be obtained.
- 9.3 In case of waiver category of items, the same shall be pre identified. For such items, the contractor shall furnish necessary certificates, test reports etc for Review/Approval to Owner/Inspection agency. The issue of Inspection Certificate/Waiver Certificate for any equipment or component there of does absolve the contractor from his contractual obligations towards subsequent satisfactory performance of the equipment at site. Should any equipment be found defective, In whole or part thereof after receipt at site or during erection/commissioning and testing shall be Rectified/Changed by contractor free of cost.
- 9.4 Contractor shall submit test plan for the equipments with four week advance notice.

10.0 TESTING & COMMISSIONING

- 10.1 The successful tenderer shall submit detailed site testing & commission procedure with time schedules for Review/Approval to Owner/MECON.
- 10.2 The successful tenderer shall provide adequate supervisory/ skilled personnel and all tools and tackles, testing equipment and instruments required for complete checking of installations and testing and commissioning of all equipment and accessories.

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)		MEC/E0086/05/E1/E/GGPL/PJS	Page 31 of 32

- 10.3 All the tests shall be conducted in the presence of Owner/ Engineer-in-charge or his authorized representative unless he waives this requirement in writing.
- 10.4 The testing and commissioning of all equipment under the scope of the tenderer shall be carried out in accordance with the latest edition of relevant Indian Standards and IE Rules.
- 10.5 Test reports shall be submitted in required number of copies duly signed by the **TENDERER** to **MECON** and **OWNER**.
- 10.6** All equipment after testing shall be energized only after certification by the qualified testing engineer that the equipment is ready for energisation and with \ the concurrence of **OWNER / MECON**.
- 10.7 After the completion of all tests and rectification of all defects pointed out during final inspection, plant start-up trials would be commenced. During the start-up trials contractor shall provide skilled / unskilled personnel and supervision round the clock at his cost. The number and category of workmen and duration up to which required, will be decided by the Engineer-in-charge. Any defects noticed during the start-up trial relating to the equipment supplied and work carried out by the Contractor, will be rectified by the contractor at his own cost.
- 10.8 On successful completion of erection of each item /equipment, a final inspection will be carried out at site by **Owner / MECON**, for correctness and completeness of erection.
- 10.9 Any work not conforming to the execution drawings, specifications or codes shall be rejected forthwith and the contractor shall carry out the rectification at his own cost.
- 10.10 After the operating conditions are fully achieved in the plant and the other requirements as stated in the General Conditions of Contract are fulfilled, the contractor would be eligible for applying for a completion certificate.
- 11.0 DRAWINGS, STANDARD SPECIFICATIONS AND INSTALLATION STANDARDS**
- 11.1 Following minimum information shall be furnished with bid:
- Type test reports of GO-AB, DO Fuse, Lightning arrestors, Insulators etc.
- 11.2 Following Drawings & Documents shall be submitted after award of contract for approval:
- Filled-Up Data sheet
 - GA of Double pole structure with equipment mounting arrangement with dimensions.
 - Earthing schedule of DP structure.
- 11.3 The equipments / materials to be supplied by the contractor shall conform to the requirements of the applicable specifications. Also the installation of various material / equipment shall

	Electrical Section, Delhi	MECHANICAL & ELECTRICAL WORKS TENDER FOR DAUGHTER BOOSTER CNG STATIONS IN EAST GODAVARI & WEST GODAVARI DISTRICTS	
PARTICULAR JOB SPECIFICATION (HT WORKS)	MEC/E0086/05/E1/E/GGPL/PJS	Page 32 of 32	

conform to the installation standards /norms.

- 11.4 The drawings accompanying the tender documents when read with specification shall depict the electrical system of the Terminal. These are indicative of the nature of work and issued for tendering purposes only. Purpose of these drawings is to enable the tendered to make an offer in line with the requirements of the Owner. Construction shall be as per drawings / specifications issued / approved by the Engineer-in-charge during the course of execution of work.
- 11.5 After the job completion, contractor shall prepare AS-BUILT drawings and documents, submit catalogues/manuals (O&M) of major brought out items like HT Substation, Transformers, LA, AB switch etc. Final certified As-Built drawings, documents and manuals etc shall be submitted by the contractor to owner in bound volume with one set in soft copy (CD) plus five sets of prints.

Training

Contractor shall train the work force of Owner with his technical and supervisory personnel for safe, efficient operation and maintenance of the equipment and system installed by the contractor. The Number of personnel to be trained and the duration and structure of the training shall be mutually discussed and finalized.

-X-X-X-

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 1 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS

1. Air Circuit Breaker

- 1) ABB Ltd
- 2) Siemens Ltd
- 3) Schneider
- 4) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 5) GE (General Electric)
- 6) C&S ELECTRIC LIMITED NOIDA
- 7) BCH ELECTRIC LIMITED NEW DELHI
- 8) HAVELLS INDIA LIMITED
- 9) NOVATEUR ELECTRICAL AND DIGITAL SYSTEM PVT. LTD.

2. Auxiliary Relays/Contactors

- 1) ABB Ltd
- 10) Siemens Ltd
- 11) Schneider
- 12) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 13) GE (General Electric)
- 2) Areva T&D India Ltd. (T&D Group)
- 3) BCH
- 4) Phoenix Contact India Pvt Ltd
- 5) Rockwell Automation
- 6) HAVELLS INDIA LTD
- 7) C&S ELECTRIC LTD
- 8) PROK DEVICES PVT LTD
- 9) NOVATEK ELECTRO INDIA LTD
- 10) WAGO PRIVATE LIMITED

3. Automatic Transfer Switch

- 1) Russelectric.
- 2) Schnieder.
- 3) Caterpillar
- 4) Siemens Ltd
- 5) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 6) ABB Ltd

4. Air Conditioner (Split/Window)

- 1) O General
- 2) Daikin
- 3) Hitachi
- 4) Carrier
- 5) Voltas
- 6) Samsung
- 7) Blue Star
- 8) Mitsubishi

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 2 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

5. AC / DC Clamp meter

1. Rishab Instruments
2. Fluke
3. Motwane
4. MECO instruments

5. Buchholz Relay

- 1) AJ Services
- 2) ATVUS Industries

6. Bus Ducts (M.V.- NSPBD)

- 1) Schneider Electric India Pvt. Ltd.
- 2) C&S Electric Ltd
- 3) Enpro Engineering
- 4) Stardrive Busducts Pvt. Ltd.
- 5) ABB Ltd.
- 6) Siemens Ltd.
- 7) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 8) Spearhead Busduct Pvt Ltd.
- 9) M.K.Engineer & Control Pvt Ltd
- 10) Ishaani Electronic Pvt Ltd
- 11) KGS
- 12) ECC
- 13) BHEL
- 14) A C POWER SYSTEM KOLKATA
- 15) NOVATEUR ELECTRICAL AND DIGITAL SYSTEM PVT. LTD. (Legrand brand)

7. Bus Ducts (M.V.- SANDWICH)

- 1) Schneider Electric India Pvt. Ltd.
- 2) C&S Electric Ltd
- 3) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 4) ABB Ltd.
- 5) Siemens Ltd.
- 6) VDEAL SYTEM LIMITED (Schneider Sandwich type design)

8. Bimetal Relays

- 1) ABB Ltd
- 2) BCH
- 3) C&S Electric Ltd
- 4) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 5) Schneider Electric India Pvt. Ltd.
- 6) Siemens Ltd
- 7) GE (General Electric)
- 8) Andrew Yule

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 3 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

9. Batteries (Lead Acid)

- 1) AMCO Batteries Ltd.
- 2) Exide Industries Ltd.
- 3) HBLNIFE Power System Ltd.
- 4) Amara Raja Batteries Ltd.
- 5) Panasonic

10. Batteries (Nickel Cadmium)

- 1) Amco Batteries Ltd.
- 2) HBLNIFE Power Systems Ltd.

11. Batteries Charger/DC-DC Converter/DC UPS

- 1) Amara Raja Power System(P)Ltd.
- 2) Chhabhi Electricals Pvt. Ltd.
- 3) Caldye Automatics Limited
- 4) HBL Power Systems Ltd.
- 5) Vertiv Energy Private Limited
- 6) Statcon Energias Pvt limited, Noida
- 7) Signatron (India) Pvt Limited, Kolkata
- 8) Universal Instruments Mfg Co Pvt Ltd, Bangalore
- 9) Sherene Electro Control
- 10) Servilink Engineers Pvt Ltd.
- 11) Live Line Electronics
- 12) Cloride controls
- 13) Ishaani electronics Pvt Ltd
- 14) Hitachi Hirel Power electronics Pvt Ltd

12. Cable – HT(XLPE)

- 1) Universal Cable Ltd.
- 2) KEI Industries Ltd.
- 3) NICCO Corporation Ltd.
- 4) Uniflex (Apar Industries Ltd)
- 5) Polycab.
- 6) Torrent
- 7) Gemscab Industries Ltd.
- 8) Paramount Cables
- 9) Havells India Ltd.
- 10) Chandresh Cables Ltd, Ahmedabad (Avocab)
- 11) Asian Cable
- 12) Finolex
- 13) Lapp
- 14) GLOSTER CABLES LIMITED
- 15) PARAMOUNT COMMUNICATIONS LIMITED
- 16) STERLITE POWER TRANSMISSION LIMITED
- 17) R R KABEL LTD
- 18) V-MARC INDIA LIMITED

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 4 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

13. Cable – LT Power and Control

- 1) Universal Cable Ltd.
- 2) KEI Industries Ltd.
- 3) Havells India Ltd.
- 4) Delton
- 5) Finolex Cables
- 6) RPG Cables/KEC International
- 7) Elkay Tele links (Signal & Control cable)
- 8) Ecko cables pvt ltd, New Delhi
- 9) Ravin
- 10) Rallison (LKB Engineering Pvt Ltd)
- 11) Netco Cable
- 12) Uniflex (Apar Industries Ltd)
- 13) Paramount Cables
- 14) Gloster Cable Ltd
- 15) Associated cables Pvt Ltd.
- 16) CMI
- 17) Gemscab
- 18) NICCO
- 19) Polycab
- 20) Torrent Power
- 21) Suyog Cables
- 22) Tortek India Pvt Ltd, Gurgaon
- 23) Ultracab India Limited, Rajkot
- 24) Special Cables Pvt Ltd, Delhi
- 25) Cords Cable Industries Ltd, New Delhi
- 26) Chandresh Cables Ltd, Ahmedabad (Avocab)
- 27) LUMINO INDUSTRIES LIMITED Kolkata
- 28) BMI Cables Pvt Ltd (FRLS type Signal & Control cable)
- 29) Nangalwala Industries (P) Ltd Alwar
- 30) Insucon Cables & Conductors Pvt Ltd
- 31) Dynamic Cables Pvt Ltd
- 32) Ravi Industries
- 33) Suraj Cables
- 34) Polyvion Cables Pvt.Ltd
- 35) R R Kabel Ltd
- 36) Centurion Power Cables Pvt. Ltd
- 37) V-Marc India Ltd
- 38) Shyam Cables India Pvt.Ltd
- 39) Bonton Cables India Pvt. Ltd

14. Cable – Fire Alarm & Communication Cables

- 1) Cords Cable Industries Ltd.
- 2) CMI
- 3) Delton cables Ltd.
- 4) ELKAY Telelinks
- 5) KEI Industries Ltd.

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 5 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 6) Reliance Engineers Ltd.
- 7) RR Kabel Ltd.
- 8) SBEE Cable (India) Ltd.
- 9) T.C Communication Pvt Ltd
- 10) Paramount Cables
- 11) APAR Industries.

15. Cable – Gland

- 1) Baliga
- 2) Commet
- 3) Flexpro
- 4) Flameproof
- 5) FCG
- 6) Electro Werke
- 7) Dowels
- 8) CCI
- 9) Cleon Optobiz Pvt Ltd (Stokes)
- 10) Sigma Industries
- 11) Polycab India Limited.

16. Cable – Lugs

- 1) Dowels
- 2) Jainson
- 3) Ismal
- 4) Conenctwell
- 5) Commet
- 6) Phoeinex
- 7) Cleon Optobiz Pvt Ltd (Stokes)
- 8) Sigma Industries
- 9) Polycab India Limited.

17. Cable Termination and Jointing Kit

- 1) CCI
- 2) Raychem RPG
- 3) M-Seal
- 4) REPL
- 5) 3M
- 6) Cabseal
- 7) Densons
- 8) Yamunagases
- 9) Gala Shrink Fit, Mumbai.

18. Cable Trays

- 1) Ercon Composites
- 2) Yamuna Power & Infrastructure Ltd.
- 3) Sumip Composites Pvt Ltd Ahmedabad (For FRP only)
- 4) Advance Power Products Kolkata
- 5) Durga Techno Industries, Kolkata

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 6 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 6) Rukmani Electrical & Components Pvt Ltd, Hoogly
- 7) Elecon Cable trays Pvt Ltd, Pune
- 8) Indiana Grating Pvt Ltd.
- 9) Aditya Steel Industries
- 10) Profab
- 11) Techno fab
- 12) Patny Systems Pvt Ltd
- 13) BEC Conduits Pvt Ltd.

19. Capacitors

- 1) ABB Ltd
- 2) BHEL, Bhopal
- 3) Shreem Capacitors Pvt. Ltd.
- 4) Universal Cables Ltd.
- 5) CG Power & Industrial Solutions Ltd.
- 6) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 7) TDK India Pvt. Ltd (Epcos).

20. Contactors (LV/MV)-Power

- 1) ABB Ltd
- 2) BCH
- 3) C&S Electric Ltd
- 4) GE (General Electric)
- 5) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 6) Schneider Electric India Pvt. Ltd.
- 7) Siemens Limited
- 8) CG Power & Industrial Solutions Ltd.
- 9) BHEL
- 10) Havell's
- 11) Andrew Yule
- 12) Novateur Electrical and Digital System/Legrand.

21. Control Transformer

- 1) AE
- 2) Indushree
- 3) Intra Vidyut
- 4) Kalpa Elektrikals
- 5) Indcoil Transformers pvt ltd
- 6) Transpower Industries Ltd.
- 7) Siemens Ltd
- 8) ABB Ltd.
- 9) GE (General Electric)
- 10) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 11) Accord Electro Power
- 12) Kappa
- 13) BCH

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 7 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 14) Pragati
- 15) Precise
- 16) Jyothi
- 17) Voltamp
- 18) Unitech Transformers
- 19) Universal Magnetic

22. Conduit (Heavy duty -PVC /GI)

BIS approved

23. Current Transformer/ Potential Transformer

- 1) ABB Ltd
- 2) Pragati
- 3) SEIL
- 4) Siemens Ltd
- 5) ECS
- 6) Jyoti
- 7) CG Power & Industrial Solutions Ltd.
- 8) Kappa
- 9) Intravidhyut
- 10) Jayshree
- 11) Precise
- 12) Schneider
- 13) AE
- 14) Silkaans
- 15) BHEL
- 16) Newtek Electricals
- 17) Reco Transformer Private Ltd

24. Digital Multimeter

- 1) MECO instruments
- 2) Rishab Instruments
- 3) Fluke
- 4) Motwane

25. Distributed or Flex I/O system

- 1) Rockwell
- 2) Siemens Ltd
- 3) GE Industrial India Pvt Ltd
- 4) Schneider
- 5) ABB Ltd

26. Diesel Generator Set- Alternator

- 1) Stamford
- 2) CG Power & Industrial Solutions Ltd.

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 8 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 3) Kirloskar
- 4) ABB Ltd
- 5) BHEL
- 6) Mecc Alte
- 7) Leroy-Somer
- 8) Toyo- Donki
- 9) Caterpillar
- 10) Brush

27. Diesel Generator Set- Battery Charger

- 1) NHP
- 2) Meanwell
- 3) Cummins
- 4) Sedemac
- 5) Ge's Zenith

28. Diesel Generator Set- PLC for AMF Panel

- 1) Siemens Ltd
- 2) Rockwell
- 3) Schneider
- 4) ABB Ltd
- 5) GE (General Electric)
- 6) Woodward
- 7) Phoenix Contact

29. Diesel Generator Set- Level Gauge

- 1) Levcon
- 2) Chemtrol
- 3) Bliss Anand
- 4) Sigma
- 5) Pune Techtrol
- 6) General Instruments
- 7) Gauges Bourdon India Pvt Ltd
- 8) Baumer Technologies India Pvt Ltd

30. Diesel Generator Set- Level Transmitter

- 1) Emerson,
- 2) E+H
- 3) Siemens Ltd
- 4) Magnetrol
- 5) Dresser
- 6) Honeywell
- 7) Yokogawa
- 8) Trumen Technologies Pvt Ltd

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 9 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

31. Diesel Generator Set- Engine

- 1) Cummins
- 2) Caterpillar
- 3) KOEL (Kirloskar)
- 4) Greaves Cotton
- 5) Perkins UK
- 6) Mitsubishi
- 7) Ashok Leyland
- 8) MTU Germany
- 9) Volvo Penta Sweden

32. Exhaust Fan/ Ceiling Fan/Pedestal Fan/Wall mounted fan

- 1) Havells
- 2) CG Power & Industrial Solutions Ltd.
- 3) GE (General Electric)
- 4) Airovient
- 5) PowerVent
- 6) Bajaj
- 7) Khaitan
- 8) Cinni
- 9) Ventwell
- 10) Usha
- 11) Orient
- 12) Polycab India Ltd

33. Earth tester

- 1) Fluke
- 2) Rishabh
- 3) Kyoritsu
- 4) Mc Miller
- 5) Motwane
- 6) Megger
- 7) WACO

34. Earthing Material

- 1) Rukmani Electrical & Components Pvt Ltd.
- 2) Jef Techno solution pvt ltd.
- 3) Advance Power Product, Kolkata.
- 4) KASA Technologies Ltd
- 5) Dehn India Pvt Ltd (new from lighting)
- 6) OBO Bettermann India (new from lightning)
- 7) Cape Electric Pvt Ltd

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 10 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

35. Fuses

- 1) GE (General Electric)
- 2) Indo Asian Fusegear Ltd.
- 3) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 4) Siemens Ltd
- 5) Cooper Bussman India Pvt Ltd
- 6) Havells
- 7) Standard
- 8) BCH
- 9) C&S Electric Ltd

36. Fuse Switch Combination

- 1) ABB Ltd
- 2) C&S Electric Ltd
- 3) Havells
- 4) Indo Asian Fusegear Ltd.
- 5) L&T/
- 6) Schneider Electric India Pvt. Ltd.
- 7) Siemens Ltd.
- 8) GE (General Electric)
- 9) Standard Electricals Ltd
- 10) BCH
- 11) CG Power & Industrial Solutions Ltd.

37. Flexible wires- fire resistant type

- 1) Finolex
- 2) Polycab
- 3) Havells
- 4) Anchor by Panasonic
- 5) RR Kabel
- 6) KEI
- 7) Paramount
- 8) Universal
- 9) Delton
- 10) Rajanigandha Cables Pvt. Ltd Kolkata
- 11) Chandresh Cables Ltd, Ahmedabad (Avocab)
- 12) Gupta Power Infrastructure Limited Bhubaneswar
- 13) ECKO Cables Pvt Ltd
- 14) Special Cables Pvt Ltd
- 15) PI Square Cables Pvt Ltd
- 16) NITCAB Electric India Pvt Ltd, Ranchi
- 17) Suraj Cable, Delhi
- 18) LKB Engg pvt ltd, Delhi (Rallison)
- 19) Gemscab
- 20) INCAB

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 11 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 21) KALINGA
- 22) RAVICAB
- 23) Sbee cables (india) limited Bangalore
- 24) Gloster cables limited Secunderabad
- 25) Polyvion cables pvt.ltd New delhi
- 26) Shyam cables india pvt.ltd Noida
- 27) Bonton cables india pvt. Ltd
- 28) Akg plastics private limited Noida
- 29) Apar industries limited

38. Flame Proof LDB's/ JB,s/Control Station/ switches/Receptacles/Hand Lamps/Lighting Fixtures

- 1) FCG
- 2) Sudhir Switchgears Pvt Ltd
- 3) Ex-Protecta, Anand
- 4) Prompt Engineering Works
- 5) Flame Proof Equipments pvt. Ltd Mumbai
- 6) Baliga Lighting Equipments Pvt. Ltd.
- 7) Flexpro Electricals Pvt. Ltd, Navsari
- 8) CG Power & Industrial Solutions Ltd.
- 9) Shyam Switchgears Pvt Ltd
- 10) Turn point (For FLP Lighting fixture only)

39. HV Isolator Indoor/ Outdoor

- 1) Elpro International Ltd.
- 2) Panickker Switchgear Ltd.
- 3) S&S Power Switchgear Ltd.
- 4) Siemens Ltd
- 5) Schneider Electric India Pvt. Ltd. (Brand Lauritz Knudsen, up to 11 KV)
- 6) A Bond Strand
- 7) ABB Ltd
- 8) BHEL
- 9) CG Power & Industrial Solutions Ltd.
- 10) Oblum

40. HV Vacuum Contactors

- 1) ABB Ltd
- 2) Siemens Limited
- 3) Schneider
- 4) CG Power & Industrial Solutions Ltd.
- 5) Rockwell
- 6) BHEL
- 7) Andrew Yule
- 8) Jyoti
- 9) Megawin

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 12 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

41. HV Vacuum Breaker

- 1) ABB Ltd
- 2) Siemens Limited
- 3) Schneider
- 4) CG Power & Industrial Solutions Ltd.
- 5) BHEL
- 6) Megawin
- 7) Schneider Electric India Pvt. Ltd. (Brand Lauritz Knudsen, up to 11 KV)

42. High Voltage PCC/ MCC panels (Up to 33kV)

- 1) BHEL
- 2) Siemens Ltd
- 3) Schneider
- 4) CG Power & Industrial Solutions Ltd.
- 5) ABB Ltd
- 6) Schneider Electric India Pvt. Ltd. (Brand Lauritz Knudsen, up to 11 KV)
- 7) Andrew Yule
- 8) Jyoti
- 9) Megawin

43. High Mast

- 1) Bajaj Electricals Limited
- 2) CG Power & Industrial Solutions Ltd.
- 3) Philips India Limited
- 4) Surya Roshani
- 5) Transrail
- 6) Utkarsh India Limited, Kolkata
- 7) Sigma Search lighting ltd
- 8) Energygreen Technopower Private Limited Bhopal

44. Load Break Switches (HV Indoor)

- 1) Panickker Switchgear Ltd.
- 2) Siemens Ltd.
- 3) ABB Ltd
- 4) Schneider
- 5) CG Power & Industrial Solutions Ltd.
- 6) BHEL
- 7) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)

45. Industrial grade managed switches

- 1) Hirschman-Belden
- 2) Moxa
- 3) Allied Telesis
- 4) Alcatel
- 5) Phoenix
- 6) Garretcom

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 13 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 7) Siemens Ltd
- 8) Cisco
- 9) Ruggedcom
- 10) Schneider
- 11) IS5
- 12) Oring

46. Indicating Meters

- 1) ABB Ltd
- 2) Siemens Ltd
- 3) ENDRIS
- 4) AE
- 5) Conzerve
- 6) Schneider
- 7) MECO Instruments Ltd.
- 8) Rishabh Instruments Pvt. Ltd.
- 9) Secure Meters
- 10) Trinity
- 11) Motwane
- 12) Rail
- 13) Toshniwal India
- 14) Sems
- 15) Simco
- 16) Remco
- 17) Dukearnics
- 18) C&S electric
- 19) Elmeasure India Pvt Ltd

47. Industrial Receptacle

- 1) Anchor
- 2) Legrand
- 3) Havells
- 4) Great white
- 5) Hensel (Polycarbonate type)

48. Lighting Fixture (Industrial)

- 1) Philips
- 2) Wipro
- 3) CG Power & Industrial Solutions Ltd.
- 4) Havells
- 5) GE Lighting ((General Electric)
- 6) Bajaj
- 7) Pyrotech
- 8) Sigma
- 9) Anchor
- 10) Great white

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 14 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 11) Tulip
- 12) Thorn
- 13) TURNPOINT TECHNOLOGIES PRIVATE LIMITED Gurgaon
- 14) Ledure lighting ltd, Noida
- 15) Polycab india ltd
- 16) Energygreen technopower private limited Bhopal
- 17) EVEREADY INDUSTRIES INDIA LIMITED Kolkata
- 18) GOLDWYN LIMITED Gautam Buddha Nagar, Noida

49. Lighting Pole

- 1) Philips
- 2) Wipro
- 3) CG Power & Industrial Solutions Ltd.
- 4) Surya Roshni
- 5) Bajaj
- 6) Utkarsh India Ltd
- 7) Shubham Poles
- 8) P.S Steel tubes, Bhilai
- 9) Transrail
- 10) Unique Electrotech pvt ltd
- 11) KL Industries, Mumbai
- 12) Ridhi Poles Pvt Ltd, Vadodara
- 13) Tube poles, Mumbai
- 14) Energygreen Technopower Pvt. Ltd., Bhopal

50. Lightning Arrestors

- 1) CG Power & Industrial Solutions Ltd.
- 2) Elpro International Ltd.
- 3) Oblum Electricals Industries (P) Ltd.
- 4) W.S. Industries (India) Ltd
- 5) Dehn India Pvt Ltd
- 6) OBO Bettermann India
- 7) JEF Techno
- 8) Lamco

51. Magnetic Oil Level Gauge

- 1) Instrument & Controls
- 2) Sukrut Udyog

52. Miniature Circuit Breakers (MCB, RCBO, RCCB)

- 1) ABB Ltd
- 2) Hager
- 3) Havell's India Ltd.
- 4) Indo Asian Fusegear Ltd.
- 5) Legrand/MDS Switchgear Ltd.

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 15 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 6) Schneider
- 7) Siemens Ltd.
- 8) HPL
- 9) Standard Electricals Ltd.
- 10) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 11) GE (General Electric)
- 12) INDOKOP
- 13) C&S Electric Ltd
- 14) BCH
- 15) MERLIN GERIN

53. Motor Protection Circuit Breaker (MPCBs)

- 1) ABB Ltd
- 2) Andrew yule
- 3) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 4) Schneider
- 5) Siemens Ltd
- 6) C&S Electric Ltd
- 7) GE (General Electric)
- 8) BCH
- 9) Havells India Ltd.

54. Moulded Case Circuit Breaker (MCCBs)

- 1) ABB Ltd
- 2) Andrew yule
- 3) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 4) Schneider
- 5) Siemens Ltd
- 6) GE (General Electric)
- 7) BCH
- 8) INDOKOP (up to 100A)
- 9) HAVELLS
- 10) C&S Electric Ltd (up to 100A)
- 11) Novatuer Electrical and digital system Pvt. Ltd. (Legrand brand)

55. Motors (Actuator)

- 1) Auma
- 2) Rotork
- 3) Limitorque
- 4) Marsh Automation
- 5) ABB Ltd

56. Motors (LV Motors)

- 1) Siemens Ltd
- 2) ABB Ltd
- 3) CG Power & Industrial Solutions Ltd.

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 16 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 4) BHEL
- 5) WEG
- 6) Marathon
- 7) LHP- Laxmi Hydraulics Pvt Ltd (upto 355 frame size)
- 8) Havells
- 9) Bharat Bijlee Ltd, Kolkata
- 10) Hem Industries, Mumbai
- 11) KEC (Kirloskar electric company)
- 12) ELGI
- 13) JYOTI
- 14) LENZE MECHATRONICS PVT LTD (for Geared motor only)
- 15) Rotomotive Powerdrives India Ltd.

57. Motors (LV Motors-FLP, Ex-d type)

- 1) Siemens Ltd
- 2) ABB Ltd
- 3) CG Power & Industrial Solutions Ltd.
- 4) BHEL
- 5) WEG
- 6) Marathon
- 7) LHP- Laxmi Hydraulics Pvt Ltd(upto 315 frame size)
- 8) Havells (upto 132 frame size)
- 9) Bharat Bijlee Ltd, Kolkata
- 10)Hem Industries, Mumbai

58. Motors (LV Motors-Crane duty)

1. Siemens Ltd
2. ABB Ltd
3. CG Power & Industrial Solutions Ltd.
4. Alstom
5. BHEL
6. WEG
7. Marathon
8. LHP- Laxmi Hydraulics Pvt Ltd (upto 315 frame size)
9. Havells (upto 132 frame size)
10. Bharat Bijlee Ltd, Kolkata
11. Hem Industries, Mumbai

59. Motors (HV Motors)

1. Siemens Ltd
2. ABB Ltd
3. CG Power & Industrial Solutions Ltd.
4. Alstom
5. BHEL
6. WEG
7. Marathon
8. TMEIC
9. Bharat Bijlee Ltd, Kolkata (Up to 6.6 kV) (Upto 300KW only)

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 17 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

10. KEC (Kirloskar electric company)
11. Jyoti Ltd

60. Insulation tester

- 1) Megger
- 2) Kyoritsu
- 3) Metrel
- 4) Motwane
- 5) Extech

61. Neutral Grounding Resistors(NGR) - HV & LV

- 1) Bhartia Industries Ltd.
- 2) Resitech Electricals Pvt. Ltd.
- 3) RSI Switchgear Pvt. Ltd.
- 4) S.R. Narkhede Engineering Pvt. Ltd, Pune
- 5) OHMARK Control

62. NGR Monitoring relays

- 1) Little fuse
- 2) Bender

63. N2 Purging System

- 1) CTR, Pune
- 2) Nitin Fire Protection Industries Ltd
- 3) EASUN-MR Pvt. Ltd.
- 4) Vimal Fire Control Pvt. Ltd.

64. Oil Temperature Indicator

- 1) Perfect Controls
- 2) Precimeasure Controls Pvt. Ltd.

65. On Load Tap Changer

- 1) BHEL (Bhopal)
- 2) CG Power & Industrial Solutions Ltd.
- 3) EASUN-MR Tap Changers P. Ltd.
- 4) On Load Gears
- 5) CTR, Pune
- 6) EMCO

66. Protection Relays – Thermal (Bimetallic)

- 1) ABB Ltd
- 2) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 3) Siemens Ltd.
- 4) BCH

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 18 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 5) C&S Electric Ltd
- 6) GE (General Electric)
- 7) Schneider Electric India Pvt. Ltd.
- 8) Rockwell Automation
- 9) Andrew Yule
- 10) Havells

67. Protection Relays – EOCR (Electronic over current relay)

- 1) ABB Ltd
- 2) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 3) Siemens Ltd.
- 4) BCH
- 5) GE (General Electric)
- 6) Schneider Electric India Pvt. Ltd.
- 7) Novatek electro India pvt ltd, Delhi
- 8) PROK DEVICES PRIVATE LIMITED (For earth leakage only)
- 9) C&S Electric Ltd.

68. Protection Relays – Numeric/ Microprocessor based

- 1) ABB Ltd
- 2) Siemens Ltd
- 3) Schneider Electric India Pvt. Ltd.
- 4) GE (General Electric)
- 5) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 6) ELMESURE
- 7) EASUN REYROLLE

69. Push Buttons and Indicating Lamp

- 1) BCH
- 2) Alstom Ltd.
- 3) Siemens Ltd.
- 4) Telemecanique & Controls (India) Ltd.
- 5) Vaishno Electricals
- 6) Controls and Switchgears Contractors Ltd.
- 7) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 8) Schneider Electric India Pvt. Ltd.
- 9) Teknic Control
- 10) Salzer
- 11) GE (General Electric)
- 12) Control devices
- 13) Essen deinki
- 14) Esbee
- 15) Sellwin electricals pvt ltd
- 16) Sen & singh engineers
- 17) Advance panels & switchgears pvt ltd

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 19 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 18) Shrenik & company
- 19) Flameproof Equipment Pvt. Ltd.
- 20) C&S Electric Ltd.
- 21) Microtech Electronics

70. Relay & Control Panel

- 1) ABB Ltd.
- 2) Areva T&D India Ltd.
- 3) Easun Reyrolle Ltd.
- 4) Pro Industrial Automation Pvt. Ltd.
- 5) Power and protection, Kolkata
- 6) Ishaani electronic pvt ltd, Kolkata
- 7) Tenco Systems & switchgears pvt ltd, Indore
- 8) Pyrotech Electronics Pvt ltd, Udaipur
- 9) Sen & Singh engineers
- 10) A C Power System, Kolkata

71. Solar Charge Controller

- 1) HBL POWER SYSTEMS LTD.
- 2) UNIVERSAL INSTRUMENT MFG CO PVT LTD, BANGALORE
- 3) SIGNOTRON (INDIA) PVT. LTD KOLKATA
- 4) STATCON ENERGIAA PVT LTD

72. Solar PCU/Inverter

- 1) DELTA ELECTRONICS
- 2) ABB LTD
- 3) KACO
- 4) SMA
- 5) SCHNEIDER
- 6) STATCON ENERGIAA PVT LTD
- 7) Microtek
- 8) Luminous
- 9) Sungrow
- 10) UTL Solar

73. Switch Boards – M.V. - Conventional Non-draw out MCC/PCC/PMCC (IEC 61439 Type tested)

- 1) GE (General Electric)
- 2) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 3) Schneider Electric India Pvt. Ltd.
- 4) Siemens Ltd.
- 5) ABB Ltd
- 6) C&S Electric Limited, Noida
- 7) Tricolite Electrical Industries Ltd.
- 8) BCH, Faridabad
- 9) Risha Controls Engineers India Pvt Ltd.

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 20 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 10) Elecmech Switchgear & Instrumentation
- 11) KMG ATOZ
- 12) Pyrotech Electronics Pvt Ltd, Udaipur
- 13) Rittal India Pvt Ltd, Bangalore
- 14) Ishaani Electronic Pvt Ltd, Howrah
- 15) M K Engineers & Control Private Ltd, Mumbai
- 16) Urjayant Engineeerg Pvt Ltd, Nashik
- 17) Expert Engineers (Conventional Type)
- 18) Unilec Engineers Ltd.
- 19) Vidyut Control India Pvt. Ltd.
- 20) Zenith Engineering
- 21) TENCO SYSTEMS & SWITCHGEARS PVT. LTD. INDORE
- 22) TRAANSRECT INDUSTRIES Raipur
- 23) POWER AND PROTECTION KOLKATA
- 24) Electro Allied Product, Kolkata
- 25) Mahendra Eletrical Pvt Limited
- 26) A C Power System, Kolkata

74. Switch Boards – M.V. - Conventional draw out MCC/PCC/PMCC (IEC 61439 Type tested)

- 1) GE (General Electric)
- 2) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 3) Schneider Electric India Pvt. Ltd.
- 4) Siemens Ltd.
- 5) ABB Ltd
- 6) BCH Electric Limited New Delhi
- 7) Advance Panels & switchgear Pvt. Ltd.
- 8) TENCO system & switchgear Pvt. Ltd.
- 9) C&S Electric Limited, Noida

75. Switch Boards – M.V. - Intelligent MCC/PCC/PMCC (IEC 61439 Type tested)

- 1) GE (General Electric)
- 2) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 3) Schneider Electric India Pvt. Ltd.
- 4) Siemens Ltd.
- 5) ABB Ltd
- 6) Rockwell Automation

76. Switch Boards – MV : PDB/MLDB/LDB/SLDB/ASB/MOVDB/Push Button Station

- 1) Risha Controls Engineers India Pvt Ltd.
- 2) GE (General Electric)
- 3) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 4) Schneider Electric India Pvt. Ltd.
- 5) Siemens Ltd.
- 6) ABB Ltd
- 7) C&S Electric Limited.

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 21 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 8) Tricolite Electrical Industries Ltd.
- 9) BCH, Faridabad
- 10) Pyrotech Electronics Pvt Ltd, Udaipur
- 11) Rittal India Pvt Ltd, Bangalore
- 12) Ishaani Electronic Pvt Ltd, Howrah
- 13) M K Engineers & Control Private Ltd, Mumbai
- 14) Urjayant Engineerg Pvt Ltd, Nashik
- 15) Expert Engineers
- 16) United Electric Co. (Delhi) Pvt. Ltd.
- 17) Andrew Yule
- 18) Havells
- 19) Standard
- 20) Advance Power Control
- 21) KMG A TO Z System
- 22) Sen & Singh Engineers
- 23) Meditron
- 24) Synergy Systems, Greater Noida (Only LDB, SLDB, MCBDB & Push button station, **not for PDB/PMCC/MCC/PCC**)
- 25) Shivshakti Automations (Only for LDB/SLDB/MCBDB/Push button station)
- 26) A C Power system Kolkata.
- 27) Advance panel & switchgear Pvt. Ltd.
- 28) Dynamic Control Konnagar
- 29) TENCO System & switchgear Pvt Ltd.
- 30) Power & Protection Kolkata.
- 31) Electro Allied Product, Kolkata.
- 32) Mahendra Electricals Pvt. Ltd. Kolkata.
- 33) Supertech Control system, New Delhi.

77. Switches – 5/15A Piano/ Plate, Switch Socket

- 1) Anchor by Panasonic
- 2) Great white electricals
- 3) Havells
- 4) Lisha Switches
- 5) Goldmedal Switches
- 6) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 7) Wipro.
- 8) Legrand
- 9) GM Modular
- 10) Kingal Electricals Pvt. Ltd.
- 11) C&S Electric limited.

78. Soft Starter (415 V Switch boards)

- 1) ABB INDIA LTD,
- 2) Hitachi-Hirel Power electronics Pvt. Ltd,
- 3) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 4) Rockwell Automation India Pvt Ltd.,

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 22 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 5) Siemens Ltd.
- 6) Yasakawa India.
- 7) Schneider.
- 8) AMTECH Electronics
- 9) LECON Energetics Pvt Ltd Bengaluru
- 10) BHEL
- 11) Danfoss
- 12) Control Technique India Pvt Ltd (Nidec)
- 13) Innovative Technomics Pvt Ltd
- 14) Dem Enterhub Electromagnetics Pvt Ltd (FCME type upto 11kV)

79. Solar Modules/PV Panels

- 1) Tata BP Solar (I) Ltd.
- 2) REIL, Jaipur.
- 3) CEIL, Sahibabad.
- 4) HBL, Hyderabad
- 5) All modules make as per ALMM list of MNRE.

80. Switches-Control/Selector

- 1) BCH
- 2) Easum Reyrolle Relays & Devices Ltd.
- 3) Alstom
- 4) Kaycee Industries Ltd.
- 5) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 6) Siemens Ltd.
- 7) GE (General Electric)
- 8) Havell's
- 9) Switron Devices , Nashik
- 10) ABB Ltd
- 11) EPCC
- 12) TEKNIK
- 13) C&S Electric Ltd
- 14) SCHNEIDER
- 15) Vaishno
- 16) Jyoti
- 17) Salzer
- 18) Standard

81. Transformers – Power – Above 5 MVA (Oil Cooled)

- 1) ABB Ltd
- 2) Schneider Electric India Pvt. Ltd.
- 3) GE (General Electric)
- 4) Bharat Bijlee Ltd.
- 5) BHEL
- 6) CG Power & industrial Solution Ltd
- 7) Transformer & rectifier
- 8) EMCO Limited

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 23 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 9) Siemens Ltd.
- 10) Voltamp Transformers (P) Ltd
- 11) Kirloskar Electric
- 12) Prolec GE
- 13) Technical Associates Limited, Lucknow.(upto 132kV Class)

82. Transformers – Distribution upto 5 MVA (Oil Cooled)

- 1) Schneider Electric India Pvt. Ltd.
- 2) GE(General Electric)
- 3) CG Power & industrial Solution Ltd
- 4) EMCO Limited
- 5) Voltamp Transformers (P) Ltd.
- 6) Bharat Bijlee
- 7) ABB Ltd
- 8) Siemens Ltd.
- 9) Kirloskar Electric
- 10) Andrew Yule
- 11) Areva
- 12) BHEL
- 13) Intra Vidyut
- 14) Indushree
- 15) Indcoil
- 16) Skippers Electricals
- 17) Transformers & Rectifiers (I) Ltd.
- 18) TELK
- 19) PETE Transformer
- 20) Sudhir Transformers
- 21) Shilchar Technologies, Vadodara
- 22) Transfix India Pvt. Ltd. , Pune
- 23) Voltech Manufacturing company Ltd., Chennai
- 24) Shirdi Sai Electricals Ltd. , Hyderabad

83. Transformers – (Dry type)

- 1) Schneider Electric India Pvt. Ltd.
- 2) GE (General Electric)
- 3) CG Power & industrial Solution Ltd
- 4) EMCO Limited
- 5) Voltamp Transformers (P) Ltd.
- 6) Bharat Bijlee Ltd
- 7) BHEL
- 8) Transformer & rectifier
- 9) Sudhir transformer
- 10) PETE Transformer/ Hammond power
- 11) Essennar Transformer
- 12) ABB Ltd
- 13) Indcoil Transformer, Mumbai (Up to 2 MVA)

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 24 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 14) Siemens Ltd.
- 15) Kirloskar Electric company (KEC)
- 16) Andrew Yule
- 17) Raychem
- 18) TELK

84. Timers & Time Delay Relays

- 1) Bhartia Industries Ltd.
- 2) Electronic Automation Pvt. Ltd.
- 3) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 4) Siemens Ltd.
- 5) ABB Ltd
- 6) BCH
- 7) Novatek Electro
- 8) GE (General Electric)
- 9) Essen
- 10) Schneider
- 11) Omron
- 12) EE
- 13) MDS (Legrand)
- 14) EAPL
- 15) C&S Electric limited.

85. Terminals Blocks

- 1) Connectwell Industries Pvt Ltd
- 2) Controls & Switchgear Co. Ltd.
- 3) Elmex Controls Pvt. Ltd.
- 4) Essen Deinki
- 5) Wago
- 6) Phoenix Contact
- 7) Schneider
- 8) EPCC
- 9) LAPP
- 10) S&S
- 11) Hansel
- 12) Techno Plast

86. UPS System – AC / DC

- 1) Vertiv Energy Private Limited
- 2) Fuji Electric Co. Ltd
- 3) Chloride, France
- 4) Schneider Electric IT business India Pvt Ltd. (GUTOR)
- 5) Toshiba Corporation.
- 6) Hitachi Hi-Rel Electronic Pvt Ltd, India
- 7) Kerala State Electric Corporation Ltd (Keltron)
- 8) Synergy Systems (upto 20 KVA only)

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 25 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 9) Numeric (IT & Commercial UPS)
- 10) GE-General Electric (IT & Commercial UPS)
- 11) APC (IT & Commercial UPS)

87. Vacuum Bottles / Vacuum Interrupter

- 1) ABB Ltd
- 2) Schneider Electric India Pvt. Ltd.
- 3) GE (General Electric)
- 4) Megarwin Switchgear Pvt Ltd
- 5) BHEL

88. Variable Frequency Drive- LV VFD drive (up to 690V)

- 1) ABB Ltd
- 2) Schneider Electric India Pvt Ltd
- 3) AMTECH Electronics
- 4) Allan Bradley (Rockwell Automation)
- 5) Siemens Ltd
- 6) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 7) Yaskawa India Pvt Ltd
- 8) Mitsubishi Electric India Pvt Ltd
- 9) BHEL
- 10) Hitachi Hi-Rel
- 11) TMEIC
- 12) Danfoss
- 13) Honeywell
- 14) Control Technique India Pvt Ltd (Nidec)
- 15) Divya Engineers (VFD Drive Panel, not VFD)
- 16) CAS Electrical Automation (VFD Drive Panel, not VFD)
- 17) Ishaani Electronics Pvt Ltd (VFD Drive Panel, not VFD)
- 18) M/s Fuzi Electric India Pvt Ltd (for VFD Drive & VFD Drive Panel)
- 19) Delta Electronics India Pvt. Ltd
- 20) Fuji Gemco Pvt. Ltd. Faridabad (VFD Drive Panel, not VFD)

89. Variable Frequency Drive- HV VFD drive

- 1) ABB Ltd
- 2) Allan Bradley (Rockwell Automation)
- 3) BHEL
- 4) Siemens Ltd
- 5) TMEIC
- 6) Yaskawa India Pvt Ltd
- 7) Danfoss
- 8) Schneider
- 9) Control Technique India Pvt Ltd (Nidec)
- 10) Hitachi Hi-Rel

90. Winding Temperature Indicator

- 1) Perfect Controls
- 2) Precise measure Controls Pvt. Ltd.

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 26 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

91. AVR (Automatic Voltage Regulator)

- 1) Reliable Power System
- 2) Jindal Rectifier
- 3) Servokon
- 4) Atandra Energy Pvt. Ltd (KRYKARD Brand)

92. Polycarbonate Panel-Enclosure

- 1) Hensel
- 2) Rittal
- 3) Eaton
- 4) Schneider
- 5) Fibox

93. HDPE Pipes (for electrical purpose only)

- 1) Sangir Plastics Pvt Ltd.
- 2) Vedanta Polymers Pvt Ltd
- 3) Finolex
- 4) Prince
- 5) Supreme
- 6) Kitec
- 7) Oriplast
- 8) Polyfab
- 9) Annapurna Industries Raipur
- 10) BEC conduits Pvt. Ltd. New delhi
- 11) Tirupati Teleplast Pvt. Ltd. Kolkata

94. Energy Meter

- 1) Secure Meters Ltd.
- 2) SEMS
- 3) Schneider Electric India Pvt Ltd (Brand Lauritz Knudsen)
- 4) SATEC
- 5) CONZERVE
- 6) DUKATI
- 7) ABB Ltd
- 8) SIEMENS
- 9) SCHNEIDER
- 10) AE
- 11) IMP
- 12) MECO
- 13) RISHABH
- 14) ENDRIS
- 15) SIMCO
- 16) BHEL
- 17) REMCO
- 18) DUKEARNICS
- 19) ENERCON

MECON LIMITED REGD. OFF: RANCHI 834002	ELECTRICAL & INSTRUMENTATION SECTION			
	OIL & GAS SBU, DELHI			
TITLE	LIST OF PREFERRED MAKES FOR ELECTRICAL ITEMS	DOCUMENT NO. MEC/05/E9/VD-E-01	Page 27 of 27	
			EDITION: 02	REV : 01
			30.04.2026	

- 20) GE (General Electric)
- 21) PML
- 22) HPL
- 23) Elmeasure India Pvt Ltd. Bangalore

95. Solar Street Light

- 1) Tata BP Solar(I) Ltd.
- 2) REIL
- 3) CEIL
- 4) HBL Power
- 5) Solar street light tested at NISE (National Institute of solar energy)

Notes:

- 1) For any electrical item(s), which is not listed above, bidders can propose or supply those item(s) from Vendors/ suppliers/ manufacturer, subject to following:
 - a) Vendors/ suppliers/ manufacturer who have earlier supplied same item(s) for the intended services in earlier projects and the item(s) offered is in their regular manufacturing/ supply range. (Bidder shall provide an undertaking & ISO certificate for compliance of this clause)
 - b) Acceptance of such Vendors/ suppliers subjected to provide documentary evidences (7 years Past Track Record such as PO copies, Inspection Certificate, completion certificates, client's satisfactory performance certificate etc. at for at least 3 Nos of project / PO) by successful bidder during detailed engineering and approval from MECON/Client.
 - c) The vendor / supplier should not be in the Holiday list of PSU / MECON / other Govt undertaking & departments and bodies. (Bidder shall provide undertaking letter from the OEM of the product/ material)
 - d) No deviation against the technical specification of MECON with duly filled / certified Datasheets and Test Certificates.
 - e) Bidder will not be provided any time extension for new / additional vendor approval.
- 2) For supply of any electrical item(s) listed above, bidders may propose other vendor/supplier/manufacturer, in case of urgency/non-availability within the project timeline, subject to following:
 - a) The proposed vendor/supplier/manufacturer shall apply in MECON's vendor development cell (CVDC) for particular item(s) under "Oil & Gas sector" category, online through Mecon's website www.meconlimited.co.in under "Vendor registration" & submit documentary evidences along-with proposal. for the same.
 - b) All the compliance & documents required, as mentioned above in Note.1 (a to e).
- 3) The Contractor shall verify capabilities/ performance of proposed vendor for supply / quality. MECON does not guarantee any responsibility on the performance/ timely supply of the items from the vendor.
- 4) Vendor who are already approved in MECON vendor development cell (CVDC) and their name is not listed in the above list, are also accepted subject to submission of valid CVDC approval letter issued by MECON with details of items & rating/capacity.
- 5) Bidder shall provide an undertaking letter from the OEM of the product/ material selected from above vendor list as that they are not be in the Holiday list of PSU / MECON / other Govt undertaking & departments during detailed engineering and document approval from MECON/Client.

-X-X-X-

QUALITY ASSURANCE PLAN (ELECTRICAL)

	CONTRACTOR		QUALITY ASSURANCE PLAN FOR ELECTRICAL EQUIPMENT			CLIENT:		GGPL																																																																																																					
	ORDER NO. & DATE					PROJECT:		Construction of CNG Stations																																																																																																					
	SUB-CONTRACTOR					PACKAGE NO.																																																																																																							
	ORDER NO. & DATE					PACKAGE NAME		Electrical System																																																																																																					
INSTRUCTIONS FOR FILLING UP : - QAP shall be submitted for each of the equipment separately with break up of assembly/sub-assembly & part/component or for group of equipment having same specification. - Use numerical codes as indicated for extent of inspection & tests and submission of test certificates & documents. Additional codes & description for extent of inspection & tests may be added as applicable for the plant and equipment - Separate identification number with quantity for equipment shall be indicated wherever equipment having same specifications belonging to different facilities are grouped together. - Weight in tonnes (T) must be indicated under column 5 for each item. Estimated weights may be indicated wherever actual weights are not available.						CODES FOR EXTENT OF INSPECTION, TESTS, TEST CERTIFICATES & DOCUMENTS: <table border="0"> <tr> <td>Code</td> <td>Description</td> <td>Code</td> <td>Description</td> <td>Code</td> <td>Description</td> <td>DOCUMENTS:</td> </tr> <tr> <td>1.</td> <td>Visual</td> <td>12.</td> <td>Routine test as per relevant IS other standard</td> <td>23.</td> <td>Short time rating</td> <td>D1. Approved GA drawings</td> </tr> <tr> <td>2.</td> <td>Dimensional</td> <td>13.</td> <td>Type test as per relevant IS/ other standard</td> <td>24.</td> <td>Operational & functional check</td> <td>D2. Approved single line/ schematic diagram</td> </tr> <tr> <td>3.</td> <td>Fitment & Alignment</td> <td>14.</td> <td>Impulse Test</td> <td>25.</td> <td>Over Speed Test</td> <td>D3. Approved data sheet</td> </tr> <tr> <td>4.</td> <td>Physical Test (Sample)</td> <td>15.</td> <td>Partial Discharge Test</td> <td>26.</td> <td>Flame Proof Test</td> <td>D4. Approved bill of materials</td> </tr> <tr> <td>5.</td> <td>Chemical Test (Sample)</td> <td>16.</td> <td>Heat run risc test/tempr.</td> <td>27.</td> <td>Clearance and creepage Distance</td> <td>D5. Unpriced P.O. copy</td> </tr> <tr> <td>6.</td> <td>Ultrasonic Test</td> <td>17.</td> <td>Enclosure Protection Test</td> <td>28.</td> <td>Acceptance Test</td> <td>D6. Calibration Certificate of all measuring instruments and gauges</td> </tr> <tr> <td>7.</td> <td>Magnetic Particle Test (MPT)</td> <td>18.</td> <td>Calibration</td> <td>29.</td> <td>Harmonics measurement</td> <td></td> </tr> <tr> <td>8.</td> <td>Radiography Test</td> <td>19.</td> <td>Noise & Vibration</td> <td></td> <td></td> <td></td> </tr> <tr> <td>9.</td> <td>Dye Penetration Test</td> <td>20.</td> <td>Test certificates for bought out components</td> <td></td> <td></td> <td></td> </tr> <tr> <td>10.</td> <td>Measurement of IR Value</td> <td>21.</td> <td>Tank Pressure Test</td> <td></td> <td></td> <td></td> </tr> <tr> <td>a) Before HV Test</td> <td></td> <td>22.</td> <td>Paint shade verification</td> <td></td> <td></td> <td></td> </tr> <tr> <td>b) After HV Test</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>11.</td> <td>High Voltage test/Dielectric test</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>						Code	Description	Code	Description	Code	Description	DOCUMENTS:	1.	Visual	12.	Routine test as per relevant IS other standard	23.	Short time rating	D1. Approved GA drawings	2.	Dimensional	13.	Type test as per relevant IS/ other standard	24.	Operational & functional check	D2. Approved single line/ schematic diagram	3.	Fitment & Alignment	14.	Impulse Test	25.	Over Speed Test	D3. Approved data sheet	4.	Physical Test (Sample)	15.	Partial Discharge Test	26.	Flame Proof Test	D4. Approved bill of materials	5.	Chemical Test (Sample)	16.	Heat run risc test/tempr.	27.	Clearance and creepage Distance	D5. Unpriced P.O. copy	6.	Ultrasonic Test	17.	Enclosure Protection Test	28.	Acceptance Test	D6. Calibration Certificate of all measuring instruments and gauges	7.	Magnetic Particle Test (MPT)	18.	Calibration	29.	Harmonics measurement		8.	Radiography Test	19.	Noise & Vibration				9.	Dye Penetration Test	20.	Test certificates for bought out components				10.	Measurement of IR Value	21.	Tank Pressure Test				a) Before HV Test		22.	Paint shade verification				b) After HV Test							11.	High Voltage test/Dielectric test					
Code	Description	Code	Description	Code	Description	DOCUMENTS:																																																																																																							
1.	Visual	12.	Routine test as per relevant IS other standard	23.	Short time rating	D1. Approved GA drawings																																																																																																							
2.	Dimensional	13.	Type test as per relevant IS/ other standard	24.	Operational & functional check	D2. Approved single line/ schematic diagram																																																																																																							
3.	Fitment & Alignment	14.	Impulse Test	25.	Over Speed Test	D3. Approved data sheet																																																																																																							
4.	Physical Test (Sample)	15.	Partial Discharge Test	26.	Flame Proof Test	D4. Approved bill of materials																																																																																																							
5.	Chemical Test (Sample)	16.	Heat run risc test/tempr.	27.	Clearance and creepage Distance	D5. Unpriced P.O. copy																																																																																																							
6.	Ultrasonic Test	17.	Enclosure Protection Test	28.	Acceptance Test	D6. Calibration Certificate of all measuring instruments and gauges																																																																																																							
7.	Magnetic Particle Test (MPT)	18.	Calibration	29.	Harmonics measurement																																																																																																								
8.	Radiography Test	19.	Noise & Vibration																																																																																																										
9.	Dye Penetration Test	20.	Test certificates for bought out components																																																																																																										
10.	Measurement of IR Value	21.	Tank Pressure Test																																																																																																										
a) Before HV Test		22.	Paint shade verification																																																																																																										
b) After HV Test																																																																																																													
11.	High Voltage test/Dielectric test																																																																																																												
ABBREVIATIONS USED : MFR : MANUFACTURER CONTR : CONTRACTOR TPI : THIRD PARTY INSPECTION AGENCY																																																																																																													
EQUIPMENT DETAILS						INSPECTION AND TESTS						Test Certificates & documents to be submitted to MECON	Acceptance Criteria Standards /IS/ BS/ASME/ Norms and Documents	REMARKS / SAMPLING PLAN																																																																																															
Sl. No.	Description (With equipment heading, place of use, and Breif Specifications)	Identificatuin No.	Quantity		Manufacturer's Name and Address	Expected schedule of Final Inspection	Raw Material and inprocess stage inspection			Final Inspection/Test by																																																																																																			
			No/M	T			MFR	CONTR	MECON	MFR	TPI				MECON/ GGPL																																																																																														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16																																																																																														
1.	Power & Lighting Distribution Board		Set				1,2,3,4, 24, 27	-	-		1,2,3,12, 22, 24,27	1,2,3,12, 13*,22, 24,27	IWC	D1, D2, D3, D4, D5, D6, 20, 12,16	Tech. Specification, Approved Drawings & Data Sheets, IS, Test certificates	13* for similar rating																																																																																													
2.	LT Power and Control Cable		Mt.				-	-	-		1,10,11, 12,13, 28	1,2,10,11, 12, 28	IWC	12,13*,28 D3, D5, D6,	Tech. Specification, Approved Drawings & Data Sheets, IS, Test certificates	13* for similar rating, Inspection to be done by TPI																																																																																													
3.	Distribution Transformer upto 100 KVA.		No.				1,2,3,4, 21,27	-	-		1,2,10,11, 12	1,2,10,11, 12,22,24, 27	IWC	12,13*,20 D3, D5, D6	Tech. Specification, Approved Drawings & Data Sheets, IS, Test certificates	13* for similar rating, Inspection to be done by TPI																																																																																													

4.	UPS-System					1,2,3,4, 24, 27	-	-	1,2,3,12, 22, 24,27	1,2,3,11, 12,16*, 22, 24,27	IWC	D1, D2, D3, D4, D5, D6, 20, 12,13*,16	Tech. Specification, Approved Drawings & Data Sheets, IS, Test certificates	16* Heat Run test upto temp stability.																
5.	Battery Set-UPS		Set			1,2,3,4, 24,27	-	-	1,2,3,12, 13,28	1,2,28	IWC	D1, D3, D4, D5, D6, 12,13	Tech. Specification, Approved Drawings & Data Sheets, IS, Test certificates	12, 13 Document to be reviewed by MECON																
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:20%; vertical-align: top;"> </td> <td style="width:20%; vertical-align: top;"> </td> <td style="width:20%; vertical-align: top;"> </td> <td style="width:40%;"></td> </tr> <tr> <td style="text-align: center;">For Manufacturer (Stamp & Signature)</td> <td style="text-align: center;">For CONTR (Stamp & Signature)</td> <td style="text-align: center;">For MECON (Stamp & Signature)</td> <td></td> </tr> <tr> <td colspan="3"></td> <td> Q.A.P. NO. MEC/E0086/05/E1/E/GGPL/QAP </td> </tr> <tr> <td colspan="3"></td> <td> SHEET 1 OF 1 R-0 </td> </tr> </table>																			For Manufacturer (Stamp & Signature)	For CONTR (Stamp & Signature)	For MECON (Stamp & Signature)					Q.A.P. NO. MEC/E0086/05/E1/E/GGPL/QAP				SHEET 1 OF 1 R-0
For Manufacturer (Stamp & Signature)	For CONTR (Stamp & Signature)	For MECON (Stamp & Signature)																												
			Q.A.P. NO. MEC/E0086/05/E1/E/GGPL/QAP																											
			SHEET 1 OF 1 R-0																											

IWC- MECON shall issued Inspection waiver Certificate (IWC) based on TPI’s Inspection Release Note, Inspection Reports & other test reports.

Inspection Categorization plan for Electrical Items

Inspection of various Electrical items shall be carried out as per following categorization plan:

S. No.	Item description	Site Acceptance based on Manufacturer Test Certificate review at site (In line with Approved documents)	Inspection at Manufacturer's works by TPIA (IWC by Mecon based on TPIA's Inspection doc)	Inspection at Manufacturer's works by Client/MECON
1	PDB, I-E LDB, PP LDB, OLDB	X	✓	X
2	FLP Feeder Pillar (Structure mounted) for outdoor lighting	X	✓	X
3	Inverter with tubular battery	✓	X	X
4	Earthing material (Earth pit with GI Electrode/Cu plate Electrode, GI/Copper Strips, GI wire, GI Lightning rod, Advance Maintenance free earthing system)	✓	X	X
5	Power & Control Cables (HT & LT)	X	✓	X
6	Lighting fixtures (FLP & Non-FLP type)	✓	X	X
7	Street Light Pole (6Mtr height)	✓	X	X
8	High Mast & FLP Feeder pillar panel for High Mast	X	✓	X
9	Distribution Transformers (11/0.433kV)	X	✓	X



**MECHANICAL & ELECTRICAL WORKS TENDER
FOR DAUGHTER BOOSTER
CNG STATIONS IN EAST GODAVARI &
WEST GODAVARI DISTRICTS**



(No. – MEC/E0086/05/E1/E/GGPL/ICP Rev. 0)

MECON LIMITED

10	MCCB Enclosure – WP Outdoor type	X	✓	X
11	ACSR weasel conductor	✓	X	X
12	Ceiling/Wall mounted Fans, Exhaust Fans,Air conditioners,	✓	X	X
13	Welding socket	✓	X	X
14	Cable Tray	✓	X	X
15	First Aid box	✓	X	X
16	Carbon-di-oxide (CO2) type fire extinguisher	✓	X	X
17	Insulating Mast	✓	X	X
18	Telephone/LAN socket, LAN Swithes	✓	X	X
19	Telephone/LAN/UTP cable	✓	X	X
20	AVR	X	✓	X
21	GG Set/ DG Set & AMF Panel	X	✓	X
22	UPS System excluding batteries	X	✓	X
23	Solar System excluding PV Modules and batteries	X	✓	X
24	PV Modules with associated hardware	X	✓	X
25	Battery Set for Solar and UPS	X	✓	X

-X-X-X-

STANDARD DATA SHEETS (ELECTRICAL SYSTEM)

DATA SHEET
FOR
UN-INTERRUPTED POWER SUPPLY (UPS)
SYSTEM

SPECIFICATION NO.- MEC/DS/05/E9/071



(OIL GAS SBU)
MECON LIMITED
DELHI 110092

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	UNINTERRUPTED POWER SUPPLY (UPS)	DOCUMENT NO. MEC/DS/05/E9/07	Page 1 of 12
			REVISION : 4
			EDITION : 1

ANNEXURE-I

PURCHASER'S DATA FOR UPS

1.0 INPUT POWER SUPPLY

1.1	Voltage/freq./ phase:	415 V (+) 10% & (-)15%, TPN, 50 Hz $\pm$ 5% with healthy Phase selector switch. As per SOR
1.2	System fault level	10 kA for 1 Sec

2.0 SITE CONDITION

2.1	Design Maximum / Minimum temperature	50 ⁰ C/2 ⁰ C
2.2	Max. Relative Humidity	95%
2.3	Altitude	Below 1000.0 M MSL

3.0 OUT PUT REQUIREMENT

3.1	Voltage/ Phase	230V $\pm$ 1% AC, Single phase 2 wire
3.2	Output waveform & frequency	Pure Sinusoidal Wave
		50 Hz $\pm$ 0.1%
		Voltage distortion (THD): Less than 3% for linear loads & Less than 5% for non linear loads.

4.0 SYSTEM REQUIREMENTS

4.1	Rating KVA	As per SOR
4.2	Type of inverter	The inverter circuit should be IGBT based, fully microprocessor controlled with PWM Technology or Latest proven technology
4.3	Overload capacity	125% of the rated output for 10 minutes & 150% for 1 minute.
4.4	Mode of operation	Single UPS as specified in SOR/Design basis/Block diagram
4.5	Inverter efficiency	>85% at 100% of load and >80% at 25% of load
4.6	Installation	Floor Mounted
4.7	Type of enclosure	Minimum IP-31
4.8	External Cable Connection	From Bottom
4.9	Internal protection	All live parts shrouded
4.10	Earthing	Doubly Earthed (Two distinct terminals to be made available)
4.11	Cooling	Forced ventilation with fans

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	UNINTERRUPTED POWER SUPPLY (UPS)	DOCUMENT NO. MEC/DS/05/E9/07	Page 2 of 12
			REVISION : 4
			EDITION : 1

4.12	Noise Level	<65 dB at full Load from 1 mtr distance (for UPS of rating 5kVA, 7.5kVA & 10kVA) <75 dB at full Load from 1 mtr distance (for UPS of rating 15kVA & 20kVA)
4.13	Crest Factor	≥3:1
4.14	Input Power Factor	> 0.95
4.15	Load Power Factor	0.8 (with variation between 0.6 to 1.0)
4.16	Overall efficiency	> 80%
4.17	Harmonics	As per IEEE 519 (Total demand distortion not more than 5.0%)
5.0 Rectifier/Charger		
5.1	Input voltage	230V AC single phase (voltage range-160V AC to 270V AC) (As per SOR).
5.2	Automatic phase selection device	As per SOR
5.3	Output DC voltage/Load	As per Manufacturer Design
5.4	Input Power factor	> 0.95 at rated load
5.5	Input current THD (Total Harmonic Distortion) at nominal load	≤ 5 %
5.6	Overload Capability	125% minimum for 10 min. 150% minimum for 1 min
5.7	Inrush current	Limited by soft-start circuit
5.8	Output voltage tolerance	+/- 1%
5.9	DC voltage ripple	<1% With battery connected <2% Without battery connected
5.10	Rectifier	IGBT based
5.11	Filter	Input side line filter
5.12	Harmonics	As per IEEE-519 (Voltage THD <5%, largest single voltage harmonics <3%, Input Current THDi <5%)
5.13	Charging	Automatic Float and Boost charging (selection as per battery charging state (voltage level))
6.0 Bypass		
6.1	Manual/Maintenance Bypass	Shall be provided
6.2	Overload on bypass	125% minimum for 10 min. 150% minimum for 1 min.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	UNINTERRUPTED POWER SUPPLY (UPS)	DOCUMENT NO. MEC/DS/05/E9/07	Page 3 of 12
			REVISION : 4
			EDITION : 1

7.0 Battery Bank		
7.1	Type of Battery	As per SOR
7.2	Battery Arrangement	1 X 100%
7.3	i) Battery end cell voltage ii) Battery stand formation iii) Battery back up time iv) De-rating factor	As per specification (clause no. 3.5) As per battery manufacturer As per SOR (i) Ageing -- 0.8 (ii) State of Charge -- 0.88 (iii) Temp. Correction -- 0.95 The rectifier/charger output current & voltage shall be limited to the battery supplier's recommendation.
8.0 Alarms, Indications and LCD Display		
8.1	Single line Power Flow Diagram (Mimic diagram) with LED indications of UPS status (i.e. Mains present, Battery charging & discharging, Low battery Voltage and unit on bypass).	
8.2	Digital panel Meter with LCD display (touch screen / touch pad) shall be provided for monitoring viz.	a) Input AC Voltage, current, frequency b) Output AC Voltage, current, frequency. c) Battery current and voltage d) Total run time e) Mains ON/OFF/TRIP, Mains Over/Under voltage, Phase fail f) Inverter ON/OFF, Inverter Over/Under voltage, inverter overload, over heat & load in % on inverter. g) Battery voltage low, Battery AH in % h) Battery Operation Boost Charge, Float Charge with of status - "in charge" or "discharge" i) Load on bypass or inverter. Detailed UPS Status with Operation/faults history
8.3	Audible Alarms With LCD Display-	a) Mains Failure b) Battery Low c) UPS fault (Continuous) d) Inverter Under-voltage e) Over Temperature (Continuous) f) Inverter Overload (Continuous)
9.0 Protective Features		
9.1	Input	Mains Over voltage, under voltage, phase failure
9.2	Inverter	Over voltage, short circuit, overload, over temperature

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	UNINTERRUPTED POWER SUPPLY (UPS)	DOCUMENT NO. MEC/DS/05/E9/07	Page 4 of 12
			REVISION : 4
			EDITION : 1

9.3	Battery	Under voltage at battery terminal, Battery over charge, Battery Over current
9.4	Rectifier & Battery charger	Maximum current limiting Over temp. Trip Boost charging and float charging current limiting with back up protection against over charging.
10.0 Distribution boxes		
10.1	Distribution Board Details	(As per tender drawings / SOR) (1)ACDB 230V, Single Phase (1 No.) : Incomer: 32A MCB (As per UPS capacity 3KVA. Outgoing: Combination of DP MCB's : 10A MCB DP-5 nos., 6A MCB-5 nos. (The rating of above-mentioned feeders may change during detail engineering; Bidder shall provide all required feeders as per requirement without any financial implications.)
11.0	UPS communication	Ethernet / preferably Modbus RS 485 (To be decided during detailed engineering)
12.0	Selector switch	For Auto manual switch for Float and boost selection

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	UNINTERRUPTED POWER SUPPLY (UPS)	DOCUMENT NO. MEC/DS/05/E9/07	Page 5 of 12
			REVISION : 4
			EDITION : 1

TECHNICAL DATA FROM MANUFACTURER (To be filled up by the Tenderer)			ANNEXURE-II
1.0	INVERTER		
1.1	Manufacturer's Model No. (Enclose catalogue)		
1.2	Rating (at specified ambient) / no. of phases		
1.3	Applicable codes/standards		
1.4	Steady state output volt/freq (230 V $\pm$ 1%) (50 Hz $\pm$ 0.1%)		
1.5	Input voltage - DC		
1.6	Synchronization (inv. phase locked with main) in percentage		
1.7	Synchronization manually adjustable in steps of		
1.8	Deleted		
1.9	Harmonics distortion for linear & non-linear loads		
1.10	Mode of operation	Single UPS with manual static bypass as specified in SOR /Design basis/Block diagram.	
1.11	Deleted		
1.12	Recovery time to reach steady state after above disturbance (not more than 100m Sec)		
1.13	Overload capacity (125% minimum for 10 min. 150% minimum for 1 min.)		
1.14	Short circuit capacity and duration (in % and m sec.)		
1.15	Noise Level (dB at 1 m) <65 dB at full Load from 1 mtr distance (for UPS of rating 5kVA, 7.5kVA & 10kVA) <75 dB at full Load from 1 mtr distance (for UPS of rating 15kVA & 20kVA)		
1.16	Efficiency at 100%/75%/50% loads (not less than		

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	UNINTERRUPTED POWER SUPPLY (UPS)	DOCUMENT NO. MEC/DS/05/E9/07	Page 6 of 12
			REVISION : 4
			EDITION : 1

	85% at 100% load)	
1.17	Type of control circuit	
1.18	Out put voltage & phase angle (for 3 Phase only) a) For 30% unbalance load b) For 40% unbalance load c) For 50% unbalance load d) For 100% unbalance load	
1.19	Crest Factors	
2.0	Deleted	
3.0	BATTERY CHARGER	
3.1	Rating (Amp.) / MAKE (Enclose back up calculation).	
3.2	Type of charger (Basic configuration)	
3.3	Output volt under float/boost charging condition	
3.4	Volt. Accuracy under specified input ($\pm 1\%$)	
3.5	Max. Ripple content on DC side (% RMS) (not more than 2% without battery & 1% with battery connected)	
3.6	Efficiency at 100%/75%/50 % of load	
3.7	Mode of Change over from float to boost and vice-versa	
4.0	BATTERY	
4.1	Make	
4.2	Type (Enclose catalogue)	
4.3	AH rating (Enclose back up calculation)	
4.4	End cell voltage at specified discharge rate (V/ cell)	
4.5	Output (Nominal) volts	
4.6	Nos. of battery banks	
4.7	Nos. of cells in each banks	
4.8	Battery charging requirements (V/ cell) a) Volts/Cell/Nominal b) Float c) Boost	

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	UNINTERRUPTED POWER SUPPLY (UPS)	DOCUMENT NO.	Page 7 of 12
		MEC/DS/05/E9/07	REVISION : 4
			EDITION : 1

4.9	Voltage variation from fully charged battery to discharged battery (volts)	
4.10	Charging time (Hrs.)	
4.11	Max. Permissible ripple content (% RMS)	
4.12	Overall dimension (L*W*H)	
4.13	Container type	
4.14	Accessories for battery as per specification included	Cell testing Voltmeter, Pair of Gloves, Insulated Spanner, Extra Electrolyte, Hydrometer, Thermometer etc.
4.15	Type/Formation of battery stand	
5.0 MANUAL TRANSFER DEVICES		
5.1	Rating (Amp.)	.
5.2	Make/Type	
6.0 Deleted		
7.0 AC DISTRIBUTION BOARD		
7.1	Nos. of feeder/rating	
7.2	Cable entry from (Bottom)	
7.3	Max. Rating of outgoing feeders possible for fault clearance by UPS with and without supply back up (as percentage of UPS rating) not less than 25% a) With fast acting semi conducting fuses	
8.0	Indications and Alarm	
9.0	Metering	
10.0	UPS Dimension (L x W x H) except Battery: (Including inverter, charger, rectifier, bypass stabilizer, ACDB etc.)	
11.0 OVERALL EFFICIENCY OF UPS SYSTEM		

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	UNINTERRUPTED POWER SUPPLY (UPS)	DOCUMENT NO. MEC/DS/05/E9/07	Page 8 of 12
			REVISION : 4
			EDITION : 1

11.1	Ratio of output load to input drawn from mains when inverters are on and synchronized with bypass. a) At 100% load a) At 75% load b) At 50% load	
12.0	RELIABILITY a) Safety factor used for selecting electronic components/ other electrical components (not less than 200%/ 125% respectively) b) MTBF / MTFR c) Availability factor	
13.0	DEGREE OF PROTECTION OF THE PANEL (Minimum IP – 31)	
14.0	Heat loss for total system (W)	
15.0	Potential free contracts (for duplicating of fault status in remote panel).	
16.0	Fault status shall be compatible to hook-up with Owner's PC through Ethernet/ preferably RS 485 interface (To be decided during detailed engineering).	

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	UNINTERRUPTED POWER SUPPLY (UPS)	DOCUMENT NO. MEC/DS/05/E9/07	Page 9 of 12
			REVISION : 4
			EDITION : 1

ANNEXURE - III

CHECK LIST (To be submit along with Datasheets)

SI. No	Description	REMARKS
1	Deviation from specification	
2	Charger sizing calculation enclosed	
3	Battery sizing calculation enclosed	
4	Battery catalogue enclosed	
5	UPS Panel Catalogue enclosed	
6	Confirm compliance to Block diagram	
7	Confirm Inspection for UPS and battery as per specification.	
8	Dimension for UPS Panel, rectifier and Battery Bank enclosed.	
9	Break up for two years operation & maintenance spares enclosed for UPS & Rectifier	

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	UNINTERRUPTED POWER SUPPLY (UPS)	DOCUMENT NO. MEC/DS/05/E9/07	Page 10 of 12
			REVISION : 4
			EDITION : 1

ANNEXURE - IV

LIST OF TWO-YEAR OPERATION MAINTENANCE SPARES

Sl No.	Description	UOM	Quantity
			Each City
1	IGBT (3 KVA)	Sets	1
2	Rectifier/ Charger Card*	Sets	1
3	Inverter Card*	Sets	1
4	Power supply card*	Sets	1
5	DC-DC Converter card*	Sets	1
6	MCB's & MCCB's (consist of one no. of each rating MCB & MCCB) **	Sets	2
7	Fuse of all ratings**	Sets	2
8	Cooling fan	Nos.	2

(1) * 1 Set=One of card of each rating/type

(2) ** 1 Set= 10% of each rating (minimum one number)

Note: Prices of 02-year O&M spares are inclusive of prices quoted by the Bidder.

-X-X-X-

REV. : 0

Edition : 1

DATA SHEET FOR LV SMALL POWER DISTRIBUTION BOARD

DATA SHEET NO. - MEC/DS/05/E9/076A



**(OIL GAS SBU)
MECON LIMITED**

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	LV SMALL POWER DISTRIBUTION BOARD	DOCUMENT NO. MEC/DS/05/E9/07 A	Page 1 of 4
			REVISION : 0
			EDITION : 1

ANNEXURE - I		
Switch Board		
1.1	Rated voltage and frequency	415V, 3phase, 4 wire, 50Hz
1.2	Maximum voltage	500V
2.0	Continuous current rating at design ambient temperature	As per approved SLD at 45°C with IP 52 enclosure
3.0	Type of enclosure as per IS 2147	IP 52
3.1	Minimum thickness of sheet steel	2mm
4.0	Applicable standards	IS 2147, 8623
5.0	Design ambient temperature	45°C
6.0	One second short time rating of switch board with minimum busbars, feeder busbars, kA(RMS)	As per SLD
7.0	Dynamic through fault current with complete busbars, kA (peak)	
8.0.	The formation (Max.)	Max 6
9.0	Maximum No. of cable terminations in each type of cubicle	
9.1	Size and no.	As per SLD
10.0	Incoming termination of LT switch board	As per SLD
11.0	Incoming termination top/bottom	Bottom for cable Top for busduct
12.0	Outgoing feeder cable entry top/bottom	Bottom
13.0	Minimum clearances at front and back of board	1.5m/1m
14.0	Dimensions LxBxH	
15.0	Maximum Dimensions of shipping sections LxBxH	2.5 x 1.5 x 2.4M
16.0	Min. clearances in air in mm	
16.1	Between phases	25.4mm
16.2	Between live parts and ground	19.0mm
17.0	One minute PF withstand voltage	2.5kV
18.0	Paint shade	631 of IS-5
	Busbars	
1.0	Busbar material & cross section	

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	LV SMALL POWER DISTRIBUTION BOARD	DOCUMENT NO. MEC/DS/05/E9/07 A	Page 2 of 4
			REVISION : 0
			EDITION : 1

1.1	Main busbars	E91E aluminium' Max. current density 0.6A/mm ²
1.2	Bus connections to circuit breakers	
2.0	Continuous rating at design ambient	
2.1	Main busbars	As per SLD
2.2	Bus connections to circuit breakers	As per rated current of
3.0	Temperature rise at rated continuous current of the busbar in the busbar chamber	40deg.C over 45deg.C
4.0	Type of busbar insulators	Resin cast/fibre glass
	Breakers/SFU	
1.0	Type of breakers	As per SLD
2.0	Standards applicable	IS 13947-2/IEC947 – part-II
3.0	Rated service voltage	415V, 3ph., 50Hz
3.1	Highest system voltage	500V, 3ph., 50Hz.
4.0	Rated current at design ambient for breakers	As per SLD
4.1	Rated with breaker in IP 52 enclosure in two tier formation in the LT switch board	As per SLD
5.0	Symmetrical breaking capacity im kA (RMS)	
	-at 415V, 0.25 PF	50 kA RMS
	-at 440V, 0.25 PF	50 kA RMS
6.0	Making capacity kA (Peak)	105kA Peak
7.0	Capacitor breaking capacity at 440V	Incomer: 600A (min.) Outgoing: 300A(min.)
8.0	1 sec. Short time rating, kA (RMS)	50kA RMS
8.1	With release in any setting	50kA RMS
9.0	Thermal release setting ranges (temperature compensated)	As per SLD
10.1	Short circuit release range	As per SLD
10.2	Short circuit release timer setting range	0.1 to 0.6 sec. mechanical
Note	All the releases O/L, S/C and E/F shall be Static/microprocessor based.	

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD DATA SHEET		
	ELECTRICAL SECTION, DELHI		
TITLE	LV SMALL POWER DISTRIBUTION BOARD	DOCUMENT NO. MEC/DS/05/E9/07 A	Page 4 of 4
			REVISION : 0
			EDITION : 1

ANNEXURE III

List of Mandatory Spares

The spare parts as listed below shall be quoted for the Electric Panel along with the offer with item wise unit prices:

1. Contractor	1 No. of each rating
2. Fuses	10% of each rating
3. Overload Relay with single phasing preventer	1 No. of each rating
4. Indication Lamps	10% of total installed installed quantity
5. MCB & MCCB	One no. of each rating.
6. Control Switches	One no. of each rating.
7. Height adjustable circuit breaker trolley For removal and replacement of the Withdraw able circuit breaker carriage	one number
8. Meters	one no. of each type

NOTE All spare parts shall be identical to the parts used in the distribution boards.

STANDARD SPECIFICATIONS (ELECTRICAL SYSTEM)

TECHNICAL SPECIFICATION
FOR
POWER AND DISTRIBUTION TRANSFORMER

DOCUMENT No. : MEC/05/E9/TS/03A

Prepared & Issued by



ELECTRICAL SECTION
(Oil & Gas SBU)
MECON LIMITED

(A Govt. of India Undertaking)
13th & 15th Floor, North Tower, SCOPE MINAR,
Laxmi Nagar District Centre,
Delhi-110092 (India)

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO.	Page 2 of 19
		MEC/05/E9/TS/03A	REVISION: 0
			EDITION: 3

INDEX

S.No.	DESCRIPTION	PAGES
01.00	INTENT	4
02.00	CODES AND STANDARDS	4
03.00	GENERAL REQUIREMENTS	5
04.00	DESIGN AND CONSTRUCTION REQUIREMENTS	5-11
04.01	CONSTRUCTION	5
04.02	CORE AND WINDINGS	6
04.03	COOLING	6
04.04	OIL	7
04.05	TAPPINGS AND CONTROL	7
04.06	TERMINAL AND MARSHALLING BOX	9
04.07	CURRENT TRANSFORMER	10
04.08	ACCESSORIES	10
04.09	NOISE	11
04.10	LOSSES	11
05.00	INSPECTION AND TESTING	11
06.00	PACKING AND DISPATCH	14
07.00	PENALTY CRITERIA	14
08.00	NITROGEN INJECTION FIRE PREVENTION SYSTEM AND EXTINGUISHING SYSTEM FOR POWER TRANSFORMERS	16

Rev	Date	Prepared by	Checked by	Approved by
0	11.07.2025	 Shifa Jindal	 Saurabh Singh	Pankaj Shrivastava

© Copyright MECON Limited – All rights reserved.

THIS DOCUMENT IS THE SOLE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED HEREIN. THIS IS NOT TO BE COPIED OR USED FOR ANY OTHER PROJECTS UNLESS EXPLICITLY PERMITTED BY MECON.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO. MEC/05/E9/TS/03A	Page 3 of 19
			REVISION: 0
			EDITION: 3

AMENDMENT STATUS

(OLD NUMBER OF STANDARD: MEC/TS/05/E9/03A)

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Document Number replaced with New number as MEC/05/E9/TS/03A	All	Rev 0/ Ed 3	11.07.2025		
2	Section re-name as Electrical Section (Oil & Gas SBU) Delhi	All	Rev 0/ Ed 3	11.07.2025		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO. MEC/05/E9/TS/03A	Page 4 of 19
			REVISION: 0
			EDITION: 3

1.0 INTENT

- The intent of this standard specification is to define the general requirements for design, manufacture, assembly and testing at manufacturer's works, packing, transportation and receipt at site with all materials and accessories of **Power and Distribution Transformer**.
- Bidder shall also refer SOR item for details/requirements as part of the project need.

2.0 CODES AND STANDARDS

- 2.1** The equipment shall comply with the requirements of latest revision of following standards issued by BIS (Bureau of Indian Standards), unless otherwise specified:

IS 5	Colour for ready mixed paints and enamels
IS 335	New insulating oils
IS 1180	Outdoor type oil immersed distribution transformers upto and including 2500kVA, 33kV Specification
IS 1271	Electrical Insulation - Thermal Evaluation and Designation
IS 2026	Power transformers
IS 2099	Bushing for alternative voltages above 1000volts
IS 2705	Current transformers
IS 3347	Dimensions for porcelain transformer bushings for use in lightly polluted atmosphere
IS 3637	Gas operated relays
IS 3639	Fittings and Accessories for Power Transformers
IS 4201	Application guide for current transformer
IS 8478	Application guide for on-load tap changers
IS 8468	On-load tap changers
IS/IEC 60529	Degree of protection provided by enclosures (IP code)
IS/IEC 60947	Low voltage switchgear and control gear
-	CBIP Manual on Transformers
S.O.4062(E)	Central Government Gazette Notification on Energy Efficiencies

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002		TECHNICAL SPECIFICATION		
		ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO. MEC/05/E9/TS/03A	Page 5 of 19	
			REVISION: 0	
			EDITION: 3	
	S.O. 513(E)	Amendment to Central Government Gazette Notification on Energy Efficiencies		

2.2 Wherever the requirements in this specification are in conflict with any of the above Standards, the requirements under this specification shall be binding.

2.3 In case of any contradiction between various referred standards/ specifications/ data sheet and statutory regulations the following order of priority shall govern. However, stringent of the below shall be followed

- Statutory regulations.
- Schedule of Rate
- Scope of Work/ Job specification.
- Design Basis.
- Data sheets.
- Standard Specification.
- Codes and standards.

3.0 GENERAL REQUIREMENTS

The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.

Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment for at least for 20 years from the date of supply.

Vendor shall give a notice for at least one year to the Purchaser of equipment before phasing out the product/spares to enable the Purchaser for placement of order for spares and services.

SITE CONDITIONS

The transformer shall be suitable for installation and satisfactory operation in outdoor installation as specified in the data sheet with humid and corrosive atmosphere.

The transformer shall be designed to operate under site conditions as specified in the data sheet. If not specifically mentioned therein, a design ambient temperature of 50°C for outdoor and an altitude not exceeding 1000metres above mean sea level shall be considered.

The transformer described in this specification is intended for continuous duty at the specified ratings under the specified site conditions.

4.0 DESIGN AND CONSTRUCTION REQUIREMENTS

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO.	Page 6 of 19
		MEC/05/E9/TS/03A	REVISION: 0
			EDITION: 3

4.1 Construction

Transformer tank shall be of welded sheet steel construction and provided with gasketed steel cover plates. Base shall be suitably reinforced to prevent any distortion during lifting. Base channels shall be provided with skids and pulling eyes to facilitate handling.

All covers and seals shall be oil and airtight and shall not be affected by mineral or synthetic oil action. Detachable radiators equipped with air vent, drain plug and lifting lugs shall be provided with shut-off valves to permit removal of any radiator unit without emptying the tank. Radiators shall be securely braced to prevent undue vibration. For transformers of ratings less than 500kVA, fixed radiators welded to the tank may be provided.

All fasteners and bolts etc. shall be cadmium plated. All surfaces to be painted shall be thoroughly cleaned, de-scaled, made free from rust and transformer shall be epoxy painted. Paint shall be suitable to withstand specified atmospheric conditions. The colour shade of the final paint shall be as specified in the datasheet. Unpainted steel parts shall be zinc passivated.

Transformer shall be suitable for using emulsifiers as part of fire protection system.

Different parts of transformers shall be connected by copper flexibles for earth continuity purpose.

4.2 Core and Windings

Transformer shall be double wound or triple wound as specified in datasheet, core type with high grade cold rolled non-aging grain oriented low loss, high permeability prime grade, silicon steel laminations (M-4 or better grade) perfectly insulated and clamped to minimise vibration and noise. Care shall be taken to insulate core- fastening bolts to reduce losses and avoid hot spots. All parts of magnetic circuit shall be bonded to earth system.

Windings shall be of 99.9% pure electrolytic grade copper and shall be designed to withstand the applicable thermal and dynamic short circuit stresses.

The completed core and coil assembly shall be dried in vacuum and shall be immediately impregnated with oil after the drying process to ensure elimination of air and moisture within the insulation.

The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand a voltage of 2000V for one minute.

4.3 Cooling

Type of cooling shall be in accordance with the data sheet.

Forced air-cooling system, if required, shall have a separate control panel to be installed near the transformer unless otherwise specified. The specified accessories for cooler controls may also be accommodated in the marshalling box if sufficient space is available. Control panel shall be weatherproof to IP-55 construction and shall accommodate the incoming/outgoing switchgear/ starters for each cooling fan motor, auto/manual selector switch, internal wiring and cable glands necessary for purchaser's external cable connections. Contacts shall be provided for remote

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO.	Page 7 of 19
		MEC/05/E9/TS/03A	REVISION: 0
			EDITION: 3

indication/alarm for following operating conditions:

- Auto/manual selection
- Winding over temp.
- Fans ON (for each fan separately).
- Fans tripped (for each fan separately).

Cooling fans shall be of rustproof construction with wire guard and totally enclosed weatherproof induction motors complete with mounting/supporting structure. These shall be suitably sized to limit the temperature rise of the transformer to specified values with continuous maximum loading of ONAF rating and at maximum specified ambient temperatures. One standby fan per 50% cooler bank shall be provided.

In Auto mode all fans including redundant fans shall be running. Temperature shall be within limits even if redundant fans fail. In manual mode, provision shall be made for starting each fan independently.

4.4 Oil

Oil shall conform to IS-335. Transformer shall be supplied with first filling of oil and 10% extra oil in non-returnable drums.

4.5 Tappings and Control

These shall be provided on high voltage side and connected to off circuit or on-load tap changing gear as specified in the data sheet. Under conditions of external short circuit, the tap changing equipment shall be capable of carrying the same current as the windings.

Off circuit tap changing gear:

Off circuit tap changing gear with number of steps as specified in the data sheet shall be provided. Off circuit tap changing gear shall have an external operating handle mounted on the transformer side and shall meet the following requirements:

- The mechanism shall be such that it is impossible for the contacts to be set in a position whereby the windings remain open-circuited or partly short-circuited.
- Positive snap-action contact changing
- The driving rod through cover or tank wall shall be properly sealed against oil leakage under all service conditions.
- Mechanical stops at the ends shall be provided to prevent overrun.

The handle shall be metallic and the adequately sized in order to allow operation without the need of tools and be located in a directly accessible position. The handle shall be provided with padlock facilities to lock the tap changer in the desired position.

Tap positions shall be clearly marked in line with the data given on the rating plate.

On Load Tap Changer

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO.	Page 8 of 19
		MEC/05/E9/TS/03A	REVISION: 0
			EDITION: 3

- a) High speed on load tap changing gear with number of steps as specified in the data sheet shall be provided and mounted on the transformer. The OLTC gear shall have diverter resistance and the current diverting contacts shall be housed in a separate oil chamber segregated from the main tank of the transformer. The contacts shall be accessible for inspection and their tips shall be replaceable.

OLTC oil chamber shall have oil filling, drain and sampling facility. It shall be provided with oil level indicator, connection orifices, valves and silica gel breather shall be provided.

- b) OLTC shall be provided with local and remote controls.
c) Manual-Mechanical Control

The cranking device for operation of the OLTC gear shall be removable and located at a height not exceeding 1500mm above ground level for easy operation. The mechanism shall be complete with normal accessories including at least the following: -

- i) A mechanical tap position indicator (Rated tap voltages shall be marked on the diagram plate).
 - ii) A mechanical operation counter.
 - iii) Mechanical stops to prevent over cranking of the mechanism beyond extreme tap positions.
- d) Electrical Control

Control circuit shall incorporate the following:

- i) Local/remote manual electrical operation.
- ii) Device to ensure a positive and full completion of tap change once it is initiated even if there is loss of power.
- iii) An interlock to cut-off electrical control automatically upon recourse being taken to manual mechanical control in emergency.
- iv) Electrical interlock to cut-off a counter impulse for a reverse tap change, being initiated during a progressive tap change and until the mechanism comes to rest and resets circuits for a fresh operation.
- v) All auxiliaries and devices for electrical control of OLTC gear should be housed in a weather-proof cabinet mounted on the transformer and shall include:
 - Local tap position indicator
 - 5-digit operation counter
 - Cubicle lighting
 - Thermostatically controlled space heater.
 - Miniature circuit breaker with magnetic and thermal overload devices for controlling the incoming supply to the OLTC motor.
 - Padlocking arrangement for the hinged cabinet door.
 - Removable plate with cable glands.
 - Inside tag with control scheme indelibly marked.

- e) Remote Tap Changer Control Panel

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO.	Page 9 of 19
		MEC/05/E9/TS/03A	REVISION: 0
			EDITION: 3

Remote Tap Changer control panel shall comprise of the following:

- i) Time delay relay.
- ii) Indicating lamp for out of step.
- iii) Out of step buzzer.
- iv) Individual/parallel control on Master follower sequence selector switch.
- v) Raise/lower control switch.
- vi) Potentiometer type tap position indicator.
- vii) Out of step relay.
- viii) Indicating lamp for tap changer supply available.
- ix) Indicating lamp for tap change in progress.

RTCC panel shall be dust & vermin proof, floor mounting, and freestanding type. The enclosure shall be cold rolled sheet of 1.6mm for front and back and 2.5mm thick for the rest. All doors and opening shall be provided with neoprene gaskets.

- f) Automatic tap changing control shall be provided complete with voltage sensing relay if specified in the data sheet.
- g) OLTC wherever called for shall be suitable for bi-directional power flow.
- h) OLTC shall also be rated for basic insulation level value as specified for the transformer in the data sheet.
- i) OLTC Motor torque in Analogue output i.e., (4-20mA) along with OLTC Motor torque, Current tap position, DI for tap change in progress, Out of step relay, Motor stuck, Over current & under current, Auto/Manual selection & AVR healthy status shall be interfaced to the purchaser distribution I/O system via the transformer RTCC panel for transformer tags indicated in the datasheet. This is to monitor the OLTC abnormality at remote location.

4.6 Terminals and Marshalling Box

Windings shall be brought out and terminated on outdoor bushings, cable boxes or bus-duct chamber, which will be located as specified in the data sheet.

Cable box and disconnecting chamber shall be air insulated. Cable box and disconnecting chamber shall be weatherproof to IP-55. For fixed portion of cable box, inspection cover with lifting handle shall be provided.

Primary cable box (where applicable) shall be able to withstand specified primary system fault level for specified duration in the data sheet.

Cable box shall be suitable for termination of specified size of XLPE insulated cable in the data sheet. Gland plate shall be removable type and undrilled. For single core cables, gland plate shall be of non-magnetic material. The head-room available between cable gland plate and terminals shall not be less than 600mm for cable upto 11kV, and 900mm for 22kV and 33kV cables.

Provision for anti condensate heater if required may also be provided in terminal box considering @MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO. MEC/05/E9/TS/03A	Page 10 of 19
			REVISION: 0
			EDITION: 3

highly humid & corrosive environment. Also provision for silica gel breather if applicable may be added.

Terminal chamber for bus-duct termination shall have a gasketed cover plate bolted to it and shall be weatherproof to IP-55. A separate inspection cover with lifting handle shall be provided to facilitate connection and inspection. Phase sequence of the bus bars shall be as specified in the data sheet.

When outdoor bushings are specified, they shall be supplied complete with terminal connectors suitable for the specified conductor size.

Marshalling box shall be weatherproof to IP-55. All protective devices and neutral CTs shall be wired by means of PVC insulated copper conductor armoured cables upto the marshalling box. Terminals shall be clamp type. Removable gland plate with double compression type glands shall be provided. Lamp with switch & socket shall be provided in the marshalling box. Preferably, marshalling box shall be located on the front side of transformer

A CT shall be mounted (if specified) on the neutral terminal with CT secondary wired up to the marshalling box. A separate neutral bushing shall be provided for neutral earthing of transformers. The neutral CT shall be mounted before bifurcation of the neutral. Supporting arrangement for GI strip/cable as applicable shall be provided for connection of neutral bushing to earth/NGR.

4.7 Current Transformers

Current transformers shall generally conform to IS 2705.

For general guidance, Vendor shall note that the protective current transformers shall have an accuracy class "5P" and an accuracy limit factor greater than or equal to "10". However, CTs for restricted earth fault and differential protection (if applicable) shall be of class "PS". Vendor shall co-ordinate the knee point voltage, magnetising current for PS class CTs to avoid saturation and mismatching of CTs provided at another end by other Vendor. Vendor shall be solely responsible for coordinating the relay characteristics with suppliers for the proper selection of all CTs with special attention to CTs of class PS.

Neutral CT ratios are tentative. Vendor shall accommodate changes, if any, at later date as required.

4.8 Accessories

Accessories as specified in the data sheet shall be provided as a minimum. Any other accessories though not specifically mentioned but required for fully functional and operation of transformer shall be supplied.

Conservator shall be complete with oil filling plug and cap, oil drain valve, oil level gauge in addition to magnetic oil level gauge. A flexible oil resistance air bag shall be provided for conservator as specified in the data sheet. Air bag shall be designed to withstand repeated expansion and contraction due to changes in oil level.

Buchholz relay shall be double float type for the main tank with separate normally open trip and alarm contacts. For the OLTC chamber the relay shall be of single float type or oil surge relay with one trip

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO.	Page 11 of 19
		MEC/05/E9/TS/03A	REVISION: 0
			EDITION: 3

contact. Isolating valve shall be provided on either side of the relay and distance piece shall be supplied.

Oil temperature indicator shall be 150mm dial type with two normally open contacts for tripping and alarm. It shall be provided with maximum reading pointer.

Winding temperature indicator shall have normally open contacts one each for tripping, alarm and starting/stopping of cooling fan motors. It shall be provided with maximum reading pointer.

Contact rating of all auxiliary devices shall be 0.5A, 110V DC.

Size of valves for drain, filter and sampling shall be as per table below.

Transformer kVA rating Over Upto & Including	Size of drain valve mm	Size of filter valve mm	Size of sampling valve mm
Upto 1600	25	25	15
1601 - 10000	50	25	15
10001 - 25000	80	50	15
25001 - 50000	100	50	15
50001 and above	100	50	15

DCS/ECS Interface shall be provided for signals as specified in the data sheet. All analogue/digital/serial links signals shall be wired to Marshalling Box or RTCC panel. Vendor shall provide suitable transducers / contacts / ports for signals in Marshalling Box or RTCC panel accordingly.

4.9 Noise

Audible Noise level shall be as per NEMA TR1.

4.10 Losses

The bidder shall guarantee individually the no-load loss and load loss without any positive tolerance. The bidder shall also guarantee the total losses at 50% and 100% load condition (at rated voltage and frequency and at 75 deg. C).

The maximum allowable losses at rated voltage and rated frequency permitted at 75 deg. C shall be as per IS:1180 (Part 1): 2014.

For distribution transformer, maximum allowable losses as stated in the Gazette notification S.O. 4062 (E) and its amendment S.O. 513 (E). For star rating/energy efficiency level of the distribution transformer, refer to the datasheet.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO. MEC/05/E9/TS/03A	Page 12 of 19
			REVISION: 0
			EDITION: 3

5.0 INSPECTION AND TESTING

During fabrication, transformer shall be subject to inspection by Purchaser or by an agency authorized by the Purchaser. Vendor shall furnish all necessary information concerning the supply to Purchaser. The Purchaser shall have free access to the Vendor's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality.

Transformers shall be tested in accordance with applicable standards and ITP. All acceptance and routine tests as follow shall be carried out at Vendor's work under his care and expense. Vendor's internal test reports shall be provided for Purchaser's review prior to inspection and testing

Visual and dimensional check of complete transformer, OLTC (if applicable), RTCC panel (if applicable) and all components

Operational check of all components under normal and worst voltage conditions.

Verification of Bill of material.

Measurement of voltage ratio at all tap positions.

Verification of voltage vector relationship

Measurement of winding resistance at all tap positions.

Measurement of no-load loss and current

Measurement of impedance voltage, short circuit impedance (principal tapping) and load loss

Dielectric tests - Induced over voltage withstand test and separate source voltage withstand test

Tests on OLTC and RTCC (If applicable)

Oil leakage Test - All tanks and oil filled compartments shall be tested for oil tightness by being completely filled with air/oil of a viscosity not greater than that of insulating oil to IS 335 at an ambient temperature and subjected to a pressure equal to the normal pressure plus 35 kN/m² measured at the base of the tank. This pressure shall be maintained for a period of not less than 12 hours for oil and 1 hour for air, during which time no leakage shall occur.

Vacuum Test - One transformer tank of each size shall be subjected to the specified vacuum as in Table-1. The tanks designed for vacuum of 760mm of mercury shall be tested at a maximum internal pressure of 3.33 kN/m² (25mm of Hg) for one hour. The permanent deflection of flat plates after the vacuum has been released shall not exceed the value specified in Table-2 without affecting the performance of the transformer.

Table – 1

MECON LIMITED REGD. OFF: RANCHI 834002		TECHNICAL SPECIFICATION		
		ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO. MEC/05/E9/TS/03A	Page 13 of 19	
			REVISION: 0	
			EDITION: 3	
	Highest System Voltage	MVA Rating	Vacuum Gauge pressure kN/m²	mm of Hg
	Upto 72kV	Upto 1.6	34.7	250
		Above 1.6 & upto 20	68.0	500
		Above 20	100.64	760
	Above 72kV	For all MVA ratings	100.64	760

Table – 2	
Horizontal length of flat plate (in mm)	Permanent deflection (in mm)
Upto and including 750	5
751 to 1250	6.5
1251 to 1750	8
1751 to 2000	9.5
2001 to 2250	11
2251 to 2500	12.5
2501 to 3000	16
Above 3000	19

Pressure Test - One transformer tank of each size shall be subjected to a pressure corresponding to twice the normal head of oil or to the normal pressure plus 35 kN/m² whichever is lower measured at the base of the tank and will be maintained for one hour. The permanent deflection of flat plates after the excess pressure has been released shall not exceed the figure specified in Table-2.

Type tests as follows shall be performed at Vendor's work or independent approved testing laboratory under his care and expense. Latest Type test certificates approved by CPRI or equivalent approved testing agency may be acceptable in lieu of actual type tests on similar transformer subject to Purchaser approval. For such case, the comparison report of characteristics of similar rating

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO.	Page 14 of 19
		MEC/05/E9/TS/03A	REVISION: 0
			EDITION: 3

transformer shall be made by Bidder as per Annex B of IEC 60076- 5 for offered transformer. This comparison report shall be provided by Bidder for Purchaser's approval.

Temperature rise test

Full wave impulse voltage withstand test

Chopped wave impulse voltage withstand test

Short circuit test

Measurement of zero sequence impedance

Measurement of noise level

Measurement of harmonics in the no load current

Measurement of power taken by fan and oil pump motors

Degree of protection

Acceptance, routine and type tests shall be witnessed by Purchaser or an agency authorized by the Purchaser. Prior notice of minimum 4 weeks shall be given to the Purchaser for witnessing the tests.

For equipment bought from other sub-suppliers, certified test reports of tests carried out at the sub-supplier's works shall be submitted. Normally all routine tests as specified in the relevant standards shall be conducted by the sub-supplier at his works.

6.0 PACKING AND DISPATCH

All the equipment shall be divided into multiple sections for protection and ease of handling during transportation. The equipment shall be properly packed for the selected mode of transportation, i.e., by ship, rail or trailer. The equipment shall be wrapped in polythene sheets before being placed in crates/ cases to prevent damage to finish. The crates / cases shall have skid bottoms for handling. Special notations such as 'Fragile', 'This side up', 'Centre of gravity', 'Weight', 'volume' 'Purchaser's particulars', 'P.O. no.' etc. shall be clearly and indelibly marked on the packages together with other details as per purchase order.

The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains and high ambient temperature unless otherwise agreed. In order to prevent movement of equipment/components within the crates, proper packing supports shall be provided.

7.0 PENALTY CRITERIA

General

Loading and Penalty criteria shall be based on guaranteed performance of the transformer. The parameters for loading shall be iron losses and copper losses, inclusive of all positive tolerance, as

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO. MEC/05/E9/TS/03A	Page 15 of 19
			REVISION: 0
			EDITION: 3

given in transformer data sheets filled in by bidder.

Loading shall be done individually for each operating transformer.

Loading Criteria

The rate of capitalization of transformer losses depends upon the rate of interest(s), rate of electrical energy per KWh (EC), life of transformer(s) and average annual loss factor (LS). The annual loss factor takes into account the power loading of the transformer during the year and is worked out on the basis of the formula given below:

$$LS = 0.3LF + 0.7(LF)^2$$

where LF is the annual load factor

Loss Capitalisation Formula

Capitalised cost of transformer = Initial cost + Capitalised cost of annual iron losses + Capitalised cost of annual copper losses.

$$= IC + L_{gi} \times 7680 \times EC \times \left(\frac{(1+r)^n - 1}{r(1+r)^n} \right) + L_{Gc} \times 7680 \times EC \times \left(\frac{(1+r)^n - 1}{r(1+r)^n} \right) \times LS$$

Where IC is initial cost of power transformer, L_{gi} is guaranteed iron losses in kW, inclusive of all positive tolerances and L_{Gc} is guaranteed copper losses in kW, inclusive of all positive tolerances.

Penalty Criteria

During the performance test at the vendor's works, in case the power transformer loss figures exceed the stipulated guaranteed loss values (inclusive of all positive tolerances), the following procedure shall be followed for imposing penalty for every extra kW consumed over and above the guaranteed loss figures.

Penalty Formula

$$\text{Penalty} = (L_{ti} - L_{Gi}) \times EC \times 7680 \times \left(\frac{(1+r)^n - 1}{r(1+r)^n} \right) + (L_{te} - L_{Gc}) \times EC \times 7680 \times \left(\frac{(1+r)^n - 1}{r(1+r)^n} \right) \times LS$$

Where

L_{ti} - Test iron loss figure

L_{te} - Test copper loss figure.

EC - Rate of electrical energy per kWh,

LS - Average annual loss factor,

L_{Gi} - Guaranteed iron losses in kW inclusive of all positive tolerances

L_{Gc} - Guaranteed copper losses in kW

r - Rate of interest

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO.	Page 16 of 19
		MEC/05/E9/TS/03A	REVISION: 0
			EDITION: 3

n - Life of transformer

This penalty will be independent of any other penalties levied elsewhere.

The rate of electrical energy per kWh (EC), rate of interest (r), life of transformer (n) and load factor (LF) shall be as specified in the data sheet.

8.0 NITROGEN INJECTION FIRE PREVENTION SYSTEM AND EXTINGUISHING SYSTEM FOR POWER TRANSFORMERS

8.1 General Description

Nitrogen injection fire protection system designed for oil filled transformers shall prevent tank explosion and the fire during internal faults resulting in an arc and also extinguish the external oil fires on transformer top cover and for external failures like bushing fires, OLTC fires and fire from surrounding equipment.

The system shall work on the principle of DRAIN AND STIR and on activation, it shall drain a pre-determined quantity of oil from the tank top through outlet valve to reduce the tank pressure and inject nitrogen gas at high pressure from the lower side of the tank through inlet valves to create stirring action and reduce the temperature of top oil surface below flash point to extinguish the fire.

Conservator tank oil shall be isolated during bushing bursting, tank explosion and oil fire to prevent aggravation of fire.

Transformer isolation shall be an essential pre-condition for activating the system. The system shall be designed to operate automatically. However, it shall be designed for manual operation, in case of failure of power supply.

The system shall consist of following equipment.

1. Fire extinguishing cubicle placed on a plinth at about 5 to 10 meters away from the transformer
2. Control box placed in the control room.
3. Pre- stressed non return valve in the conservator pipe.
4. Required number of fire detectors on the tank top cover.
5. Signal box fitted on the tank top or tank side wall

8.2 Scope

The scope covers design, engineering, supply, testing at works before dispatch, installation supervision, testing and commissioning and performance demonstration of " fire protection and extinguishing system by nitrogen injection method". Supply of oil pipe, oil separation tank, nitrogen pipe, electrical cables, control boxes, extinguishing cubicle, nitrogen cylinder, PRV, fire detectors and other equipment & accessories required for successful operation of the system is scope of supplier. However, installation and external cable laying of the all the fire protection system is responsibility of the Owner awarded composite contractor under supervision of the fire protection system supplier. Testing, commissioning and performance demonstration of the complete fire protection system is in the scope of the Supplier. It will be the responsibility of the supplier, i.e., transformer manufacturer to

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO.	Page 17 of 19
		MEC/05/E9/TS/03A	REVISION: 0
			EDITION: 3

coordinate with the supplier of the Fire Protection. System for all the arrangements for the complete installation supervision, testing, commissioning and performance tests. Notwithstanding the technical specifications and requirements mentioned herewith any modification can be incorporated for correct operation of nitrogen injection fire protection system without extra cost. The full details of the same are required to be submitted to applicable statutory authorities for approval.

8.3 Operational Controls

The system shall be provided with automatic control for fire prevention and fire extinction. Besides automatic control remote electrical push button control on control box and local manual control in the fire extinguishing cubicle shall be provided. Spare interlocks are to be provided for ensuring that it should not be possible to close HV or MV circuit breakers to energize the transformer after the activation of the fire prevention and fire extinction system.

Necessary provision shall be provided in the fire protection system control box for remote interfacing with station PLC to control and monitoring. Modbus TCP/IP communication shall be provided in the control box. List of signals to be provided shall be as per MR/ Datasheet.

System Activating Signals

Transformer isolation shall be an essential pre-condition for activating the system. Transformer isolation through Master trip relay or circuit breaker (HV and MV side in series has to be incorporated. Besides, two electrical signals to be provided in series, for activating the system as under:

For Prevention:

: Differential relay.

: Buchholz relay paralleled with pressure relief valve.

For Extinction:

: Fire detector.

: Buchholz relay paralleled with pressure relief valve.

System Equipment

Fire Extinguishing Cubicle (FEC), placed on plinth at about minimum 5 meter away from the transformer, shall consist of

1. Nitrogen gas cylinder with regulator and falling pressure electrical contact manometer. The same shall be interfaced with PLC.
2. Oil drain pipe with mechanical quick drain valve.
3. Electro mechanical control equipment for oil drains and predetermined regulated nitrogen release.
4. Pressure monitoring switch for backup protection for nitrogen release
5. Limit switches for monitoring of the system.
6. Flanges on top panel for connecting oil drain and nitrogen injection pipes for transformer.
7. Panel lighting
8. Oil drain pipe extension of suitable sizes for connecting pipes to oil pit.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO. MEC/05/E9/TS/03A	Page 18 of 19
			REVISION: 0
			EDITION: 3

Control box with activating, monitoring devices and line faults indicators. (To be placed in control room). It should have audio visual alarm indication and push button switches.

Pre-stressed non return valve (PNRV) to be fitted in the conservator pipe line, between conservator and Buchholz relay operating mechanically on transformer oil flow rate with electrical signal for monitoring.

Fire detectors to be fixed on transformer tank top cover and On load Tap Changer for sensing fire.

Signal box to be fixed on transformer side wall for terminating cable connections from fire detectors and PNRV.

All other consumables necessary for complete system.

8.4 Other Requirements for System Installation

Oil drain and nitrogen injection openings with gate valves on transformer tank at suitable locations

Flanges with dummy piece in conservator pipe between Bucholz relay and conservator tank for fixing PNRV

Fire detector brackets on transformer top cover.

Spare potential free contacts for system activating signals i.e., differential relay, buchholz relay, pressure relief valve, transformer isolation (master trip relay)

Pipe connections between transformer to fire extinguishing cubicle and fire extinguishing cubicle to oil pit.

Cabling on transformer top cover all fire detector to be connected in parallel and inter cabling between signal box to control box and control box to fire extinguishing cubicle.

Plinth for fire extinguishing cubicle. Oil pit with capacity as 10% of total oil quantity of transformer

8.5 Technical Details

Fire prevention system vendor shall provide the following details for proper and safe operation of the system along with bid documents.

1. Fire Extinction period
 - a. On commencement of Nitrogen injection
 - b. On system activation up-to post cooling
2. Fire detectors heat sensing temperature
3. Heat sensing area
4. Pre- stressed non return valve setting for operation

8.6 Cabling

Fire survival cables, able to withstand 750 °C, 4 core x 1.5 mm sq for connection of fire detectors in parallel shall be used. The test certificates for the cables shall be submitted. Other control and power cables required for the operation of system shall be provided and installed by purchaser. The type

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND DISTRIBUTION TRANSFORMER	DOCUMENT NO. MEC/05/E9/TS/03A	Page 19 of 19
			REVISION: 0
			EDITION: 3

and sizes of the cables shall be indicated in the vendor drawing/documents during detailed engineering of the fire protection system by supplier.

8.7 Tests

Type Tests

Type test reports including that for detectors along with declared response time as per TAC's letter shall be submitted along with the tender. The system shall be tested by UL, FM, LPC or a national testing body (BIS recognized laboratory). TAC's approval, if any, shall be submitted with the tender.

Factory Test

Tests will be carried out on individual equipment of the system and the total system in the supplier's workshop in presence of purchaser's representative.

Performance Test

Performance test of the complete system shall be carried out after complete erection at site by the supplier's representative. These tests shall include simulation and verification of the response the complete system without actual draining of the oil and injection of the nitrogen gas. In addition to above, additional tests as required necessary shall be conducted.

Drawing and Manuals

Detailed layout drawing along with the equipment drawing to be given in the tender along with complete bill of materials. After awarding of contract, detailed dimensional drawing of the system complete bill of materials including location and size of plinth cubicle and recommended capacity of oil separation tank shall be submitted for purchaser's approval.

Soft back up of controller program, if PLC is used, to be provided along with software to view and modify the program. PDF copy of PLC program to be provided.

Redundant modbus communication (different domain) between NIFPS devices & PLC to be provided.

Mandatory Spares

One full set of spare nitrogen gas filled cylinder; fire detectors (heat sensing element) shall be provided in addition to additional other recommended spares. List of the mandatory spares shall be as specified in the material requisition. The list of recommended spares is to be submitted along with the tender.

TECHNICAL SPECIFICATION
FOR
MEDIUM VOLTAGE SWITCHBOARD

DOCUMENT No. : MEC/05/E9/TS/06

Prepared & Issued by



ELECTRICAL SECTION
(Oil & Gas SBU)
MECON LIMITED

(A Govt. of India Undertaking)
13th & 15th Floor, North Tower, SCOPE MINAR,
Laxmi Nagar District Centre,
Delhi-110092 (India)

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 2 of 31
			REVISION: 0
			EDITION: 3

INDEX

Sl. No.	Description	Page No
S.No.	DESCRIPTION	PAGES
01.00	INTENT	4
02.00	CODES AND STANDARDS	4
03.00	DESIGN AND FABRICATION	5
04.00	SWITCHBOARD COMPONENTS	15
05.00	INTERFACE REQUIREMENTS	24
06.00	PROTECTION AND METERING	24
07.00	DRAWINGS AND DOCUMENTS	28
08.00	COMPLETENESS OF EQUIPMENT	29
09.00	INSPECTION AND TESTING	29

Rev	Date	Prepared by	Checked by	Approved by
0	11.07.2025	 Chirosmita Banerjee	 Saurabh Singh	Pankaj Shrivastava

© Copyright MECON Limited – All rights reserved.
THIS DOCUMENT IS THE SOLE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED HEREIN. THIS IS NOT TO BE COPIED OR USED FOR ANY OTHER PROJECTS UNLESS EXPLICITLY PERMITTED BY MECON.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 3 of 31
			REVISION: 0
			EDITION: 3

AMENDMENT STATUS

(OLD NUMBER OF STANDARD: MEC/TS/05/E9/06)

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Document Number replaced with New number as MEC/05/E9/TS/06	All	Rev 0/ Ed 3	11.07.2025		
2	Section re-name as Electrical Section (Oil & Gas SBU) Delhi	All	Rev 0/ Ed 3	11.07.2025		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO.	Page 4 of 31
		MEC/05/E9/TS/06	REVISION: 0
			EDITION: 3

1.0 INTENT

The intent of this standard specification is to define the general requirements for design, manufacture, assembly and testing at manufacturer's works, packing, transportation and receipt at site with all materials and accessories of Medium Voltage Switchboard.

02.0 CODES & STANDARDS

The equipment shall comply with the requirements of latest revision of following standards issued by BIS (Bureau of Indian Standards), unless otherwise specified:

IS 5	Colours for ready mixed paints and enamels
IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories
IS 2705	Current transformers
IS 2824	Method for determining of the proof and the comparative tracking indices of solid insulating materials
IS 3156	Voltage transformers
IS 3231	Electrical relays for power system protection
IS 3618	Phosphate treatment of iron and steel for protection against corrosion
IS 5082	Wrought aluminium and aluminium alloy bars, rods, tubes and sections for electrical purposes
IS 5578	Guide for marking of insulated conductors
IS 6005	Code of practice of phosphating of iron and steel
IS 8623	Low voltage switchgear and controlgear assemblies
IS 11353	Guide for uniform system of marking and identification of conductors & apparatus terminals
IS 12672	Internal fuses and internal overpressure disconnectors for shunt capacitors
IS 13340	Power capacitors of self-healing type for AC power systems having rated voltage upto and including 1000V
IS 13341	Requirements for ageing test, self-healing test and destruction test on shunt capacitors of the self-healing type for ac power systems having a rated voltage upto and including 650V
IS 13703	Low voltage fuses for voltages not exceeding 1000V AC or 1500V DC
IS/IEC 60529	Degree of protection provided by enclosures (IP code)
IS/IEC 60947	Low voltage switchgear and control gear

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO.	Page 5 of 31
		MEC/05/E9/TS/06	REVISION: 0
			EDITION: 3

IEC 61641 Enclosed low-voltage switchgear and control gear assemblies – Guide for testing under conditions of arcing due to internal fault

Wherever the requirements in this specification are in conflict with any of the above Standards, the requirements under this specification shall be binding.

In case of any contradiction between various referred standards/ specifications/ data sheet and statutory regulations the following order of priority shall govern. However, stringent of the below shall be followed

- Statutory regulations.
- Schedule of Rate
- Scope of Work/ Job specification.
- Design Basis.
- Data sheets.
- Standard Specification.
- Codes and standards.

03.00 DESIGN AND FABRICATION REQUIREMENTS

03.01 Assembly

The switchboard shall be metal enclosed, free standing, floor mounting, compartmentalized, modular type, fully draw out or fixed type as specified in the data sheet.

The switchboard enclosure shall be dust and vermin proof and shall provide a degree of protection as specified in the data sheet.

The switchboard shall be assembled out of vertical panels of uniform height in single line up. The switchboard height shall be restricted to 2300mm.

The switchboard shall be designed to ensure maximum safety during operation, inspection, connection of cables, relocation of outgoing circuits and maintenance, with the bus bar system energised and without taking any special precautions.

It shall be possible to extend the switchboard, in either direction at a later date. Ends of bus bars shall be suitably drilled for this purpose. Panels at extreme ends shall have openings, which shall be covered with plates screwed to the panel. Details of drilled holes in bus bar and openings in the panels, provided for future extension shall be clearly shown in the vendor drawings.

Adequate means shall be provided to prevent shorting of power and / or control terminals due to accidental dropping of maintenance tools etc. inside the switchboard. Checking and removal of components shall be possible without disturbing adjacent equipment.

All identical equipment and corresponding parts shall be fully interchangeable.

The frame, of individual vertical panels shall be fabricated using pressed and cold rolled sheet steel. The sheet steel used for panel shall be of minimum 2mm (14SWG) CRCA except that the doors and covers may be made of 1.6mm (16SWG) CRCA. Wherever required, stiffeners shall be

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO.	Page 6 of 31
		MEC/05/E9/TS/06	REVISION: 0
			EDITION: 3

provided to increase stiffness of large size doors and covers.

The switchboard shall be provided with integral base frame for each vertical panel. The switchboard integral base frame shall be suitable for tack welding.

All openings, covers and doors shall be provided with neoprene Gaskets. Removable blanking plates shall be provided to cover the openings in the event of withdrawing the feeder modules. Number of blanking plates shall be 10% of each module size with a minimum of one number.

All hardware shall be corrosion resistant. All joints and connections of the panel members shall be made by zinc passivated cadmium plated high quality steel bolts, nuts and washers.

Removable, CRCA or non-magnetic gland plates having minimum 3mm thickness shall be provided. Non-magnetic cable gland plates shall be provided for termination of single core cables only.

Suitable removable type eyebolts shall be provided for the lifting of the panel/shipping section.

These bolts, when removed shall not leave any opening in the panels.

The switchboard shall be formed using distinct vertical panels each comprising of following compartments.

- a) A metal enclosed horizontal bus bar compartment running at top unless otherwise specified.
- b) Individual feeder modules in multitier mode.
- c) Cable termination compartment.
- d) Vertical bus bars serving all feeder modules in the vertical panel.
- e) Perforated sheet steel / insulating material enclosed horizontal auxiliary bus bars for control, interlock, indication and metering wiring running horizontally.

Metal sheets shall be provided between two adjacent vertical panels running up to full useful height of the switchboard.

MCC shall be of single/double front execution as specified in the data sheet. However, air circuit breaker panels and fixed type switchboard shall be in single front execution only.

Motor starter and switch fuse modules shall not be accommodated at front and rear of Incomer and bus coupler panel.

All metering and protection equipment associated with a particular circuit as specified in the data sheet shall be housed in separate and independent compartment earmarked for that particular circuit and in the fixed portion of the vertical panel in case of circuit breaker panels.

All auxiliary devices for control, reset, indication, measurement and protection such as push buttons, control and selector switches, indicating lamps, measuring instruments and protective relays shall be mounted on the front side of the respective compartment. The design shall be such that all power on/off or start / stop and relay reset operations shall be performed without opening the panel door.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO.	Page 7 of 31
		MEC/05/E9/TS/06	REVISION: 0
			EDITION: 3

All dummy panels and rear extensions required for bus trunking, cable terminations, mounting of relays, metering and control components etc. shall be supplied by Vendor. Additional dummy panels required to have unobstructed cable entries shall be provided as specified in the data sheet.

The switchboard panels shall be provided with space heaters to prevent moisture condensation. The space heater shall be located in the bottom part of each panel and shall be supplied from 240 V AC auxiliary bus for space heater. The space heater shall be provided with a thermostat having adjustable setting and double pole miniature circuit breaker.

Panel Illumination and receptacle shall be provided in cable alley of each vertical section of the switchboard as follows

- a) Door limit switch and illuminating compact fluorescent lamp.
- b) Single phase 5 A decorative type receptacle with on-off switch.

Auxiliary bus bars each of minimum size 18-mm² coppers shall be provided for following applications. Exact number of bus bars shall depend on various control, metering and auxiliary power distribution requirement.

- a) Panel space heater supply and motor space heater supply.
- b) Control supply for breaker spring charging motors, motor starter control and indication circuit.
- c) Control supply for breaker tripping, closing and indication circuits.
- d) AC potential supply for energy meters, voltage operated relays etc.
- e) Tee-off connectors shall be used for distributing auxiliary supply to each vertical panel. Rubber grommets shall be used for all wire entries to make the entries dust and vermin proof.
- f) Provision to hook up of external DC control supply to be provided either in bus PT panel or bus coupler panel.

All identical feeder modules shall be interchangeable in case of draw out execution.

Each vertical panel shall have a separate cable alley. The width of this cable alley shall be sufficient to accommodate all the cables and shall have free access for cable terminations and in any case shall not be less than 200mm minimum. Cable alleys shall be provided with suitable doors.

Sheet steel barriers shall be provided between individual compartments and cable alley. This barrier shall be provided with opening for power and control connections and it shall be possible to safely carryout maintenance work on cable connections to any one circuit in the cable alley with the busbars and the adjacent circuits live.

Maintenance and connection of cables to any modules shall be possible without having to take out

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO.	Page 8 of 31
		MEC/05/E9/TS/06	REVISION: 0
			EDITION: 3

the modules from its position from the panel.

Switchboard shall be completely lined up in one straight row with the type and quantities of feeders as defined in the data sheet. Generally, the feeders of three main categories are identified as air circuit breaker, motor starters, switch fuse / moulded case circuit breakers.

The maximum height of the operating handle and switches shall not exceed 1900mm and the minimum height not below 300mm.

Unused modules in the panel shall be fully equipped with hinged door, power and control terminals for starter modules and cradle for future use.

Segregation Form shall be min. 3B.

03.02 Bus Bar

Bus bars shall be of high conductivity electrolytic aluminium supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that defined in Indian standards.

The main bus bars shall have uniform current ratings throughout their length as specified in the data sheet. The current rating of the neutral shall be half that of the phase bus bars. Removable neutral links shall be provided on feeders to permit isolation of the neutral bus bar.

Both horizontal and vertical bus bars, bus joints and supports shall be capable of withstanding dynamic and thermal stresses of short circuit currents for 1 second as specified in the data sheet. The short circuit capacity of the neutral bus bars shall be in line with IS/IEC 60947.

Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers shall be used for all bus bar joints and supports.

The hot spot temperature of bus bars including joints at design ambient temperature shall not exceed 95°C for normal operating conditions.

The current rating as defined for switchboard and components in the data sheet are for design ambient temperature at site conditions and for being inside the cubicle at fully loaded condition. The vendor shall suitably derate the nominal rating to suit the above condition.

All bus bars shall be insulated with heat shrunk PVC sleeves of 1100V grade. Red, yellow and blue colour shall be used for phase bus bars and black colour shall be used for neutral bus bars. Removable type shrouds shall be provided for joints.

Interconnections between the main bus bars and individual units shall be made by using aluminium bus bars of adequate rating. These interconnections of the vertical bus bars shall be in separate compartment and fully shrouded.

Minimum clearance between live parts, between live parts/neutral to earth shall be 19 mm. However, clearances between terminals at components shall be as per applicable individual standards for components.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO.	Page 9 of 31
		MEC/05/E9/TS/06	REVISION: 0
			EDITION: 3

Vertical bus bars for circuit breaker panels shall be sized depending upon the rating and number of breakers per vertical panel. However Vertical bus bars of all other panels shall be of uniform cross section. Size of vertical bus bars shall not be less than 500mm² Aluminium per phase or equivalent copper for panels rated above 25kA.

03.03 Air Circuit Breaker Feeders

The air circuit breaker panels shall have distinct bus bar, breaker and cable compartments. The design of each compartment shall be such as to prevent movement of vermin from a particular compartment to any other compartment of the panel when the air circuit breaker is withdrawn and compartment door is closed.

Blanking plates shall be provided for each air circuit breaker compartments, which would be used after installation, to cover the openings in the event of taking out the breaker outside the compartment.

In order to minimise accidental access and avoid accidents due to falling tools, all the outgoing links shall be shrouded.

Outgoing air circuit breaker can be mounted in a maximum of two-tier execution while the incoming/bus coupler Air circuit breaker shall be in single tier execution only.

All ACBs shall be provided with zone selective interlocking which helps in reducing the thermal stress and provides discrimination between incoming & outgoing breaker during short circuit and ground faults. The manufacturer shall supply all necessary equipment like ZSI module, power supply and wiring connectors to implement ZSI.

Cable compartment

a) Separate compartment totally enclosed from all sides shall be provided for cable termination, on the rear side. Access to cables shall be from the rear side after opening the cabling compartment door.

b) The incoming / outgoing cable termination shall be staggered for each circuit and barriers of sheet steel or insulating material shall be provided between termination of two circuits such that maintenance on one circuit could be carried out while the other circuit is live. Suitable clamping arrangements shall be provided for cables and cable termination. Terminal blocks shall not be used for supporting the cables.

c) The incoming supply for PCC / PMCC panels shall be through top entry bus ducts or through top or bottom entry cables as specified in the data sheet. The outgoing cables shall have top or bottom entry as specified in the data sheet.

d) The cable terminations shall be suitably sized for receiving specified number of cables per termination and provision shall be made for terminating each outgoing cable with a separate bolted connection. In case the total number of cables entering a particular panel cannot be accommodated in the cabling compartment of the panels an extension panel of full height shall be

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO.	Page 10 of 31
		MEC/05/E9/TS/06	REVISION: 0
			EDITION: 3

added to the cabling compartment for accommodating extra cables.

Air circuit breaker compartment

a) The air circuit breaker compartment shall be fully draw out or fixed type as specified in the data sheet. Suitable guides shall be provided to facilitate easy withdrawal of the air circuit breaker in case of fully draw out execution.

b) The current transformers for the ammeter/protection circuits shall be mounted on the fixed portion of the compartment. However, current transformers associated with built-in releases may be mounted on the air circuit breaker trolley.

c) All terminals except wiping/sliding type control terminals shall be shrouded with plastic covers to prevent accidental contact. For direct termination - clip on shrouded type terminals shall be provided.

d) There shall be three positions for the fully draw out execution of draw out trolley viz:

i) "Service" position - In this position both power and control circuits shall be connected. This shall be the normal operating position of the air circuit breaker.

ii) "Test" position - The power contacts shall be disconnected in this position but the control connections shall not be disturbed, it shall be possible to close and trip the air circuit breakers in this position.

iii) "Drawout" Position - both power and control circuits shall be disconnected in this position and air circuit breaker removed from the cubicle.

e) The air circuit breaker shall be lockable in "service" and "test" positions. Safety shutters shall be provided when the air circuit breaker is in withdrawn/drawout position.

f) The earth connection must remain connected in "Test" position; Earthing of the unit shall be done with a "pin" or with scrapping earth connections.

g) The earth connection shall make before the main power / control contacts make and break after the power /control contacts are disconnected. Earthing connection through a plug and socket connection shall not be acceptable

Interlocks

Following interlocks shall be provided:

a) Compartment doors shall be interlocked against opening when air circuit breaker is in closed condition. However, it shall be possible to defeat this interlock for inspection purposes.

b) It shall not be possible to push "in " a drawn-out air circuit breaker in closed condition or withdraw an air circuit breaker in closed condition.

c) It shall be possible to operate an air circuit breaker only in the defined "Full in" or "service"

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 11 of 31
			REVISION: 0
			EDITION: 3

and "test" position inside the panel. It shall not be possible to operate the air circuit breaker in intermediate positions while inserting or withdrawing air circuit breaker.

d) Electrical/mechanical interlocking shall be provided between incomers and bus coupler of switchboard as specified in Operating philosophy and or SLD.

Any unused air circuit breaker compartment shall be fully equipped and provided with compartment door, vertical busbars and control terminals/ wiring etc. such that the same could be used for housing outgoing air circuit breakers in future without any modifications to the panel.

03.04 Non air circuit breaker feeders

The non-air circuit breaker feeders shall be fully draw out or fixed type as specified in the data sheet. The design of drawout feeder modules shall not change for single front or double front execution. Separate vertical bus bars shall be provided for each front side modules.

The outgoing feeder trolleys for draw out type switchboard shall be fully drawout and shall have the following features.

a) It shall be possible to withdraw the trolley without having to unbolt or unscrew any power and control connections to the equipment mounted on the withdrawable trolley.

b) Both power and control connections shall be drawout type. All line and bus PTs shall be in drawout execution only. However, outgoing modules having size more than half of the useful vertical height of the panel may be in mixed combination of drawout /fixed type.

c) Control supply transformer modules with burden higher than 2.5kVA may be in fixed execution.

d) The trolley withdrawal shall be by means of crank and screw arrangement. Alternatively, movement on guided rollers may also be acceptable. Plug in operation shall be independent of manual force.

e) For drawout type feeders of size equal to or greater than half the useful vertical height of panel, positive clamping arrangement shall be provided on the top portion of the trolley in addition to clamping arrangement at the bottom, to ensure all round positive pressure on the power drawout contacts once the trolley is plugged in.

f) Power drawout contacts shall preferably be located towards the bottom portion of each trolley. The trolley shall be lockable in fully plugged in position and devices shall be provided to ensure positive plugging in. In test position, power contacts shall be totally isolated and a device shall be provided for indication of test position.

g) Vendor shall supply ACB withdrawal mobile trolley with winch assembly duly certified by a competent authority as per factory act/rules as part of their base quote.

The incomer and bus coupler feeders with load break switches rated 800A and above may be in fixed execution.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 12 of 31
			REVISION: 0
			EDITION: 3

Various compartment sizes in a vertical panel shall be multiples of a basic dimension. However, the minimum module size for switch fuse feeder / MCCB feeder shall not be less than that defined in the data sheet. Vertical bus bars shall be pre-drilled at regular intervals for complete flexibility for changes in size of modules.

All switch drives other than rotary control switches, shall be lockable in both 'ON' and 'OFF' positions.

The switches/Moulded case circuit breakers /MCB shall be interlocked with the compartment door to prevent opening of the door when the switch/ moulded case circuit breaker is in 'ON' position and to prevent switching on when the door is open. A defeat mechanism for this interlock shall also be provided.

03.05 Motor starter and contactor-controlled feeders

Starter modules required for motor control shall be of following types and internal control wiring of all starter modules of each type shall be identical for all ratings.

- d) FVNR Full voltage non -reversing starter with minimum 18 control terminals.
- e) FVR Full voltage reversing starter with minimum 24 control terminals.
- f) FVNR – HD Full voltage non -reversing heavy duty starter with long starting time such as for compressors and fans etc. with minimum 18 control terminals.

Switch fuse / contactor feeder modules shall be of following types and internal control wiring of all modules of each type shall be identical for all ratings.

- a) SFUC Switch fuse contactor modules with 18 control terminals.
- b) MCCBC MCCB contactor modules with 18 control terminals.

Various compartment sizes in a vertical panel shall be multiples of a basic dimension. However, the minimum module size for motor starter / contactor-controlled feeder shall not be less than that defined in the data sheet. Vertical bus bars shall be pre-drilled at regular intervals for complete flexibility for changes in size of modules

Minimum 2000 VA control transformer shall be provided for each bus section of the switchboard having contactor control feeders and each transformer shall be sized for the entire switchboard. For switchboard having two bus sections and coupled by bus coupler shall have manual changeover switch for the control transformers.

To facilitate site modification due to changes in motor kW ratings and to minimize spares inventory, overload relays and power fuse links shall meet the following requirements.

- a) All bimetal overload relays shall be separately mounted type with connecting links rated for the maximum rating of the contactor in a starter module.
- b) Bimetal overload relays of various current ranges required for motors likely to be connected to a contactor must be identical in dimension for inter-changeability. In case offered relays are with

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 13 of 31
			REVISION: 0
			EDITION: 3

different dimension for any particular starter module, special mounting plate suitable for mounting different relays shall be provided in all the modules of that size.

Heavy duty motor starters shall be provided with saturable type current transformer operated overload relays only, which shall be suitable for motor starting time of 15-60 seconds.

All contactor-controlled starter feeders shall meet the requirements of type-2 co-ordination as per IS/IEC 60947.

Selection, sizing and suitability of all components shall be the Vendor's responsibility and all equipment required for safe and satisfactory operation shall be included by the Vendor even if not specifically mentioned.

Control circuit provided for motor feeders shall be with fail safe feature.

Soft starter modules shall be interfaced over Modbus TCP/IP protocol.

03.06 Clearance and Creepage distances

The clearance and creepage distances shall not be lower than the values specified below:

- a) Minimum clearance between two live conductors (Ph-Ph) : 25.4mm
- b) Minimum clearance between live conductor and earth : 19mm
- c) Minimum creepage distance : 20mm

The clearances and the creepage, as specified above, shall definitely be maintained in the bus-bar system. Provision of bus-bar insulations, separator or barriers shall not be considered to reduce the clearance from the values specified above.

At the termination points in the equipment, e.g., ACB, MCCB, switches, contactors, thermal relays, etc. it is realized that above clearance may not always be possible to be maintained. All such points where above clearance is not possible to be maintained should, therefore, be insulated or taped.

03.07 Wiring and Terminations

Inside the cubicles, the wiring for control, signalling, protection and instrument circuits shall be done with BIS approved, PVC insulated, flame retardant type, copper conductor wire. The insulation grade shall be 660V. The wiring shall preferably be enclosed in plastic channels or neatly bunched together.

PVC insulated copper conductor of cross section 1.5mm² may normally be used provided the control fuse rating is 10amps or less. For 16amps control fuse circuit 2.5mm² copper conductor shall be used. Each wire shall be terminated at a separate terminal. C.T.Circuit wiring shall be done with 2.5mm² Copper conductor.

Shorting links/suitable-shortening arrangement for shorting CT secondary shall be provided.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO.	Page 14 of 31
		MEC/05/E9/TS/06	REVISION: 0
			EDITION: 3

Each wire shall be identified at both ends by PVC ferrules.

Inter panels wiring within each shipping section shall be switchboard vendor's responsibility. For wiring between shipping sections, vendor shall provide terminal blocks on adjoining shipping sections and supply suitable jumpering wires. Interpanel wiring shall be taken thorough PVC sleeves or rubber grommets.

A minimum of 10% spare terminals shall be provided on each terminal block.

Conductors shall be terminated with adequately sized compression-type lugs for connection to equipment terminals and strips. Stranded conductors shall be soldered at the ends before connections are made to the terminals. Sufficient terminals shall be provided on each terminal block to ensure that not more than one outgoing wire is connected per terminal.

Terminal strips shall preferably be separated from power circuits by metal barriers or enclosures. All spare contacts of auxiliary relays, timers, etc shall be wired up to the terminals.

All external power and control cables shall enter the switchboard from top or bottom as specified in the data sheet. Sufficient space shall be provided for ease of connection and termination of cables. Terminals shall be suitable for termination of external power and control cable sizes as specified in the data sheet.

The switch board shall be completely factory wired and ready for external connections.

03.08 Earthing

All panels shall be connected to a tinned copper earth bus bar running throughout the length of the switchboard.

The minimum earth bus size shall be 30x6 mm² copper for fault level up to 31.5kA and 50 x 6mm² copper for fault level above 31.5kA. However, vendor to ensure the size of conductor as per the fault level specified in the datasheet.

All doors and movable parts shall be earthed using flexible copper connections to the fixed frame of the switchboard. Provision shall be made to connect the earthing bus bar to the plant-earthing grid at two ends.

All non-current carrying metallic parts of the mounted equipment shall be earthed. Minimum 4 nos. 10mm diameter bolts with nuts shall be provided on the earth bus for termination of fourth core of cable per vertical panel.

03.09 Name plate

A nameplate with the switchboard designation shall be fixed at the top of the central panel. A separate nameplate giving details for each feeder compartment of all panels shall be provided.

The nameplates for feeder compartments shall be in two parts. One part shall have necessary details pertaining to the compartments number of vertical panel of the switchboard. The other

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 15 of 31
			REVISION: 0
			EDITION: 3

parts shall be removable and shall contain all details regarding the feeder number for drives/equipment controlled by the particular module as per approved single line diagram.

Nameplate or polyester adhesive stickers shall be provided for each equipment mounted inside the switchboard. Special warning plates shall be provided on removable covers or doors giving access to cable terminals and bus bars.

Blank nameplates shall be provided for all spare and vacant modules.

Engraved nameplates shall preferably be of 3-ply (Black-White Black) lamicoid sheets or anodised aluminium. However back engraved perspex sheet nameplates may also be acceptable. Nameplates shall be fastened by screws and not by adhesives.

Special warning labels shall be provided inside the switchboard also, wherever considered necessary. Identification tags shall be provided inside the panels matching with those shown on the circuit diagram.

03.10 Painting

All metal surfaces shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The under surface shall be prepared by applying a coat of phosphate paint and coat of yellow zinc chromate primer. The under surface shall be made free from all imperfections before undertaking the finishing coat.

After preparation of the under surface, the switchboard shall be spray painted with two coats of epoxy based final paint or shall be powder coated.

Colour shade of final paint shall be as specified in the data sheet.

The finished panels shall be dried in stoving ovens in dust free atmosphere. Panel finish shall be free from imperfections like pinholes, orange peels, runoff paint etc. Vendor shall supply final paint (1 litre per switchboard) in non-returnable container for final touch up at site.

All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust formation. If these parts are moving elements then they shall be greased.

04.00 SWITCHBOARD COMPONENTS

04.01 Air circuit breakers

Air circuit breakers shall be air break type and shall be provided with electrical power operating mechanism. Wherever air circuit breakers are provided in place of Isolators, air circuit breaker can be manually operated type. It shall be applicable for IoT.

Operating Mechanism

- Electric power operating mechanism shall be motor wound spring charged stored energy type. However, manual-operating mechanism may be of the spring charging stored energy type or the spring assisted type. For air circuit breakers with electrical power operating mechanism,

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 16 of 31
			REVISION: 0
			EDITION: 3

provision shall also be made for manual spring charging. Closing time of air circuit breakers with manual operating mechanism shall be independent of the speed of the operating handle.

- b. All stored energy operating mechanism shall be equipped with following features.
 - i) Failure of springs, vibrations or shocks shall not cause unintended operation of air circuit breaker or prevent intended tripping operation.
 - ii) Closing of air circuit breakers shall be prevented unless the spring is fully charged.
- c. All electrical power operating mechanisms shall be suitable for remote operation and shall be equipped with following features.
 - i) Provided with emergency manual charging facility. The motor shall be automatically, decoupled (mechanically) once the manual-charging handle is inserted.
 - ii) Provided with universal motor operable on AC or DC control supplies.
 - iii) Closing operation of air circuit breaker shall automatically initiate charging of the spring for the next closing operation without waiting for tripping of air circuit breaker.
 - iv) Closing operation shall be completed once the closing impulse is given and the first device in the control scheme has responded even though the control switch / Push Button is released provided no counter trip impulse is present.
 - v) Spring charging motors in switchboard shall be suitable for control supply as specified in the data sheet.

Air circuit breaker trip and closing coils in case of electrically operated breakers and trip coil in case of mechanically operated breakers and air circuit breaker indication shall be suitable for satisfactory operation on a control supply system indicated in the data sheet.

Air circuit breakers shall be provided with anti-pumping and trip free feature.

The air circuit breakers shall be provided with mechanically operated emergency tripping device. This device shall be available on the front of the panel. Mechanically operated 'closing' device shall be provided for all air circuit breakers. However mechanical closing shall be inhibited for all air circuit breakers in service position.

Air circuit breakers open and closed positions, service and test locations and spring charged condition shall also be indicated mechanically in addition to electrical indications.

Castle lock arrangement shall be provided for all the air circuit breakers so that air circuit breakers can be locked in the test position while carrying out the maintenance of down stream equipment.

Air circuit breakers and the switchboard shall be designed in such a way that over tightening of the air circuit breakers while racking-in (plugging-in) shall not damage the air circuit breakers.

Air circuit breakers shall be provided with operation counters.

Releases are not required to be provided with air circuit breakers where relays are used. However,

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 17 of 31
			REVISION: 0
			EDITION: 3

air circuit breakers having AC control supply voltage shall be provided with under voltage release unless specified otherwise.

Air circuit breakers shall be provided with minimum 4 NO + 4 NC contacts, wired and available for Purchaser's use.

ACB shall have Ready to Close indication. Ready to close indication shall give a single indication, only if ACB is ready to be closed, after checking all the given conditions (UV release energized, Shunt release de-energized, spring charged, Breaker is not "ON", Breaker has not tripped on fault, Breaker is not mechanically interlocked with other breaker and ACB is not racked in completely in service position) ensuring safety for user and electrical distribution. The tripping and closing coils shall be continuously rated.

04.02 Switches

All switches or fuse switches shall be air break type provided with quick make/break manual operating mechanism. The operating handle shall be mounted on the door of the compartment having the switch.

Rating of switches for starter module shall meet the requirements of AC-23 duty as per IS/IEC 60947 and minimum rating shall be as specified in the data sheets.

Switches shall have a rated short-circuit making capacity in conformity with the prospective short-circuit currents, as specified for the busbar system.

04.03 Fuses

Fuses shall be non-deteriorating HRC cartridge link type. The rupturing capacity of the fuse shall be equal to the short circuit rating of the busbar system.

Power fuses shall be pressure fitted type and shall preferably have ribs on the contact blades to ensure good line contact.

It shall be possible to handle fuses during off load conditions with full voltage available on the terminals. Wherever required fuse pullers shall be provided. The fuse base shall be so located in the modules to permit insertion of fuse pullers and removal of fuse links without any problem.

4.04 Contactors

The contactors shall be air break, holding coil type and shall have AC3 or AC4 ratings as specified in the data sheet.

The holding coil of the contactor shall be suitable for operation on specified control supply voltage in the data sheet and shall work satisfactorily between 65 to 110% of the rated value.

4.05 Thermal overload relay

Bimetal relays/ Microprocessor based shall be provided for protecting the motor from thermal overload as per mentioned in datasheet.

Bimetal relays shall be positive acting ambient temperature compensated type with adjustable
@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 18 of 31
			REVISION: 0
			EDITION: 3

setting range.

Bimetal relays shall have built-in single phasing prevention feature, which operate even with 50% rated current at the time of single phasing.

Bimetal relays shall be manually reset type with the reset push button brought out on the front of the panel. The reset push button shall be capable of being operated without opening the compartment door.

04.06 Moulded case circuit breakers

MCCBs shall be provided with spring assisted quick make/ break manually operated trip free mechanism. Wherever specified, MCCB shall be suitable for remote tripping operation and the tripping device shall be suitable for the specified control supply voltage in the data sheet.

MCCBs shall be provided with tripping device having inverse time characteristic for over load protection and instantaneous characteristics for short circuit protection and MCCB rated above 125A shall preferably have adjustable settings.

'ON' and 'OFF' position of the operating handle of MCCB shall be displayed and the operating handle shall be mounted on the door of the compartment housing MCCB.

MCCB's as part of motor starter module shall be current limiting type and type tested for type-2 coordination as per IS/IEC 60947. MCCB's as part of power feeder module shall be current limiting type.

MCCBs shall be provided with solenoid / Motorized closing mechanism to make them suitable for remote closing operation if specified in the data sheet. The closing solenoid/motor shall be suitable for specified control supply voltage in the data sheet.

MCCB shall not have any line load bias.

MCCBs shall be designed to prevent access to live parts when the cover is removed,

04.07 Relays

Type of relay shall be numerical, static or electromagnetic type as specified in the data sheet.

All electromagnetic protective relays shall be back connected, of drawout type, suitable for flush mounting, and fitted with dust-tight covers. Alternatively, "plug-in" type relays will also be acceptable. Auxiliary relays are acceptable in fixed execution.

The protective relay cases shall have provision at the front for "testing and calibration" purposes. It shall be possible to test the relays without disconnecting the wiring and without withdrawing the relays. The insertion of the test plug shall automatically short circuit the CTs and permits extension of external power supply to the relay.

Each tripping relay shall be lockout type with hand reset coil cut-off contact. The tripping relay shall be suitable for satisfactory operation from 50 % to 110 % of the specified control supply voltage.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 19 of 31
			REVISION: 0
			EDITION: 3

Each protective relay shall be provided with minimum 2 nos. potential free contacts of required configuration.

Protective relays, metering and control components shall be preferably mounted on the front side and upper part of the panel and mounting of relays on the lower portion shall be avoided. All protection relays shall be numerical type and shall communicate with station PLC over Modbus TCP/IP.

Only major relays, meters and controls are indicated in the data sheet. For other relays, bidder is free to quote for equivalent numerical relay. Any auxiliary relays, timers, switches, etc, as required while developing the control schematic and felt necessary for safe operation, even if these are not specifically included, shall be supplied.

04.08 Instrument transformers (CT's/PT's)

Current transformers shall generally conform to IS 2705 and any special requirement with respect to Numerical relay shall be taken care by the vendor.

For general guidance, Vendor shall note that the protective current transformers shall have an accuracy class "5P" and an accuracy limit factor greater than or equal to "10". However, CTs for restricted earth fault shall be of class "PS". Vendor shall co-ordinate the knee point voltage, magnetising current for PS class CTs to avoid saturation and mismatching of CTs provided at another end by other Vendor. Vendor shall be solely responsible for coordinating the relay characteristics with suppliers for the proper selection of all CTs with special attention to CTs of class PS.

Current transformers for instruments shall have an accuracy class 1.0 and accuracy limit factor less than 5.0. However, accuracy class of 3.0 is acceptable for CT's meant for remote ammeters. All CTs shall be star-connected.

The current transformers in circuit breaker feeders shall be capable of withstanding the applicable peak momentary short circuit and the symmetrical short circuit current for 1.0 second.

The voltage transformers shall be cast resin type transformers and PT shall generally conform to IS 3156. PT shall be provided with HRC fuses on primary side and Miniature circuit breakers with auxiliary contact on the secondary side.

CT ratios of outgoing feeders are tentative. Vendor shall accommodate changes, if any, at later date as required. The VA burden, knee-point voltage, CT resistance and magnetizing current shall be calculated by the Vendor and the same shall be reviewed by the Purchaser before proceeding with manufacture.

04.09 Measuring instruments

All measuring instruments shall be of 96 x 96mm and 72 x 72mm square pattern, flush mounting type. Measuring instruments shall be provided, as specified in the data sheet. All required auxiliary equipment such as shunts, transducers etc, shall be included.

All AC ammeters and voltmeters type shall be as specified in the data sheet and shall have
 @MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO.	Page 20 of 31
		MEC/05/E9/TS/06	REVISION: 0
			EDITION: 3

accuracy class of 1.5 as per IS. Analogue meters shall be of moving-iron type. Ammeters for motor feeders shall have a non-linear compressed scale above rated current to indicate motor starting current

All frequency meters and power factor meters type shall be as specified in the data sheet and shall have accuracy class of 1.5 as per IS.

All auxiliary equipment such as shunts transducers, CTs PTs etc. as required shall be included in the supply of the switchboard.

The kW/kWH meters type shall be as specified in the data sheet and shall have accuracy class of minimum of 2.5. The kW/kWH meters shall be suitable to measure unbalanced loads on 3 phase 4-wire system. Test terminal block shall be provided for KWH meters.

All meters shall be separate or composite type, high reliable, accurate, compact and self-powered. Digital meter data shall be saved in case of power failure. Field programming from front of the meter shall be possible and shall be RS485port over modbus TCP/IP in case specified in data sheet.

Phase sequence indicating device type shall be as specified in the data sheet. This shall be provided with push button and contactor of 110V DC coil.

04.10 Control switches

All control switches shall be rotary type, having a cam operated contact mechanism. Switch shall have pistol grip handles for circuit breaker control and knob type handle for other applications.

Ammeter selector switches shall have make before break feature on its contacts. The selector switch shall generally have 4 positions for reading 3 phase currents and fourth position for off. The voltmeter selector switch shall also have 4 positions. Three positions shall be used to measure phase to phase voltage and fourth shall be OFF position.

04.11 Push buttons

Push button colours shall be as follows:

Start/close	:	Green
Stop /open/emergency	:	Red
Reset/test	:	Yellow / Black /white

04.12 Indications

Clustered LED type indicating light with minimum 8mm diameter size shall be provided for indications.

Breaker positions (Close, Open, spring-charged, test position, service position) electrical indications, with colors as given below, shall also be provided:

Breaker 'Close'	:	Red lamp
Breaker 'Open'	:	Green lamp

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 21 of 31
			REVISION: 0
			EDITION: 3

Breaker auto-trip : Amber lamp Trip
circuit healthy : White lamp
Spring charging : Blue lamp

Outgoing feeder (Close, Open, trip) electrical indications, with colors as given below, shall also be provided:

'Close' : Red lamp
'Open' : Green lamp
'Trip' : Amber lamp

Phase sequence indicating device shall be provided on incomer panels. This shall be of AE make or equivalent with push button and contactor of 110V DC coil.

04.13 Auxiliary relays/contactors

Auxiliary relays/contactors shall generally be used for interlocking and multiplying contacts. Auxiliary contact shall be capable of carrying the maximum anticipated current.

Fail Safe Scheme shall be provided for all outgoing feeders. Required no. of auxiliary contactors in tripping and closing circuit for transformer feeders shall be provided by vendor. Detailed scheme shall be reviewed during detail engg. without any time and cost implication.

04.14 Timers

For re-acceleration duty, timers unless otherwise stated, shall be pneumatic type and shall have adjustable time setting of 0-60 seconds. Alternatively static timer may be considered. The time settings, where specified, shall be accurately set before despatch of the switchboard. Timer provided for control of capacitor feeder shall have minimum setting of 0-5 minutes.

04.15 Miniature circuit breaker

MCB shall provide high mechanical and electrical life, reliable protection of circuits against overload and short circuit and shall have minimum breaking capacity of 9kA unless otherwise specified. Positive ON/OFF indication shall be provided.

Earth leakage circuit breaker shall have earth sensitivities range 30mA to 300mA unless otherwise specified.

04.16 Capacitor Unit

Unless specified in the data sheet, all capacitors shall be MPP (Metalized Polypropylene) self-healing, double layer type. Single layer shall not be acceptable.

Each capacitor unit shall be a self-contained, with a rating at 50 Hz required to give approximate capacity as specified in the data sheet. As far as possible, capacitors of larger sized units shall be provided.

The rated voltage of the capacitor unit shall be so selected that it would be nearer to actual service voltage prevailing in the network for most of the time and not necessarily to the rated system

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 22 of 31
			REVISION: 0
			EDITION: 3

voltage or nominal system voltage. Service voltage shall be arrived at after considering overvoltage due to reactor and harmonics in the system. Series reactor causes a rise in the voltage across capacitor terminals. If the capacitor voltage is rated higher than the actual service voltage, then the capacitor output at service voltage will reduce. However, the capacitor voltage shall be slightly higher than or equal to the actual service voltage.

The temperature rise above the specified ambient of any part of the capacitor unit and associated equipment's shall not exceed the maximum permissible temperature as specified in IS 13340.

Each capacitor unit active parts shall be non-inflammable dielectric immersed in suitable impregnant, self-cooled, and hermetically sealed. The impregnant shall be non-PCB (Polychlorinated Biphenyl) oil.

Each capacitor unit shall be individually protected by an HRC fuse suitably rated for load current and interrupting capacity, so that a faulty capacitor unit shall be disconnected by the fuse. An operated fuse shall give visual indication so that it may be detected during periodic inspection. The fuse breaking time shall coordinate with the pressure built up within the capacitor unit to avoid explosion. Mounting of the individual fuse may be internal or external to the capacitor case.

Each capacitor unit case shall be earthed to a separate earth bus in ungrounded system.

Each capacitor unit shall be fitted with directly connected continuously rated, low loss discharge device to discharge the capacitors and reduce the voltage to less than 50volts within one minute for capacitors rated upto 650V and ten minutes for capacitors rated above 650V.

There shall not be switch, fuse or any other isolating device between the capacitor unit and the discharging device.

Bushings shall be of porcelain and shall be joined to the case by soldering/welding or other method which ensures an adequate and permanent seal.

The capacitor unit with its accessories shall be suitable for installation in metal enclosed panel.

04.17 Series Reactor

The reactor design shall be such that the capacitor banks shall be able to withstand the overload due to harmonics. The series reactor shall be -

- Completely sealed unit.
- Air core air cooled or air core oil cooled.
- Designed to have a linear V-I characteristics upto 150% of rated capacitor current.
- Designed to have temperature rise within limits as specified in relevant standard.
- Magnetically or non-magnetically shielded depending on requirements.
- Shall be suitable for installation in metal enclosed panel

04.18 Soft Starters

The soft starter shall apply a slowly increasing voltage to the motor, providing smooth acceleration whilst drawing the minimum necessary starting current.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 23 of 31
			REVISION: 0
			EDITION: 3

A microprocessor-based circuit shall control the starter, providing stable and repeatable performance in both 3 wire and 6 wire (inside delta) motor connections, with and full control, status and diagnostic information clearly displayed using LED indicators.

In each phase the power module shall comprise two back-to-back SCRs with integral semiconductor fuses incorporated onto the input busbar. Phase modules shall be interchangeable between phases within the starter, and between starters of the same rating without the need for calibration or adjustment. The low voltage control circuitry shall be isolated from the SCR assembly, and employ pulse transformers to carry the SCR firing signals. Metal Oxide Varistors and RC snubber networks shall be used to provide transient and false firing protection.

The soft starter shall provide the following (but not limited to) range of adjustments as applicable:

- Ramp up time: 1-60s
- Ramp down time: 1-120s
- Pump Control Ramp adjustable pump stop profile
- Current Limit (Starting): 200-450% In
- Pulse start: 450% current for 0.5-2.0s
- Motor FLC: 50-100% of starter FLC

The soft starter shall protect against the following (but not limited to) as applicable:

- Phase imbalance
- Phase reversal
- SCR faulty or shorted SCR
- Motor Thermal Overload
- Soft Start thermal overload
- Over voltage
- Under voltage
- Locked Rotor
- Excessive Starts per hour
- Phase loss input / output
- Motor output loss

The soft starter shall provide the following indications (but not limited to) as applicable:

- Line failure
- Phase imbalance
- Over temperature – motor
- Over temperature – Soft Starter
- Shorted Thyristor
- Open Thyristor
- Locked Rotor
- Overload / Underload
- Motor output loss
- Phase imbalance

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO.	Page 24 of 31
		MEC/05/E9/TS/06	REVISION: 0
			EDITION: 3

- Over voltage
- Under voltage
- Excessive Starts
- Phase reversal

05.00 INTERFACE REQUIREMENTS

Switchboard interface requirement with station PLC shall be as specified in the data sheet. All analogue/digital/serial links signals shall be wired to Marshalling Panel which shall be part of switchboard through inter panel wiring. Vendor shall provide suitable transducers / contacts / ports for signals in respective feeders accordingly.

06.00 Protection and Metering Scheme of Plant:

The protective system shall be selected and coordinated to ensure the following:

- Protection of equipment against damage, which can occur due to internal or external short circuits or atmospheric discharges.
- Uninterrupted operation of those parts of the system, which are not affected by the fault.
- Personnel and plant safety.

All the protection relays shall be of numerical type unless otherwise specified.

Protection relays shall be provided as specified below or in SLD. In general, quick acting relays (with time delays, if necessary) shall be used and all fault tripping shall be done through high-speed tripping relays.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 25 of 31
			REVISION: 0
			EDITION: 3

RELAY PROTECTION SYSTEM

(Figure inside bracket refers to note below) √Applicable

Description	Relay Number	HV Transformer Feeder		Motor Feeder	Outgoing Breaker Feeder		Incomer Feeder		Bus Coupler
		Secondary winding Voltage ≥ 6kV	Secondary winding Voltage ≤ 0.433kV	HV	HV Plant Feder	MV PCC/P MCC	HV	MV PCC/P MCC	
IDMT Over current	51	√	√	-	√	√ (4)	√	√ (4)	√
IDMT Earth fault	51N	√ (7)	-	-	√	√ (4)	√	√	√
Back up Earth Fault (Secondary Neutral)	51G	√	√	-	-	-	-	-	-
Motor protection relay (50, 50N, 46, 49, 50LR)	99	-	-	√	-	√ (8)	-	-	-
Inst. Restricted earth fault (secondary side)	64R	√	√ (16)	-	-	-	-	-	-
Inst. Over current	50	√	√	-	-	-	-	-	√
Inst. Earth Fault	50N	√ (6)	√	-	-	-	-	-	-
Differential Protection	87	√ (1)	-	√2	√ (3)	-	-	-	-
Lockout or High speed tripping	86	√	√	√	√	√	√	√	√
Trip circuit supervision	95	√	√	√	√	-	√	-	-
Transformer auxiliary	94	√	√	-	-	-	-	-	-
Under voltage with timer	27/2	-	-	√13	-	-	√ (5)	√5)	-

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002		TECHNICAL SPECIFICATION								
		ELECTRICAL SECTION (OIL & GAS SBU) DELHI								
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06								Page 26 of 31
										REVISION: 0
										EDITION: 3
Synchronism Check Relay	25	-	-	-	-	-	-	-	√	
Phase- Balance Current Relay	46	-	-	-	-	-	-	√ (12)	-	
Phase Sequence Voltage Relay	47	-	-	-	-	-	-	√ (12)	-	
Over Voltage Relay	59	-	-	-	√ (10)	-	-	√ (12)	-	
Frequency Relay	81	-	-	-	-	-	-	√ (12)	-	

Note:

1. For transformers rated 5 MVA and above.
2. For motors rated 1500kW and above or does not have standby HV motor/pump.
3. For critical/long feeders
4. At remote substation where DC supply is not envisaged, 415V switchboard shall have inherent releases instead of relays.
5. Wherever auto transfer feature is provided.
6. Instantaneous earth fault 50N shall be provided only for transformer with star primary
7. Directional IDMT earth fault 67N shall be provided for transformer with star primary
8. For motor feeder rated 55kW and above

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 27 of 31
			REVISION: 0
			EDITION: 3

Metering shall be provided to keep a record of power consumption and supervision of all concerned parameters like current, voltage, power, frequency, power factor etc. as specified in SLD. Multi-Function meter (MFM) shall be provided where applicable.

Metering shall be provided to keep a record of power consumption and supervision of all concerned parameters like current, voltage, power, frequency, power factor etc. as specified in SLD. Multi-Function meter (MFM) shall be provided where applicable.

Feeder Type	A	V	Hz	PF	MW	MWH	Hour Run	MVAR	MVAH	MVA
HV Incomer	X	X	X	X	X(see note-2)	X	-	X	X(see note-2)	X(see note - 1, 2)
HV Bus Tie	X	-	-	-	-	-	-	-	-	-
HV Transformer	X	-	-	-	-	X	-	-	-	-
HV Bus P.T.	-	X	-	-	-	-	-	-	-	-
HV Plant Feeder	X	-	-	-	-	X	-	-	-	-
HV Motor	X	-	-	-	-	X kWh	X	-	-	-
HV Capacitor	X	X	-	X	-	-	-	-	-	-
PCC/PMCC Incomer	X	X	-	X	-	X kWh	-	-	-	-
PCC/PMCC Bus Tie	X	-	-	-	-	-	-	-	-	-
PCC Bus P.T	-	X	-	-	-	-	-	-	-	-
ACB Outgoing	X	-	-	-	-	X kWh	-	-	-	-
MV Motor	X	-	-	-	-	X kWh	X	-	-	-
MCC/ASB Incomer	X	X	-	-	-	X kWh	-	-	-	-

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION											
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI											
TITLE	MEDIUM VOLTAGE SWITCHBOARD						DOCUMENT NO. MEC/05/E9/TS/06				Page 28 of 31	
											REVISION: 0	
											EDITION: 3	
MCCB/SFU	X	-	-	-	-	X kWh	-	-	-	-		
O/G												
LDB Incomer	X	X	-	-	-	X kWh	-	-	-	-		
DG Set	X	X	X	X	X KW	X kWh	X	-	-	-		

Notes:

1. MVA meter in Grid Incomers shall include maximum demand indication also.
2. MW, MVAR, MVA, MVAH meters shall be provided for only Grid Incomer feeders.
3. Field Ammeters are to be provided for all motors rated above 5.5kW.
4. Volt meters and Ammeters shall be of analog type.
5. Other meters shall be of composite type multi-function meters shall be provided with MODBUS TCP/IP link and shall be interfaced with Flex I/O system.
6. Trivector meter shall also be provided with MODBUS TCP/IP link and shall be interfaced with Flex I/O system

07.00 DRAWINGS & DOCUMENTS

Vendor shall furnish all data/ GA & Construction drawings/documents specified in the vendor data requirement.

Approval of the drawing shall not relieve the manufacturer of his responsibility to equipment conforming to the relevant specification and standards or for any mistakes, errors or omissions in the drawing.

Following Drawings & Documents shall be submitted after award of contract for approval:

- a) Schedule of Vendor Documents
- b) Technical Data Sheets (Duly Filled-In)
- c) Dimensional / Assembly Drawings
 - GA Drawings (Elevation and Plan) including clearance requirements
 - Installation Plans including foundation, cutout and mounting details
 - Cross Sectional Views
 - Cubicle Arrangement Drawings
 - Component Drawings
 - Name Plate Drawings
 - Cable Termination Arrangement Drawings
- d) Detailed construction drawings in Plan and section
- e) Supporting structure details drawings
- f) Civil foundation assignment drawings
- g) Electrical Wiring Drawings
 - Single Line Diagrams

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO.	Page 29 of 31
		MEC/05/E9/TS/06	REVISION: 0
			EDITION: 3

- Schematic Diagrams
- Wiring Diagrams and Terminal Details
- Interpanel Wiring Diagrams
- Modbus mapping details
- Ladder logic diagrams in PDF and Native form

- h) Bill Of Materials.
- i) Calculations.
 - Bus Bar Sizing Calculation
 - Calculation of CT/ PT burdens, V_k , I_m , R_{ct} etc. for class PS CT's
 - Panel heat load calculations
- j) Relay Characteristics Curves & Total discrimination chart
- k) Auxiliary Power Requirement Data (AC & DC)
- l) QA Plan Of Vendor
- m) Inspection Plan And Testing Procedure (For review by inspection)
- n) Test Records
- o) Type Test Certificates
- p) List of Commissioning Spares
- q) List of Maintenance Spares
- r) List Of Special Tools & Tackles
- s) Data Book /Manual
 - Installation Manual
 - Operating / Maintenance manual
 - Catalogues / Brochures
- t) Equipment storage procedure at site
- u) Packing and shipping list

08.00 COMPLETENESS OF EQUIPMENT

All fittings, accessories or apparatus which may not have been specially mentioned in this specification but which are otherwise necessary for satisfactory working of Isolator shall be deemed to have been included in the scope of supply.

09.00 INSPECTION AND TESTING

During fabrication, switchboard shall be subject to inspection by Purchaser or by an agency authorized by the Purchaser. Vendor shall furnish all necessary information concerning the supply to Purchaser. The Purchaser shall have free access to the Vendor's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality.

Switchboards shall be tested in accordance with applicable standards. All acceptance and routine tests as follow shall be carried out at Vendor's work under his care and expense. Vendor's internal test

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 30 of 31
			REVISION: 0
			EDITION: 3

reports shall be provided for Purchaser's review prior to inspection and testing.

- Visual and dimensional check of complete switchboard assembly and all components
- Operational check of all switchboard components under normal and worst voltage conditions.
- Verification of Bus bar insulation, support arrangement, creepage distances and clearances with respect to type tested assembly drawings.
- Verification of Bill of material
- Verification of Rack-in and Rack-out of trolleys.
- Verification of Interchange ability of trolleys in identical feeders.
- Verification of wiring for control and auxiliary circuits and auxiliary contacts.
- Verification of operation for all control functions and interlocks as per schematic diagrams in Test and Service position.
- Verification of relays operation through secondary injection
- Verification of operating mechanisms, mechanical locking and interlocking systems, safety shutters, partitions and shrouds
 - Verification of communication between relays and Data concentrator / MMI (If applicable)
 - MMI operation and functional checks (If applicable)
 - Measurement of resistance of main circuit
 - Insulation resistance of main, auxiliary and control circuit before and after HV test.
 - Power Frequency Voltage withstand test on main, auxiliary and control circuits

Type tests as follows shall be performed at Vendor's work or independent approved testing laboratory under his care and expense. Type test certificates approved by CPRI or equivalent approved testing agency may be acceptable in lieu of actual type tests on identical switchboard subject to Purchaser approval.

- Short circuit making and breaking tests
- Temperature Rise Test
- Degree of protection
- Impulse and Power Frequency Withstand
- Short circuit test duties
- Internal Arc Test (If specified)

Acceptance, routine and type tests shall be witnessed by Purchaser or an agency authorized by the Purchaser. Prior notice of minimum 4 weeks shall be given to the Purchaser for witnessing the tests.

For equipment bought from other sub-suppliers, certified test reports of tests carried out at the sub-supplier's works shall be submitted. Normally all routine tests as specified in the relevant standards shall be conducted by the sub-supplier at his works.

10.00 PACKING AND DISPATCH

All the equipment shall be divided into several shipping sections for protection and ease of handling during transportation. The equipment shall be properly packed for selected mode of transportation i.e. by ship/rail or trailer. The panels shall be wrapped in polyethylene sheets before being placed in wooden crates /cases to prevent damage to the finish. Crates /cases shall have skid bottoms for handling. Special precaution notations such as Fragile, This side up, center of gravity, weight,

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	MEDIUM VOLTAGE SWITCHBOARD	DOCUMENT NO. MEC/05/E9/TS/06	Page 31 of 31
			REVISION: 0
			EDITION: 3

Purchaser's particulars, Purchase number etc. shall be clearly marked on the package together with other details as per purchase order.

The equipment may be stored outdoors for long periods before installation. The packing should be suitable for outdoor storage in areas with heavy rains and high ambient temperature unless otherwise agreed.

REV: 0

EDITION: 3

TECHNICAL SPECIFICATION
FOR
POWER AND CONTROL CABLES

DOCUMENT No: : MEC/05/E9/TS/09

Prepared & Issued by



**ELECTRICAL SECTION
MECON LIMITED**

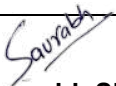
(A Govt. of India Undertaking)
13th & 15th Floor, North Tower, SCOPE MINAR,
Laxmi Nagar District Centre,
Delhi-110092 (India)

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND CONTROL CABLES	DOCUMENT NO.	Page 2 of 10
		MEC//05/E9/TS/09	REVISION: 0
			EDITION: 3

Table of Contents

S.No.	DESCRIPTION	PAGES
01.00	INTENT	4
02.00	CODES AND STANDARDS	4
03.00	CONSTRUCTIONAL REQUIREMENTS	6
04.00	INSPECTION AND TESTING	8
05.00	PACKING AND DISPATCH	10

Rev	Date	Prepared by	Checked by	Approved by
0	11.07.2025	 Chirosmita Banerjee	 Saurabh Singh	Pankaj Shrivastava

© Copyright MECON Limited – All rights reserved.
THIS DOCUMENT IS THE SOLE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED HEREIN. THIS IS NOT TO BE COPIED OR USED FOR ANY OTHER PROJECTS UNLESS EXPLICITLY PERMITTED BY MECON.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND CONTROL CABLES	DOCUMENT NO.	Page 3 of 10
		MEC//05/E9/TS/09	REVISION: 0
			EDITION: 3

AMENDMENT STATUS

(OLD NUMBER OF STANDARD: MEC/TS/05/E9/09)

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Document Number replaced with new number as MEC/05/E9/TS/09.	All	Rev 0/ Ed 3	11.07.2025		
2	Section re-name as Electrical Section (Oil & Gas SBU) Delhi	All	Rev 0/ Ed 3	11.07.2025		

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND CONTROL CABLES	DOCUMENT NO.	Page 4 of 10
		MEC//05/E9/TS/09	REVISION: 0
			EDITION: 3

1.0 INTENT

- The intent of this standard specification is to define the general requirements for design, manufacture, assembly and testing at manufacturer's works, packing, transportation and receipt at site with all materials and accessories of **Power and Control Cables**.
- Bidder shall also refer SOR item for details/requirements as part of the project need.

2.0 CODES AND STANDARDS

The equipment shall comply with the requirements of latest revision of following standards issued by BIS (Bureau of Indian Standards), unless otherwise specified:

IS 209		Zinc ingot
IS 1554 : Part 1		PVC insulated (heavy duty) electric cables: Part 1 For working voltages upto and including 1100V
IS 3961 : Part 2		Recommended current ratings for cables: Part 2 PVC insulated and PVC sheathed heavy duty cables
IS 3975		Mild steel wires, formed wires and tapes for armouring of cables
IS 5831		PVC insulation and sheath of electric cables
IS 7098		Cross linked polyethylene insulated PVC sheathed cables
IS 8130		Conductors for insulated electric cables and flexible cords
IS 10418		Drums for electric cables.
IS 10462 : Part 1		Fictitious calculation method for determination of dimension of protective coverings of cables: Part 1 Electrometric and thermoplastic insulated cables
IS 10810: Part 41		Methods of test for cables Part 41: Mass of zinc coating on steel armour
IS 10810 : Part 58		Methods of test for cables Part 58: Oxygen index test
IS 10810 : Part 61		Methods of test for cables: Part 61 Flame retardant test
IS 10810 : Part 62		Methods of test for cables: Part 62 Fire resistance test for bunched cables
IEC 60332-3		Tests on electric and optical fibre cables under fire conditions
IEC 60502		Power cables with extruded insulation and their accessories for rated voltages from 1kV (Um = 1.2kV) up to 30kV (Um = 36kV)
IEC 60811		Electric and optical fibre cables - Test methods for non-metallic materials
ASTM D2863		Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ANSI/NEMA WC 70-2009/ICEA		Power cables rated 2000 volts or less for the distribution of electrical energy

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND CONTROL CABLES	DOCUMENT NO.	Page 5 of 10
		MEC//05/E9/TS/09	REVISION: 0
			EDITION: 3
	S- 95-658-2009		
	ANSI/NEMA WC 71- 1999/ICEA S-96-659-1999		Standard for non-shielded cables rated 2001-5000V for use in the distribution of Electric Energy
	ANSI/NEMA WC 74/ICEA S-93-639-2012		5-46kV shielded power cable for use in the transmission and distribution of electric energy
	WC 7-1988		Cross-linked thermosetting polyethylene insulated wire and cable for transmission and distribution of electrical energy

Wherever the requirements in this specification are in conflict with any of the above Standards, the requirements under this specification shall be binding.

In case of any contradiction between various referred standards/ specifications/ data sheet and statutory regulations the following order of priority shall govern. However, stringent of the below shall be followed

Statutory regulations.

Schedule of Rate

Scope of Work/ Job specification.

Design Basis.

Data sheets.

Standard Specification.

Codes and standards.

3.0 CONSTRUCTIONAL REQUIREMENTS

3.1 General

The cables shall be suitable for laying in trays, trenches, ducts, and conduits and for underground-buried installation with uncontrolled backfill and possibility of flooding by water and chemicals.

Outer sheath of all PVC and XLPE cables shall be black in colour and the minimum value of oxygen index shall be 29 at 27 ± 2 °C. In addition suitable chemicals shall be added into the PVC compound of the outer sheath to protect the cable against rodent and termite attack.

All cables covered in this specification shall be flame retardant (FR) unless specified otherwise in the data sheet. The outer sheath of PVC and XLPE cables shall possess flame propagation properties meeting requirements as per IS 10810 : Part-62 category AF.

Sequential marking of the length of the cable in metres shall be provided on the outer sheath at every one metre. The embossing / engraving shall be legible and indelible.

The overall diameter of the cables shall be strictly as per the values declared by the manufacturer in the technical information subject to a maximum tolerance of ± 2 mm up to overall diameter of 60mm and ± 3 mm for beyond 60mm.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND CONTROL CABLES	DOCUMENT NO.	Page 6 of 10
		MEC//05/E9/TS/09	REVISION: 0
			EDITION: 3

PVC / Rubber caps shall be supplied free of cost for each drum with a minimum of eight per thousand metre length. In addition, ends of the cables shall be properly sealed with caps to avoid ingress of water during transportation and storage.

The cables used in installation under the jurisdiction of Director General of Mines and safety (DGMS) shall be of copper conductor only, and shall have valid DGMS approvals for the specified locations. The word "Mining Cable" shall be embossed / engraved on the cable outer sheath as per the applicable Indian Standards.

3.2 PVC cables

All control cables for use on medium voltage systems shall be heavy-duty type, 650/1100V grade with copper conductor, PVC insulated, inner-sheathed, armoured and overall PVC sheathed unless specified otherwise in the data sheet.

The conductors shall be solid circular shape.

The core insulation shall be with PVC compound applied over the conductor by extrusion and shall conform to the requirements of type 'A' compound as per IS 5831. The thickness of insulation and the tolerance on thickness of insulation shall be as per Table 2 of IS 1554 : Part 1. Control cables having 6 cores and above shall be identified with prominent and indelible English numerals on the outer surface of the insulation. Colour of the numbers shall contrast with the colour of insulation with a spacing of maximum 50mm between two consecutive numbers. Colour coding for cables up to 5 cores shall be as per Indian Standard.

The inner sheath shall be applied over the laid-up cores by extrusion and shall be of PVC conforming to the requirements of Type ST-1 PVC compound as per IS: 5831. The minimum thickness of inner sheath shall be as per IS 1554 : Part 1. Single core cables shall have no inner sheath.

If armouring is specified for multicore cables in the data sheet, the same shall be by single round galvanized steel wires where the calculated diameter below armouring does not exceed 13mm and by galvanized steel trips where this dimension is greater than 13mm. Requirement and methods of tests for armour material and uniformity of galvanisation shall be as per IS-3975 and IS 10810 : Part 41. The dimension of Armour shall be as per method (b) of IS 1554 : Part 1. If armouring is specified for single core cables in the data sheet, the same shall be with H4 grade hard drawn aluminium round wire of 2.5mm diameter.

For mining cables, the size and type of armour shall be such that the combined conductance of armour shall be equivalent to 75 percent of the conductance of the largest conductor of the cable.

The outer sheath for the cables shall be applied by extrusion and shall be of PVC compound conforming to the requirements of type ST-1 compound as per IS 5831. The minimum and average thickness of outer sheath for unarmoured cables and minimum thickness of outer sheath for armoured cables shall be as per IS 1554 : Part 1.

If heat resisting PVC cables are specified in the data sheet, the following shall be the requirements:

It shall be possible to continuously operate the cable at a maximum conductor temperature of 85°C.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND CONTROL CABLES	DOCUMENT NO.	Page 7 of 10
		MEC//05/E9/TS/09	REVISION: 0
			EDITION: 3

PVC compounds used for HR PVC cable shall be as follows:

- a) Conductor insulation - Type C
- b) Inner Sheath - Type ST-2
- c) Outer Sheath - Type ST-2

3.3 XLPE Cables

Power cables from 650/1100V grade up to and including 33 kV systems shall be Aluminium / Copper conductor, XLPE insulated, sheathed, armoured and overall PVC sheathed.

The conductors shall be solid for conductor of nominal area up to and including 6mm² and stranded beyond 6mm². Conductors of nominal area less than 16mm² shall be circular only. Conductors of nominal area 16mm² and above may be circular or shaped as per IS 8130. Cables with reduced neutral conductor shall have sizes as per Table 1 of IS 1554 : Part 1.

The conductors of 3.3kV up to and including 33 kV systems shall be stranded and completed circular for all cables.

All cables rated 3.8 / 6.6 kV and above shall be provided with both conductor screening and insulation screening. The conductors shall be provided with non-metallic extruded semiconducting screen.

The core insulation shall be with cross linked polyethylene insulating compound dry cured, applied by extrusion. It shall be free from voids and shall withstand all mechanical and thermal stresses under steady state and transient operating conditions. It shall conform to the properties given in the Table -1 of IS 7098 : Part-2

The insulation screen shall consist of non-metallic extruded semi-conducting compound in combination with a non-magnetic metallic copper screen. Unless specified otherwise, the copper screen for all the three cores together for three core cables and individual core for single core cables shall be capable of carrying the single line to ground fault current value and the duration specified in the data sheet.

The conductor screen, XLPE insulation and insulation screen shall be extruded in one operation by 'Triple Extrusion' process to ensure perfect bonding between the layers. The core identification shall be by coloured strips or by printed numerals.

The inner sheath shall be applied over the laid up cores by extrusion and shall conform to the requirements of type ST-2 compound of IS 5831. The extruded inner sheath shall be of uniform thickness. In case of single core cables, there shall be extruded inner sheath between insulation metallic screen and armouring.

For multicore cables, the armouring shall be by galvanized steel strips as per method (b) of IS 7098 : Part 2. If armouring is specified for single core cables in the data sheet, the same shall be with H4 grade hard drawn aluminium round wire of 2.5mm diameter.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND CONTROL CABLES	DOCUMENT NO.	Page 8 of 10
		MEC//05/E9/TS/09	REVISION: 0
			EDITION: 3

The outer sheath of the cables shall be applied by extrusion over the armouring and shall be of PVC compound conforming to the requirements of Type ST-2 compounds of IS 5831. The minimum and average thickness of outer sheath for unarmoured cables and minimum thickness of outer sheath for armoured cables shall be as per IS 7098 : Part 2.

The thickness of the insulation, inner sheath shall be governed by values given in IS 7098 : Part 2.

Where specified, 1100V grade power cables shall also be XLPE insulated and shall meet the requirements specified in IS 7098 : Part-1.

4.0 INSPECTION AND TESTING

During fabrication, cables shall be subject to inspection by Purchaser or by an agency authorized by the Purchaser. Vendor shall furnish all necessary information concerning the supply to Purchaser. The Purchaser shall have free access to the Vendor's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality.

Cables shall be tested in accordance with applicable standards. All acceptance, routine, type and special tests as follows shall be carried out at Vendor's work under his care and expense. Vendor's internal test reports shall be provided for Purchaser's review prior to inspection and testing.

All routine tests, acceptance tests, type tests and additional type tests for improved fire performance shall be carried out as listed in IS 1554 : Part 1, and IS 7098 : Part 2 on PVC and XLPE insulated cables respectively.

The test requirement for PVC insulation and sheath of cables shall be as per IS 5831.

Test for Resistance to Ultra Violet Radiation: This test shall be carried out as per DIN 53387 or ASTM G-53 on outer sheath. The retention value of tensile strength and ultimate elongation after the test shall be minimum 60% of tensile strength and ultimate elongation before the test. Test certificates with respect to this test (not older than one year) from recognized testing laboratory to be furnished for review by Purchaser before dispatch clearance of cables. In case test certificates are not available, test is to be conducted by vendor at his own cost in any recognized test laboratory or in house testing laboratory, before dispatch clearance of cables. Sampling for this test is to be done randomly once for each order, provided outer sheath remains same.

Acceptance tests as per IS 1554 : Part 1 and IS 7098 : Part 2 and the following special tests to be performed on the cables as per sampling plan.

a) **Accelerated water absorption test** for insulation as per NEMA WC-5 (For PVC insulated cables) and as per NEMA WC-7 (for XLPE insulated cables). Test certificates with respect to this test (not older than one year) from recognized testing laboratory to be furnished for review by Purchaser. In case test certificates are not available, test is to be conducted by Vendor at his own cost in any recognized test laboratory or in house testing laboratory, before dispatch clearance of cables. Sampling for this test is to be done randomly once for each order, provided type of

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND CONTROL CABLES	DOCUMENT NO.	Page 9 of 10
		MEC//05/E9/TS/09	REVISION: 0
			EDITION: 3

insulation remains same.

b) **Dielectric Retention Test:** The dielectric strength of the cable insulation tested in accordance with NEMA WC-5 at $75 \pm 1^\circ\text{C}$ shall not be less than 50 % of the original dielectric strength. (For PVC insulated cables). Test certificates with respect to this test (not older than one year) from recognized testing laboratory to be furnished for review by Purchaser before dispatch clearance of cables. In case test certificates are not available, test is to be conducted by vendor at his own cost in any recognized test laboratory or in house testing laboratory, before dispatch clearance of cables. Sampling for this test is to be done randomly and once for each order.

c) **Oxygen Index Test:** The test shall be carried out as per ASTM D 2863 or applicable Indian Standard specifications. Sampling is to be done for every offered lot / size as per sampling plan.

d) **Flammability Test:** The test shall be carried out on finished cable as per IS 10810: (Part 61 & 62). Sampling for these tests is to be done randomly once for each order, provided outer sheath remains same. The acceptance criteria for tests conducted shall be as under:
Part 61- The cable meets the requirements if there is no visible damage on the test specimen within 300mm from its upper end.

Part 62- The maximum extent of the charred portion measured on the test sample should not have reached a height exceeding 2.5 m above the bottom edge of the burner at the front of the ladder.

e) **Test for rodent and termite repulsion property:** The vendors shall furnish the test details to analyse the property by chemical method. Sampling is to be done for every offered lot / size as per sampling plan.

Acceptance, routine, type and special tests shall be witnessed by Purchaser or an agency authorized by the Purchaser. Prior notice of minimum 4 weeks shall be given to the Purchaser for witnessing the tests.

5.0 PACKING AND DISPATCH

Cables shall be despatched in non-returnable wooden or steel drums of suitable barrel diameter, securely battened, with the take-off end fully protected against mechanical damage. The wood used for construction of the drum shall be properly seasoned, sound and free from defects. Wood preservatives shall be applied to the entire drum. Ferrous parts used shall be treated with a suitable rust preventive finish or coating to avoid rusting during transit or storage.

On the flange of the drum, necessary information such as project title, manufacturer's name, type size, voltage grade of cable, length of cable in metres, drum no., cable code, BIS certification mark, gross weight etc. shall printed. An arrow shall be printed on the drum with suitable instructions to show the direction of rotation of the drum.

Unless otherwise specified, cables shall be supplied in drum lengths as follows:

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	POWER AND CONTROL CABLES	DOCUMENT NO.	Page 10 of 10
		MEC//05/E9/TS/09	REVISION: 0
			EDITION: 3

MV Cables

- Multicore Power cables upto 6mm² : 1000m
- Multicore Power cables from 10mm² up to 300mm² : 500m
- Single Core Power cables up to 630mm² : 1000m
- Control cables up to 61 cores : 1000m

HV Power cables –up to 11k V (E) Grade

- Three Core cables up to 400mm² : 500m
- Single Core cables up to 400mm² : 1000m
- Single Core cables above 400mm² and up to 630mm² : 750m

HV Power Cables –Above 11 kV (E) Grade and up to 33kV (E) Grade

- Three Core cables up to 300mm² grade : 350m
- Single Core cables up to 400mm² : 1000m
- Single Core cables above 400mm² and upto 630mm² : 500m

A tolerance of plus 3% (no negative tolerance) shall be permissible for each drum. However, overall tolerance on each size of cable shall be limited to + 2%. Offers with short / non-standard lengths are liable for rejection. If non-standard drum lengths are specified in the data sheet, the same shall be supplied.

TECHNICAL SPECIFICATION
FOR
AC UPS
DOCUMENT No. : MEC/05/E9/TS/10A

Prepared & Issued by



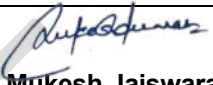
ELECTRICAL SECTION
(Oil & Gas SBU)
MECON LIMITED

(A Govt. of India Undertaking)
13th & 15th Floor, North Tower, SCOPE MINAR,
Laxmi Nagar District Centre,
Delhi-110092 (India)

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO. MEC/05/E9/TS/10A	Page 2 of 24
			REVISION: 0
			EDITION: 3

INDEX

Sl. No.	Description	Page No
1.0	INTENT	4
2.0	CODES AND STANDARDS	4
3.0	GENERAL REQUIREMENTS	5
4.0	SITE CONDITIONS	6
5.0	TECHNICAL REQUIREMENTS	6
6.0	CONSTRUCTION	15
7.0	ALARM, CONTROL, INDICATION AND METERING	17
8.0	INSPECTION AND TESTING	20
9.0	SITE ACCEPTANCE	24
10.0	PACKING AND DISPATCH	24

Rev	Date	Prepared by	Checked by	Approved by
0	11.07.2025	 Mukesh Jaiswara	 Saurabh Singh	Pankaj Shrivastava

© Copyright MECON Limited – All rights reserved.
 THIS DOCUMENT IS THE SOLE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED HEREIN. THIS IS NOT TO BE COPIED OR USED FOR ANY OTHER PROJECTS UNLESS EXPLICITLY PERMITTED BY MECON.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO. MEC/05/E9/TS/10A	Page 3 of 24
			REVISION: 0
			EDITION: 3

AMENDMENT STATUS

(OLD NUMBER OF STANDARD: MEC/TS/05/E9/10A)

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Document Number replaced with New number as MEC/05/E9/TS/10A	All	Rev 0/ Ed 3	11.07.2025		
2	Section re-name as Electrical Section (Oil & Gas SBU) Delhi	All	Rev 0/ Ed 3	11.07.2025		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 4 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

1.0 INTENT

The intent of this standard specification is to define the general requirements for design, manufacture, assembly and testing at manufacturer's works, packing, transportation and receipt at site with all materials and accessories of AC UPS.

2.0 CODES AND STANDARDS

The equipment shall comply with the requirements of latest revision of following standards issued by BIS (Bureau of Indian standards) unless otherwise specified:

IS5	Colours for ready mixed paints and enamels
IS1248	Direct acting indicating analogue electrical measuring instruments and their accessories
IS2705	Current Transformers
IS 3700 :Part7	Essential ratings and characteristics of semiconductor devices - Part VII : Reverse blocking triode thyristors
IS 3715 :Part4	Letter symbols for semiconductor devices: Part 4 thyristors
IS4411	Code for designation of semi-conductor devices
IS5001	Guide for preparation of drawings of semiconductor devices IS5469
	Code of practice for the use of semi-conductor junction devices IS7204
	Stabilized power supplies dc output
IS12021	Control transformers for switchgear and controlgear for voltages not exceeding 1000VAC
IS13314	Solid state inverters run from storage batteries
IS13703	LV fuses for voltage not exceeding 1000VAC or 1500VDC
IS14901	Semiconductor devices - Discrete devices and integrated circuits IS:10918
	Vented type nickel cadmium batteries
IS:16049	Secondary cells and batteries containing alkaline or other non-acid electrolytes- sealed Nickel Cadmium prismatic rechargeable single cell
IS/IEC60529	Degree of protection provided by enclosures (IP code) IS/IEC60947

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 5 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

Low voltage switchgear and controlgear

IEC60146-1-1	Semiconductor converters – General requirements and line commutated converters – Part 1-1 : Specification of basic requirements
VDE-0875	Radio-frequency disturbance characteristics – Limits and methods of measurement
IEEE 519	IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

In case of imported equipment, standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian standards.

The equipment shall also conform to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.

In case Indian standards are not available for any equipment, standards issued by IEC/BS/IEEE/NEMA/VDE or equivalent agency shall be applicable.

In case of any contradiction between various referred standards / specifications / data sheet and statutory regulations, the following order of priority shall govern:

- Statutory regulations.
- Schedule of Rate
- Scope of Work/ Job specification.
- Design Basis.
- Data sheets.
- Standard Specification.
- Codes and standards.

However, the vendor shall bring any such contradiction to the notice of Purchaser for prior approval.

3.00 GENERAL REQUIREMENTS

The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.

Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply.

Vendor shall give a notice of at least one year to the end user of equipment before phasing out the product/spares to enable the end user for placement of order for spares and services.

The Online AC UPS system shall be an integrated system comprising static rectifier/chargers, batteries, static inverters, static switches, manual by pass switch, AC distribution board, voltage stabilizer in bypass, isolating and protection devices and all other equipment/ accessories required for completeness of the system

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 6 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

whether specifically mentioned herein or not, but necessary for completeness and satisfactory performance of the system.

The Online AC UPS system shall be suitable to feed all loads connected to the output which are primarily instruments, DCS, computers, disc drives and other SMPS equipment leading to high crest factor of the load. The main station UPS as well as SV-UPS systems shall simultaneously feed both sensitive loads such as instrumentation panels and shall also cater to non-sensitive loads such as electric valve actuator motor and cathodic protection transformer cum rectifier units etc. Vendor shall design the system in such a way that the output voltage of UPS shall recover in milli seconds (maximum in 1-cycle) because of operation of non-sensitive loads and shall maintain the output voltage of UPS within $240V \pm 1\%$ so that the functionality of sensitive loads will not get affected under any circumstances because of fluctuation in the output voltage of UPS. This is a very important aspect and vendor shall demonstrate the same during FAT and also during SAT.

The inverter shall be transistorized (IGBT) type or with the latest proven technology. All components shall be of a high quality and reliability that satisfy with the requirements of a secure AC power to vital equipment with respect to performance, controlling, monitoring and safeguarding function in continuously operating petrochemical process units, petroleum refineries, gas processing facilities, utility and other miscellaneous industrial plants. Components shall be capable of withstanding the thermal and dynamic stresses resulting from internal and external short circuits and switching surges etc.

The design of the Online AC UPS shall be such as to minimize the risk of short circuits and shall ensure human and operational safety.

The vendor shall be responsible for design, engineering and manufacturing of the complete system to fully meet the intent and requirements of this specification and enclosed data sheets. Selection, sizing and suitability of all equipment and components used for UPS system shall be vendor's responsibility.

The Online AC UPS shall be single phase or three phase system as indicated in the datasheet.

4.00 SITE CONDITIONS

The Online AC UPS system shall be suitable for installation and satisfactory operation in a closed substation with restricted natural air ventilation in tropical, humid and corrosive atmosphere.

The Online AC UPS system shall be designed to operate under site conditions as specified in the data sheet. If not specifically mentioned therein, a design ambient temperature of 40°C and an altitude not exceeding 1000 metres above mean sea level shall be considered

5.00 TECHNICAL REQUIREMENTS

Input power supply

The Online AC UPS system shall be suitable for input power supply as defined in the data sheet. If not specified therein the Online AC UPS shall be suitable for the following input power supply.

Voltage: $415V \pm 10\%$ & $240V \pm 10\%$ (As per datasheet)

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 7 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

Frequency: 50Hz $\pm$ 3%

In addition to above variations, the input voltage may be subject to transient variations comprising voltage dip to 20% of normal voltage during motor start-up and voltage interruption during short circuit as well as frequency variations due to large motor start up. Online AC UPS system shall be designed to operate satisfactorily while deriving the input power from an emergency diesel generator set.

Online AC UPS system shall also operate satisfactorily on input power supply having:

- The ratio of negative to the positive sequence components not exceeding 5% and
- Total harmonic distortion of not more than 5%.

Total Harmonic Distortion is the ratio in percentage of r.m.s. value of the harmonic content to the r.m.s. value of the fundamental component of alternating quantity.

The incoming power supply to Online AC UPS system will be provided based on Online AC UPS system configuration as described below:

Online ACUPS System Configuration and Operational requirements

The Online AC UPS system shall have one of the following basic configurations as specified in the data sheet/drawings.

Single Online ACUPS with Bypass (with1X100%Batteries)

In Online AC UPS system having this configuration a single rectifier/charger and inverter shall be provided. Under normal conditions when AC mains power is available, the rectifier/charger shall simultaneously feed DC power to inverter as well as for float/rapid charging of the battery. The AC supply to loads shall be fed from inverter output. In case of any fault in the inverter, the load shall be automatically transferred to stabilized bypass supply and retransfer of load from stabilized bypass supply to the inverter shall be possible in auto as well as in manual mode without any interruption.

In case of AC input power failure or rectifier/charger failure, the battery shall supply power to inverter without any interruption. The rectifier/charger shall be designed for simultaneously feeding complete inverter load and for float/rapid charging the battery to its rated capacity. Rectifier/charger shall be equipped with 'On Line' automatic as well as manual charging facility.

Parallel Redundant Online ACUPS with bypass (with2X50%batteries)

In Online AC UPS system having this configuration two sets of rectifier/chargers and inverters shall be provided. Under normal conditions, when AC mains power is available, both the rectifier/chargers shall operate in parallel and supply DC power for float/rapid charging the battery and simultaneously to inverters. In case of failure in one rectifier/charger, the other rectifier/charger shall feed the complete load and the battery without any interruption; In case of incoming supply failure or failure of both rectifier/chargers the battery shall feed the inverters without any interruption. Each rectifier/charger shall

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 8 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

be designed for simultaneously feeding complete inverter load and float/rapid charging of the battery to its rated capacity. Each rectifier/charger shall be equipped with 'On Line' automatic as well as manual charging facility.

Normally both inverters will be synchronized with each other and with stabilized bypass supply. Both inverters shall operate in parallel and share the load equally. When a disturbance/fault occurs in any one of the inverters, the faulty unit shall automatically get disconnected and the entire load shall be fed from the other inverter. In case both the inverters develop a fault, the complete load shall be transferred to stabilized bypass supply through the static switches and retransfer of load from stabilized bypass supply to the inverter shall be possible in auto as well as in manual mode.

Hot stand-by Redundant Online ACUPS with bypass

In Online AC UPS system having this configuration, the arrangement of rectifier/chargers, inverters and the operating philosophy is same as described in above clause, except that only one inverter shall be operating at one time. The other inverter shall not be sharing the load but shall be synchronized with the running inverter and stabilized bypass supply and remain ready to accept the load in case of fault in the running inverter. Retransfer of load from stabilized bypass supply to the inverter shall be possible in auto as well as in manual mode.

In all Online AC UPS system configurations, the facility for uninterrupted manual transfer in either direction through static switches shall also be provided.

For ease of maintenance, it shall be possible to isolate inverters and static switches from load through manually operated make before break switches. In case of larger rating Online AC UPS, where it is not possible to provide one power switch with make before break feature, combination of breakers with the control scheme having make before break logic may be provided which ensures momentary paralleling before tripping of selected breaker.

Parallel Redundant Online ACUPS with bypass and with additional charger (with 2X50% batteries)

i. UPS system having this configuration, two sets of rectifiers and inverters (UPS - A&B) shall be provided. Under normal conditions, when AC mains power is available, both the rectifiers (UPS - A&B) shall operate in parallel and supply DC power for float/rapid charging the battery and simultaneously to inverters. In case of failure in one rectifier, the other rectifier shall feed the complete load and the battery without any interruption. In case of incoming supply failure or failure of both rectifiers the battery shall feed the inverters without any interruption. Each rectifier shall be designed for simultaneously feeding complete inverter load and float/rapid charging both the battery banks to its rated capacity. Each rectifier shall be equipped with 'On Line' automatic as well as manual charging facility.

ii. Normally both inverters will be synchronized with each other and with stabilized bypass

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 9 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

supply. Both inverters shall operate in parallel and share the load equally. When a disturbance/fault occurs in any one of the inverters, the faulty unit shall automatically get disconnected and the entire load shall be fed from the other inverter. In case both the inverters develop a fault, the complete load shall be transferred to stabilized bypass supply through the static switches and retransfer of load from stabilized bypass supply to the inverter shall be possible in auto as well as in manual mode.

iii. In addition to 1Phase rectifiers (UPS - A&B), a 1Phase rectifier unit (UPS - C) shall also be provided in such a way that, this rectifier (UPS – C) shall operate only when DG supply is available. This 1Phase rectifier shall be designed for feeding inverter loads and only float charging load of both the battery banks to its rated capacity.

Interlock between 1Phase rectifiers (UPS - A&B) and 1Phase rectifier (UPS - C) shall be provided such that 1Phase rectifiers (UPS – A&B) and 1Phase rectifier (UPS – C) do not supply power simultaneously either during DG operation nor during Grid power supply as connection of both rectifiers UPS – A&B and UPS – C are before incoming MCCBs.

iv. In all UPS configurations, the facility for uninterrupted manual transfer in either direction through static switches shall also be provided.

v. For ease of maintenance, it shall be possible to isolate inverters and static switches from load through manually operated make before break switches. In case of larger rating UPS, where it is not possible to provide one power switch with make before break feature, combination of breakers with the control scheme having make before break logic may be provided which ensures momentary paralleling before tripping of selected breaker.

Online AC UPS Design and Performance Requirements

Incoming AC supply shall be converted to DC through three phase full wave-controlled rectifier/chargers. The rectifier/chargers shall operate according to the constant voltage current limiting principle and shall incorporate a "Soft Start" feature to gradually accept load on initial energizing.

The rectifier/charger section of the Online AC UPS system shall be capable of precise regulation to prevent damage to the battery. The output voltage of rectifier/charger DC bus without the battery shall be stabilized to within $\pm 1\%$ of set value during load variation between 0 to 100% of the rectifier/charger and specified mains input supply voltage variation.

Suitable protection shall be provided in the control circuits to guard against instability of phase-controlled rectifier/chargers due to electrical oscillations which may be present in the input supply as caused by emergency DG set.

The Online AC UPS system including the stabilized by-pass shall be galvanically isolated from input power supply system by providing double wound transformers. All transformers shall be natural air cooled, dry type suitable for location inside the panel. All rectifier/chargers shall also have a double wound transformer at its input.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 10 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

An RFI filter shall be provided. The production of radio frequency interference voltage shall not exceed the value of suppression grade 'N' as defined in VDE-0875. The performance of Online AC UPS system shall not get affected or in any way be degraded by the use of portable radio transmitter receiver in the vicinity of the Online AC UPS system and or Online AC UPS room.

Transient/surge protection circuit shall be provided in the input circuit to rectifier/chargers to protect the Online AC UPS from surges & voltage spikes.

The Online AC UPS system shall be designed to draw power from mains supply at a minimum power factor of 0.85 while working at rated load in normal operating Online AC UPS configuration.

The Online AC UPS shall be provided with automatic sequence and power walk in circuit(s) with time delay of upto 15 sec. such that the rectifier/chargers and inverters can start operating automatically when incoming AC power is restored allowing the Online AC UPS to be loaded automatically.

Facility for initial charging of batteries shall also be provided. The inverters may be disconnected during initial charging of the battery.

For battery sizing, the following factors shall be considered unless specified otherwise in the data sheet

- Load Power Factor of 0.8.
 - Minimum ambient temperature as specified in the datasheet.
- Battery Current = $\frac{\text{Inverter rated KVA} \times \text{Rated load p.f.}}{\text{Inverter Efficiency} \times \text{End cell voltage} \times \text{No. of cells}}$ at 50% load on each inverter for parallel redundant Online AC UPS
- Aging factor of 0.8.
 - Back up time specified in the data sheet.
 - Minimum end cell voltage for lead acid/VRLA battery 1.85V per cell and 1.0V per cell for Ni-Cd battery
 - Battery state of charge factor of 0.95 (Not applicable for LA batteries).

The rectifiers/chargers shall be designed to completely charge the Lead acid and Nickel cadmium batteries in a maximum time of 10 hours after complete discharge. Facilities shall be provided to initiate battery rapid charge operation by manual & automatic means. An auto charging sequence should be provided for the rapid and float charging based on current sensing. Rectifier/charger for VRLA battery shall be sized to provide boost charging of the battery up to 90% of rated Ampere hours within duration of 24 hours and to 100% within 4 days. In addition to above, the charging shall be transferred from rapid to float mode after a preset time adjustable through 0-24 hours timer as back up protection against overcharging.

The rectifier/chargers shall be sized based on the maximum inverter input load when inverter is delivering its rated output at 0.8 pf. lagging and recharge the battery to nominal rated capacity of the battery. The DC load imposed by the inverters shall be considered under the most severe operating conditions where only one rectifier/charger is operating but the Online AC UPS load is equally shared by all the inverters. The rating of each rectifier/charger shall not be less than the value calculated as follows:

For Lead Acid Batteries = Inverter input current + 0.14Ah (10 hr. Rating of the battery)

For Nickel- Cadmium Batteries = Inverter input current + 0.2Ah (5 hr. Rating of the battery)

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 11 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

For VRLA Batteries = Inverter input current + 0.2Ah (10 hr. Rating of the battery)

where Inverter input current = $\frac{\text{Rated kVA capacity of Online ACUPS} \times \text{Load power factor}}{\text{Battery charging voltage} \times \text{Inverter efficiency}}$

The DC rectifier/chargers shall sense the battery charging current and adjust the DC bus voltage to maintain the charging current to preset level. A separate current limit circuit shall also be provided for adjustment of battery current. The rectifier/chargers shall be protected against reverse battery connection at DC link voltage bus. Subsequent to a discharge cycle when battery is connected to rectifier/charger, the battery current shall be monitored, controlled and limited to set value automatically irrespective of the inverter input current.

The battery may be taken out of service for maintenance, during which period it shall be possible for the inverter to continue operation by drawing power from the rectifier/charger. Ripple content at the DC link shall not exceed 2% even with battery disconnected.

Battery/ D.C. link shall be provided with a sensitive earth leakage protection.

The inverter shall be of the current limiting type (short circuit proof) and have nominal output voltage and frequency as specified in the data sheet. The inverter output voltage and frequency shall not exceed the operational tolerances, as measured at the output terminals of the unit during the following conditions of Online AC UPS loading:

- Load variations between 0-100% of the rated output of Online ACUPS
- Load power factor over the range of 0.7 lagging to unity.
- Load current waveform having a relative harmonic content varying between zero and 50%, the latter waveform having a crest factor not exceeding 2.5 and individual harmonics not exceeding the following values:

3rd harmonic 44% of fundamental

5th harmonic 33% of fundamental

7th harmonic 18% of fundamental

9th harmonic 7% of fundamental

11th harmonic 10% of fundamental

The Relative harmonic content is the ratio of the r.m.s. value of the harmonic content to the

r.m.s. value of the total non-sinusoidal periodic waveform i.e. relative harmonic content =

$\sqrt{1 - (\text{Rms value of the fundamental component of current or voltage})^2} / \text{Rms value of total waveform of current or voltage}$

- DC input voltages over the range corresponding to battery rapid charge and battery discharge operation during the specified discharge times.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 12 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

The Online AC UPS output voltage waveform shall be sinusoidal with a relative harmonic content not exceeding 5% under linear load conditions, and not exceeding 15% under the non-linear load conditions specified above.

The inverter shall control the output voltage of the Online AC UPS such as to maintain synchronism with the mains bypass voltage during variations in mains frequency up to the limits specified.

During variations in mains frequency exceeding these limits, the inverter shall revert to internal frequency control.

It shall be possible to vary the inverter output voltage sleeplessly within $\pm 5\%$ of the specified output voltage. This adjustment shall be possible to be made when the inverter is in operation.

The steady state output voltage and frequency (free running) variation of inverters shall not exceed $\pm 1\%$ from the set value for specified input power supply conditions from no load to full load condition and load power factor variation from 0.7 lag to 1.0.

The Online AC UPS system shall be able to operate satisfactorily on rated loads (in kVA) with power factors in the range of 0.7 lag to 1.0. The overall efficiency of the Online AC UPS system shall not be less than 80% at rated load and 0.8p.f.

The Online AC UPS shall have capacity to deliver a minimum overload of 125% for 10 minutes and 150% for 10 sec. Online AC UPS shall be provided with current limit circuit to avoid excessive loading beyond its permissible overload with stand capability.

The inverters shall be 'phase locked' to the stabilized bypass power supply as long as stabilized bypass supply frequency remain within $\pm 3\%$ of nominal. When bypass supply frequency variation exceeds the above limits, the inverters shall be de-linked from mains. Free running frequency tolerance limit shall not exceed $\pm 1\%$. Facility shall also be provided for adjustment of range of synchronizing frequency.

Unless otherwise specified, the Online AC UPS system output voltage variation shall not exceed

$\pm 10\%$ and complete recovery to normal steady state shall be within 0.1 Sec. The phase angle disturbance shall be less than $120^\circ \pm 3\%$ in case of 3 phase inverter. The above requirement shall be complied for following transient disturbances.

- 100% step load and unload (For single Online ACUPS and hot stand by Online ACUPS)
- 50% step load(for parallel redundant Online ACUPS)
- Momentary interruption in power supply
- Load transfer to stabilized by pass supply
- Complete load transfer to other healthy inverter when one of the two parallel inverters develop a fault.

For 3 phase Online AC UPS system, the maximum output voltage and angle variation between the phases should not exceed 6% and 3 degrees respectively even under the condition of 100% unbalanced loading of the 3-phase output.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 13 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

Online AC UPS system shall be suitable both for floating output or earthing of one leg / star point in case of single phase/ three phase system respectively. The neutral of AC ups shall be solidly grounded.

The stabilized bypass supply shall be designed to regulate the output voltage within $\pm 2\%$ of the rated voltage over complete range of load from no load to full load and for specified input supply voltage variation. Voltage stabilizer in stabilized bypass supply shall be static type, unless otherwise specified.

The stabilized bypass supply shall have a continuous current rating equivalent to the rated output of the Online AC UPS unit and be capable of conducting a current ten times the rated output for the duration more than the fault clearing time of the type of fuse provided. The load transfer devices shall comprise of continuously rated static elements in both inverter and stabilized bypass supply.

Adequately rated static switches in required number & configuration shall be provided in the inverter(s) output and stabilized bypass supply to ensure positive isolation of faulty inverter section such that the other inverter and bypass circuits do not feed into the fault leading to under voltage / trip. The short time rating of all the static switches shall be at least 10 times the rated output for the duration more than the fault clearing time of the type of fuse provided.

Facility shall be provided to manually and automatically initiate transfer of the load from inverters to the stabilized bypass supply and from stabilized bypass supply to the inverters. Under voltage and over voltage sensing levels to initiate transfer shall be adjustable. The maximum transfer time between inverters and bypass supply shall not exceed 4 msec and 20 msec in synchronous and asynchronous mode respectively.

The criteria for load transfer:

- a) Load transfer from inverter to the stabilized by pass supply shall be as follows:
 - i) The load transfer shall only be possible when:
 - The stabilized bypass output voltage is within, $\pm 5\%$ of rated Online ACUPS output voltage and
 - The mains bypass frequency is within $\pm 3\%$.
 - ii) Auto-transfer of the load from inverter to stabilized by pass supply shall be initiated when:
 - the inverter output voltage drops below 95% of nominal output voltage under steady state condition and/or if the inverter output voltage falls below 90% of the nominal value under transient conditions.

OR

 - The inverter output voltage exceeds 105% of the nominal output voltage under steady state condition and/or if the inverter output voltage reaches 110% of the nominal value under transient conditions.

OR

 - The inverter output current exceeds it's tolerable limits.
 - b) Re transfer of load from stabilized by pass supply to the inverter shall be as follows:
 - i) The load transfer shall be possible when-
 - The inverter output voltage is within $\pm 5\%$ of nominal output voltage for more than 5sec. and
 - Inverter output and stabilized bypass supply are synchronized
- Retransfer of load from stabilized by pass to the inverter shall be done manually only unless otherwise specified in the data sheet.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 14 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

If automatic retransfer of load to the inverter is specified in the data sheet, then the retransfer of load to the inverter shall be inhibited following four automatic transfers of load to stabilize by pass within a period of 5 minutes.

All breakers shall be adequately rated for continuous rating as well as breaking capacity as applicable. Paralleling of breaker/ switch/ contactor poles to achieve the required current rating is not acceptable. All output isolating device shall be double pole type.

All electronic power devices including thyristors, transistors (IGBTs), diodes etc. shall be rated under operating conditions for approximately 200% of the maximum current carried by the device. All other electrical components such as transformers, reactors, breakers, contactors, switches, busbars etc. shall be rated for at least 125% of the maximum required rating. No electronic device shall be subjected to PIV greater than 50% of its rated value.

All the thyristors, power transistors, diodes and other electronic devices of Online AC UPS shall be protected with high-speed semiconductor fuses. It co-ordination between fuse and semi- conducting power devices shall be ensured.

The outgoing circuits of ACDB shall be protected by semiconductor fuses. Each inverter shall be designed to clear a fault in any of the branch circuits upto a maximum rating of 25% of the system capacity without the assistance of the stabilized bypass supply. In case of any fault in branch circuits, the load connected to the healthy circuits shall not get affected. The fault clearing time shall be less than 4msec.

All PCBs shall be provided with a transparent epoxy coating for environmental protection and topicalization. They shall be suitably located away from heat sources.

All electronic control and monitoring printed circuit cards shall be installed in standardized electronic equipment frames and shall be fitted with suitable means for easy removal. The frames shall incorporate guides for PCB's to facilitate correct insertion of PCB's and shall allow access to the wiring side of the connectors. All PCBs shall be placed in a manner to avoid replacement of a PCB by a wrong spare PCB. Monitoring points shall be provided on each of the PCB's and the PCB shall be firmly clamped in position so that vibration or long usage do not result in loose contacts. Failure of each PCB shall be indicated by visual alarms. Visual fault diagnostics shall preferably identify faults upto various sections in the card.

Forced ventilation of panel, if provided, shall be supplemented by 100% redundant fans. In normal operation, normal & redundant fans shall run together. The power supply for the fans shall be tapped from the inverter output. However, the rating of the Online AC UPS as specified in the data sheet shall be the net output of Online AC UPS after deducting power consumption for fans etc. However, in case of non-operation of 50% of running fans the Online AC UPS output shall not be affected. The fans shall be arranged to facilitate removal of faulty fan for maintenance without requiring system shutdown. All fans shall be equipped with monitoring facilities to provide an alarm in the event of a failure.

Maximum noise level from Online AC UPS system at 1 metre distance under rated load with all normal cooling fans shall not exceed 75dBA.

@MECON Limited; all rights reserved

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 15 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

6.00 Construction

Rectifier/charger and inverter, stabilized bypass supply and static switch sections shall be suitably housed in sheet steel panels complete with all interconnections.

Online AC UPS panels, ACDB and cell booster enclosures shall be fabricated from structural/CRCA sheet steel. The frames shall be fabricated by using minimum 2mm thick CRCA sheet steel while the doors and covers shall be made from 1.6mm thick CRCA sheet steel. Wherever required suitable stiffeners shall be provided.

The panels shall be free standing, fitted with suitable louvres for ventilation and cooling fans as required. Hinged doors shall be provided at the front and back with dust tight gaskets. Interpanel sheet steel barriers shall be provided. The enclosure shall provide minimum IP-31 degree of protection, if not specified otherwise in the data sheet. The maximum and minimum operating height of the switches shall be 1800 mm and 300 mm respectively.

Power cables shall be with aluminum / copper conductors and control cables shall be with copper conductors. All the cable connections shall be from bottom and front of the panel, if not specified otherwise in the data sheet. A removable bolted gland plate shall be provided along with single compression type nickel plated brass cable glands for external cable connections. Clamp type terminals shall be used for connection of all wires upto 10 mm². Bolted type terminals suitable for cable lugs shall be provided for wire size above this. Tinned copper lugs for all external connections provided with the panels. Terminals for all external connections shall be provided. Interconnections cables for cubicles located side to side shall be supplied.

Bus bars shall be used in all power circuits which are rated above 100 Amp. Copper conductor PVC insulated cables or wires of 660V grade shall be used for power circuits rated less than 100

Amp. Bus bars shall be colour coded and live parts shall be shrouded to ensure complete safety to personnel intending routine inspection by opening the panel doors. All wires shall be ferruled and terminals shall be numbered.

MCCBs, MCBs and load break power switches shall be mounted inside the panel. The control switches shall be rotary type, mounted on the door and shall be externally operable. An 8W LED lamp controlled through a door switch shall be provided for illumination in each panel. All instruments shall be analogue/digital, switchboard type, back connected, 72 x 72 mm. square (Analogue type). Analogue instruments' scale shall have red mark indicating maximum permissible operating rating. Separate test terminals shall be provided for measuring and testing of the equipment to check the performance. The status contacts of MCCBs, MCBs and SFUs, fuse failure shall be wired upto a common TB for purchaser's use

A suitably sized earth bus shall be provided at the bottom of the panels including ACDB running through the panels line up with provision for earth connection at both ends to purchaser's main earth grid. The minimum size of earth bus shall be 25 x 3 mm² copper (or equivalent aluminium). All potential free metallic parts of various equipment shall be earthed suitably to ensure safety.

All panels shall be of same height so as to form a panel line up which shall have good aesthetic appearance.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 16 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

Inside the panels, the controls connections shall be done with 660V grade PVC insulated wires having stranded copper conductors. 1.5 mm² size wire shall normally be used for circuits with control fuse rating of 10 Amp. or less. For control circuit having fuse of 16 Amps, 2.5 mm² size wire shall be used, Control wiring for electronic circuits shall be through flat ribbon cable or through copper wire minimum of 0.5 mm dia.

All control wiring shall preferably be enclosed in plastic channels or otherwise neatly bunched together. Each wire shall be identified at both ends by PVC ferrules. Ferruling of wires shall be as per relevant IS.

All metal surfaces shall be thoroughly cleaned and de-greased to remove mill scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The under- surface shall be prepared by applying a coat of phosphate paint and a coat of yellow zinc chromate primer. The under-surface shall be made free from all imperfections before undertaking the finished coat.

After preparation of the under-surface, the panels shall be spray painted with two coats of epoxy- based final paint or shall be powder-coated. Spray painted finished panels shall be dried in stoving ovens in a dust-free atmosphere. Panel finish shall be free from imperfections like pinholes, orange peels, runoff paint, etc. Colour of final paint shall be shade RAL7035, unless specified in the data sheet. All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust corrosion.

All components / devices / feeders shall be provided with screwed nameplates and device tag numbers as per the schematic diagram. Nameplates shall be 3 ply white-black-white 2 colour laminated plastic type. Lettering shall be of minimum 6 mm height and edges shall be bevelled at 45°.

The status contacts of MCCBs, MCBs and SFUs, fuse failure shall be wired upto a common TB for purchaser's use. Marshalling Cubicle in each DCDB/ACDB for further integration with station PLC on hardware

Cell Booster

Cell booster shall be suitable for charging one to six cells within time duration as specified. It shall be suitable for charging not only the new cells before being introduced to the battery bank but also any treatment to be given to the individual weak cells. Quantity of such boosters shall be as defined in the FOA/PO. Cell booster shall be suitable for 240V ± 10%, 50 Hz ± 3% SPN input power supply. Cell booster output voltage shall be in the range of 0 -18V and 0 - 12V for Lead Acid and Nickel Cadmium batteries respectively. Cell booster shall be sized as under:

For Lead Acid battery= $0.14 \times \text{Ah of cell (10hr. Rating of the cell)}$ For VRLA
battery= $0.2 \times \text{Ah of cell (10hr. Rating of the cell)}$

For Ni-Cd battery = $0.2 \times \text{Ah of cell (5 hr. Rating of the cell)}$

Cell booster shall have heavy duty switch fuse or MCCB on AC incomer and DC output, AC voltmeter, DC ammeter and voltmeter, indicating lamp for AC / DC power ON. The output voltage and current of cell booster shall have manual control using a suitably rated variac or a full wave-controlled rectifier bridge.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 17 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

Suitable interlock shall be provided so as to ensure that the variac/ controlled rectifier/charger is at its minimum position while switching on the cell booster. Cell booster shall be portable type with wheels. Each cell booster shall be supplied with 5 m long flexible copper conductor, PVC insulated and braided cable for AC incomer power supply and DC output connection to the battery.

AC Distribution Board

Sheet steel enclosed AC distribution board shall be provided as part of the complete Online AC UPS system. It shall accommodate AC feeders as indicated in the data sheet. The distribution board shall be floor mounted, fixed type with compartmentalized construction unless otherwise indicated in the data sheet. It shall be possible to operate the switches without opening the doors. Switches shall be provided with door interlock. Vertical cable alley of minimum 200mm width with suitable supports shall be provided for the termination of outgoing cables. Suitable supports shall be provided for supporting incoming and outgoing cables. All outgoing switches shall be air insulated load break type. Fuses on outgoing feeders shall be fast acting semiconductor type and cable entry shall be from bottom. The gland plates of the distribution board shall be removable, CRCA or non-magnetic having minimum 3mm thickness. Non- magnetic cable gland plates shall be provided for termination of single core cables only. Surge suppression devices shall be provided in all outgoing feeders of Online AC UPSACDB.

7.00 ALARM, CONTROL, INDICATION AND METERING REQUIREMENTS

If not specified otherwise in the data sheet, following schedule shall be followed for alarm, control, indication and annunciation. Any additional devices/features considered necessary for reliable operation and maintenance shall also be included in various panels and same shall be highlighted separately. An illuminated one-line diagram indicating operational status shall be provided on the front of the panel. Metering, indications, audio-visual alarm shall be provided.

Parameters/ information indicated shall be available in LCD panel or by other means directly or indirectly. All the indicating meters on the panel shall be digital type.

Metering- Multi Function Meter with Modbus TCP IP

Backup time left based on current discharge rate

Rectifier/charger

- Incoming line voltages (For all the three phases).
- Input line currents (For all the three phases)
- D.C. voltage at each rectifier/charger output.
- Battery Bank current.
- Battery Bank Voltage.

Inverters

- AC voltage at each inverter output (ACvoltagesfor1 phase and 3phaseinverter))
- AC current at each inverter output (ACcurrentsfor1 phase and 3phaseinverter)
- Frequency meter at each inverter output

Stabilized bypass supply

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 18 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

- Frequency meter for incoming supply.
- Voltmeter with selector switch for incoming supply.
- Ammeter with selector switch for incoming supply.

ACDB

Following shall be provided for each of the ACDB incomers

- Voltmeter (voltmeter selector switch shall also be provided for 3phase inverter).
- Ammeter (ammeter selector switch shall also be provided for 3phase inverter).
- Power factor meter.

Indications

(All indication lamps shall be provided with series resistors. Clustered/Jumbo LED's of minimum 10 mm dia. may be provided in place of lamps subject to their having at least equal illuminance.)

- AC mains 'ON' -rectifier/charger.
- AC mains 'ON' - Bypass.
- Indication lamp for 3 phase Voltage (R Y B respectively)

Rectifier/chargers (for each rectifier/charger)

- Rectifier/charger output 'ON'
- Battery on float charge
- Battery on rapid charge

Inverters (for each inverter)

- DC input 'ON'
- Load on inverter.
- Inverter synchronized with mains.

Load on bypass.

Audio-Visual Alarm (separately for each circuit)

- Mains failure
- Rectifier/charger failure
- Battery fault
- Inverter temperature high
- Low voltage from inverter
- Load on bypass
- Inverter overloaded
- All power Fuse failures
- DC earth fault
- backup left less than suitable time (say 10 minutes) shall be included in audio visual alarms.

For interfacing with Station PLC on hard wired 2nos.changeover contacts shall be wired to the terminal strip, 1no.for common remote alarm of 'Online AC UPS fault' in Purchaser 's panel and 1 no for 'load on bypass supply' annunciation.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 19 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

UPS shall be provided with provision to hook up all indications and audio-visual alarms, as specified above with purchaser PLC and RTU through Modbus TCP/IP.

Redundant communication (Two Different IP Domain) with Station PLC/SCADA RTU to be provided as applicable

Controls

- All the switches for starting, shut down and testing sequence.
- Primary input circuit breakers for feeding rectifier/chargers, bypass line and dc bus from battery including backup protection.
- Inverter ON/OFF switch (to initiate inverter operation)
- Static switch transfer test Push Button

Reliability

All necessary care shall be taken in selection, design, manufacture and testing of the equipment for ensuring high system reliability. Following design consideration shall be taken into account to ensure maximum availability of the system.

There shall be no common device, between main and redundant units (e.g. master oscillators etc.) in order to ensure that the failure of the same does not cause shutdown of more than one unit.

It shall be possible to take out any individual power circuit for maintenance without affecting the total Online AC UPS supply.

Series- parallel combination of smaller devices to achieve required rating shall not be acceptable.

Vendors shall offer their nearest higher standard size that will meet the requirement of the specified Online AC UPS rating.

System Manage Module /Fault Diagnostic Unit

When specified in the data sheet, each Online AC UPS set shall have microprocessor-based system manage module with Modbus TCP/IP communication and shall have capability to communicate with Purchaser's PLC and RTU On redundant link (two different IP domains). It shall also have capability to provide the status of all analog & digital parameters of the Online AC UPS system. This shall supervise the Online AC UPS operation continuously. It shall identify and locate faults immediately so that corrective action can be taken. System manage module shall be compatible to hook up with Purchaser's PC through RS485 interface. The necessary hardware and software shall be provided on a Hard Disc/CDROM.

The System Manage module shall have provision for monitoring input/output voltages, currents, frequency as a minimum under the following conditions.

- Online AC UPS power source changeover from mains to battery.
- Online AC UPS power source changeover from battery to mains.
- Change over from inverter to stabilized by pass supply and vice versa.
- Changeover from one inverter to another inverter.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 20 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

- Changeover time in case of inverter to stabilized bypass supply and from one inverter to another inverter.
- Online AC UP failure.
- Type of failure incident along with diagnostic report.

In addition to the above, any other feature which vendor feels may be useful shall be provided and highlighted separately.

If any additional equipment is required for connecting this unit with Online AC UPS system as well as Purchaser's PC, the same are also to be included in the vendor's scope.

MODBUS TCP/IP ports shall be daisy looped for interfacing with station PLC and RTU for fetching all the parameters/diagnostics in an elaborate way. If any of the parameter scan not be communicated over the said protocol then vendor shall provide transducers.

8.00 INSPECTION AND TESTING

During fabrication, the equipment shall be subjected to inspection by Purchaser or by an agency authorized by the Purchaser. Vendor shall furnish all necessary information concerning the supply to Purchaser. The Purchaser shall have free access to the Vendor's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality.

Online AC UPS system shall be tested in accordance with applicable standards. Following acceptance tests on each Online AC UPS system as a minimum shall be carried out at Vendor's works under his care and expense. Vendor's internal test reports shall be provided for Purchaser's review prior to inspection and testing. All tests shall be witnessed by purchaser or its authorised representative and 4 weeks prior notice shall be given before the date of commencement of tests. The tests certificates indicating test results shall be furnished. Following system acceptance tests shall be conducted on each UPS system.

Insulation tests

Insulation tests shall be performed as per IEC 60146-1-1.

The insulation tests shall be carried out using an AC power frequency voltage or by using DC Voltage at the choice of the vendor. In the case of AC power frequency voltage test, the test voltage at the frequency available in the test facility or at the rated frequency, but not exceeding 100 Hz, of the full value starting at a maximum of 0.5 p.u. The unit on test shall withstand the specified voltage for 1 minute.

In case DC voltage is used for the test, the value of DC voltage shall be equal to the crest value of the test voltage specified in the table.

$V_p / \sqrt{2}$ (V _p is the highest crest voltage to be expected between any pair of terminals)	Test Voltage (AC rms value)
≤ 60 V	500 V

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO. MEC/05/E9/TS/10A	Page 21 of 24
			REVISION: 0
			EDITION: 3
	≤125 V	1000 V	
	≤ 250 V	1500 V	
	≤ 500 V	2000 V	

Interconnection cable check

The interconnection cable are to be checked for correct wiring, insulation and quality of the terminations

A.C. input failure test

The test is performed with the test battery and carried out by tripping a.c. incoming circuit breakers or by switching off rectifier/chargers and bypass supply at the same time. Output voltage and frequency variations are to be checked for specified limits.

A.C. input return test

The test is performed by closing a.c. incoming circuit breakers or is simulated by energizing rectifier/chargers and bypass supply. Proper operation of rectifier/chargers starting and voltage and frequency variations of output are to be checked.

Simulation of parallel redundant Online ACUPS fault

The test is applicable for Online AC UPS with parallel redundant configuration. Fault of rectifier/charger or inverter are to be simulated and output transients are to be recorded.

Transfer test

Transients shall be measured during load transfer from inverter to bypass supply caused by simulated fault and load retransfer after clearing the fault.

Regulation test

This test shall be carried out by measuring input voltage, input current, output voltage, output current, DC link voltage, output distortion, input active power, output active power and frequency at no load, 50% load and 100% load at 0.7 and 0.8p.f.

Following parameters of rectifier/chargers and inverters are to measured:

Measurement shall be carried out in the rectifier/charger float charge mode and in rapid charge mode. Measurement shall be at nominal a.c. voltage and at no load, 50% load and 100% of rectifier/charger full load.

Rectifier/charger measurement shall comprise of: -

- Input voltage, frequency, phase current and input power.
- D.C. output voltage and current.
- Ripple current at the DC'link bus shall be recorded after isolating the test battery.

Inverter measurement shall also be at no load. 50% load and 100% load of inverter rated output current and

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 22 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

shall be repeated for inverter D.C. input voltages corresponding to battery float charge operation as well as rated inverter maximum and minimum input D.C. voltage. Measurement shall comprise of:

- Input voltage, input current.
- Output voltage, frequency and wave form distortion, output power and current.

Online AC UP efficiency

This shall be determined by the measurement of the active power input and output at rated p.f. for 50%, 75% and 100% load.

Current division in parallel Online ACUPS

Load sharing between Online AC UPS units shall be measured with a dummy load under parallel redundant Online AC UPS configuration.

Light load test

The test is to verify that all functions of the Online AC UPS system operate properly. The load applied is limited to some percentage of rated loads. The following points are to be checked.

- a) Output voltage and frequency and correct operation of meters.
- b) Operation of all control switches and other means to put Online ACUPS system into operation.
- c) Functioning of protective and warning devices

Burn-in test for Printed circuit boards

PCB's and other electronic components sub-assemblies shall undergo a burn – in test for 96 hours at 50 °C at a voltage varied between the maximum and minimum supply voltage. In case of failure of any component during testing. The tests shall be repeated after replacement of the faulty component. Supplier's test certificates are also acceptable for this test.

Continuous full load test at 0.8 power factor with temperature rise measurement

The test is required to be performed by connecting resistive load or resistive and inductive load to the Online AC UPS system output. The load shall be placed outside the test room to avoid influences of its heat upon Online AC UPS ventilation. Online AC UPS system in this test shall undergo a complete full load test for 32 hours at 0.8 power factor. Out of these 32 hours, each inverter section shall be subjected to full load test for 8 hours, both inverters sections operating in parallel shall be subjected to full load test for 8 hours and the for remaining 8 hours; the bypass section shall be subjected to full load test. Steady state temperature of rectifier/charger transformer, rectifier/charger set, D.C. choke, inverter set, static switch etc. shall be recorded during the test. The temperature of all Online AC UPS panels is also to be recorded.

Auxiliary equipment and control circuit tests

The correct functioning of all measuring instruments, alarms, indications, protection devices and controls are to be verified. The functioning of auxiliary devices such as lighting, cooling fans, annunciation etc. should be checked.

Synchronization test

Frequency variation limits of inverter are to be tested by feeding bypass supply incoming line by variable

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO.	Page 23 of 24
		MEC/05/E9/TS/10A	REVISION: 0
			EDITION: 3

frequency generator and inverter synchronization limit is to be checked as specified.

Unbalanced load test (For3phaseOnlineACUPSONly)

Unbalance load at specified limits is applied to the Online AC UPS system. The specified voltage and phase angle variation may be checked for compliance with specified values.

Output voltage unbalance (For3phaseOnlineACUPSONly)

Output voltage unbalance shall be checked under symmetrical load conditions and unbalance load conditions. Phase to phase and phase to neutral output voltage are to be observed. The voltage unbalance is the ratio of highest phase voltage minus lowest phase voltage to the average value. Phase angle variation may be measured for phase to phase and phase to neutral voltages

Overload capability test

Specified values of short time overload are to be applied for specified time interval. Values of Output voltage and output current are to be recorded.

Short circuit current capability test

Specified short circuit current capability is to be tested by application of a short circuit to Online AC UPS output if necessary, via a suitable fuse. Short circuit current is to be recorded.

Short circuit fuse test

Fuse tripping capability of the Online AC UPS system is to be tested by short circuiting the Online AC UPS system output via a specified rating of fuse. The test is carried out at an appropriate Online AC UPS load under normal operation.

Restart

Manual restart to be tested after complete shutdown of Online AC UPS system.

Output overvoltage

Operation of output over voltage protection is to be checked.

Dynamic Response test

Output recording at different loads and operating condition to be done.

Harmonic components

Harmonic components of output voltage are to be recorded at no load, 50% load and 100% load conditions. Harmonic voltages caused by Online AC UPS system components in the A.C. incomer side shall be recorded at site.

Earth fault test

An earth fault is to be applied to the output terminal of Online AC UPS system. Online AC UPS output transients are to be measured. An earth fault is also to be applied to the battery terminal and Online AC UPS system output transient shall be measured.

Audible noise test

The audible noise is required to be measured at 1 meter distance from Online AC UPS system in at least 4

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	AC UPS	DOCUMENT NO. MEC/05/E9/TS/10A	Page 24 of 24
			REVISION: 0
			EDITION: 3

to 5 locations and its value shall be within permissible limit.

Batteries shall be tested in accordance with applicable standards. Following acceptance tests on each AH rating of cells/battery shall be carried out at Vendor's works under his care and expense. Vendor's internal test reports shall be provided for Purchaser's review prior to inspection and testing. For long duration type tests, type test certificates of identical Ampere hour rating shall be furnished

- Physical examination
- Polarity and absence of short-circuit
- Marking and packing
- Verification of dimensions
- Air pressure test
- Test for voltages during discharge
- Test for AH capacity
- Test for charge retention if specified in the datasheet.
- Insulation resistance

Battery duty cycle test to meet the load cycle requirement shall also be performed at site after installation as part of commissioning unless otherwise defined in the datasheet.

Acceptance, routine and type tests shall be witnessed by Purchaser or an agency authorized by the Purchaser. Prior notice of minimum 4 weeks shall be given to the Purchaser for witnessing the tests.

For equipment bought from other sub-suppliers, certified test reports of tests carried out at the sub-supplier's works shall be submitted. Normally all routine tests as specified in the relevant standards shall be conducted by the sub-supplier at his works.

9.00 SITE ACCEPTANCE TESTS

Vendor shall furnish Site Acceptance Tests procedure to be followed. Final acceptance testing along with the batteries shall be done at site. It shall be Vendor's responsibility to arrange necessary instruments and tools as required by their commissioning engineer for these tests.

10.00 PACKING AND DISPATCH

All the equipment shall be divided in to several shipping sections for protection and ease of handling during transportation The equipment shall be properly packed for transportation by ship/rail or trailer. The equipment shall be wrapped in polyethylene sheets before being placed in wooden crates /cases to prevent damage to the finish. Crates /cases shall have skid bottoms for handling. special notations such as 'Fragile', 'This side up', 'centre of gravity', 'weight', 'Purchaser's particulars', 'PO nos.' etc. shall be clearly marked on the package together with other details as per purchase order.

The equipment may be stored outdoors for long periods before installation. The packing should be suitable for outdoor storage in areas with heavy rains and high ambient temperature unless otherwise agreed.

@MECON Limited; all rights reserves

REV: 0

EDITION: 3

TECHNICAL SPECIFICATION
FOR
ELECTRICAL BULK MATERIAL

DOCUMENT No. : MEC/05/E9/TS/11

Prepared & Issued by



**ELECTRICAL SECTION
MECON LIMITED**

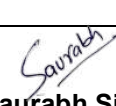
(A Govt. of India Undertaking)
13th & 15th Floor, North Tower, SCOPE MINAR,
Laxmi Nagar District Centre,
Delhi-110092 (India)

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO.	Page 2 of 14
		MEC/05/E9/TS/11	REVISION: 0
			EDITION: 3

Table of Contents

S.No.	DESCRIPTION	PAGES
01.00	INTENT	4
02.00	CODES AND STANDARDS	4
03.00	SITE CONDITIONS	6
04.00	DESIGN AND CONSTRUCTION REQUIREMENT	6-14
04.01	LOCAL CONTROL STATION	6
04.02	WELDING RECEPTACLES with PLUG	7
04.03	CABLE GLANDS	8
04.04	CABLE LUGS	8
04.05	HV TERMINATION and JOINTING KITS	9
04.06	CABLE TRAYS	9
04.07	LIGHTING and SMALL POWER DISTRIBUTION BOARDS	10
04.08	LIGHTING FIXTURES	11
04.09	SMALL POWER RECEPTACLES	12
04.10	SWITCHES	13
04.11	JUNCTION BOXES	13
04.12	LIGHTING POLES	14
04.13	SAFETY EQUIPMENTS	14
05.00	INSPECTION AND TESTING	14
06.00	PACKING AND DISPATCH	15

Rev	Date	Prepared by	Checked by	Approved by
0	11.07.2025	 Chirosmita Banerjee	 Saurabh Singh	Pankaj Shrivastava

© Copyright MECON Limited – All rights reserved.
THIS DOCUMENT IS THE SOLE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED HEREIN. THIS IS NOT TO BE COPIED OR USED FOR ANY OTHER PROJECTS UNLESS EXPLICITLY PERMITTED BY MECON.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO. MEC/05/E9/TS/11	Page 3 of 14
			REVISION: 0
			EDITION: 3

AMENDMENT STATUS
(OLD NUMBER OF STANDARD: MEC/TS/05/E9/11)

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Document Number replaced with New number as MEC/05/E9/TS/11	All	Rev 0/ Ed 3	11.07.2025		
2	Section re-name as Electrical Section (Oil & Gas SBU) Delhi	All	Rev 0/ Ed 3	11.07.2025		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO. MEC/05/E9/TS/11	Page 4 of 14
			REVISION: 0
			EDITION: 3

1.0 INTENT

- a. The intent of this standard specification is to define the general requirements for design, manufacture, assembly and testing at manufacturer's works, packing, transportation and receipt at site with all materials and accessories of **Electrical Bulk Material**.
- b. Bidder shall also refer SOR item for details/requirements as part of the project need.

2.0 CODES AND STANDARDS

2.1 The equipment shall comply with the requirements of latest revision of following standards issued by BIS (Bureau of Indian Standards), unless otherwise specified:

IS 5	Colours for ready mixed paints and enamels
SP 30 (BIS)	National Electrical Code 2011
IS 816	Code of practice for use of metal arc welding for general construction in mild steel
IS 875 - 3	Design Loads (Other Than Earthquake) For Buildings and Structures - Code of Practice - Part 3: Wind Loads
IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories
IS 1293	Plugs and Socket-outlets Of Rated Voltage Up to And Including 250Volts And Rated Current Up To 16 Amperes
IS 1364	Hexagon head bolts, screws and nuts of product grades A and B
IS1573	Electroplated Coatings of Zinc on Iron and Steel
IS 2157	Handloom shoddy woollen blankets
IS 2309	Code of practice for the protection of buildings and allied structures against lightning
IS 2418 - 1	Specification for Tubular Fluorescent Lamps for General Lighting Service - Part 1: Requirements and Tests
IS 2629	Recommended practice for hot dip galvanizing of iron and steel
IS 2633	Methods for testing uniformity of coating of zinc coated articles
IS 3043	Code of practice for earthing
IS 3323	Bi-pin Lamp Holders for Tubular Fluorescent Lamps

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO. MEC/05/E9/TS/11	Page 5 of 14
			REVISION: 0
			EDITION: 3

IS 3618	Phosphate treatment of iron and steel for protection against corrosion
IS 3854	Switches for Domestic and Similar Purposes
IS 4759	Hot-dip zinc coatings on structural steel and other allied products
IS 5081	Glass Tubes for Tubular Fluorescent Lamps for General Lighting Service - Specification
IS 6005	Code of practice for phosphating of iron and steel
IS 8224	Electric Lighting Fittings for Division 2 Areas
IS 9794	Boards/blanks for sley bottom, race, cap and box back of cotton looms
IS 9974: Part 1	High pressure sodium vapour lamps: Part 1 General requirements and tests
IS 13021	AC supplied electronic ballasts for tubular florescent lamps
IS 13032	AC Miniature Circuit-breaker Boards for Voltages Not Exceeding 1000V
IS 16101	General Lighting: LED and LED Modules
IS 16102	Self-Ballasted LED lamps for General Lighting Services
IS 16103	LED modules for General Lighting
IS 16104	DC or AC Supply Electronic Control gear for LED Modules
IS 16107	Luminaries Performance
IS/IEC 60079-1	Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"
IS/IEC 60309	Plugs, sockets-outlets and couplers for industrial purposes
IS/IEC 60529	Degrees of protection provided by enclosures (IP CODE)

2.2 Wherever the requirements in this specification are in conflict with any of the above Standards, the requirements under this specification shall be binding.

2.3 In case of any contradiction between various referred standards/ specifications/ data sheet and statutory regulations the following order of priority shall govern. However, stringent of the below shall be followed

- Statutory regulations.
- Schedule of Rate
- Scope of Work/ Job specification.
- Design Basis.
- Data sheets.
- Standard Specification.
- Codes and standards.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO. MEC/05/E9/TS/11	Page 6 of 14
			REVISION: 0
			EDITION: 3

3.0 SITE CONDITIONS

The electrical bulk items shall be suitable for installation and satisfactory operation in indoor or outdoor installation as specified with humid and corrosive atmosphere.

The electrical bulk items shall be designed to operate under site conditions as specified in the site conditions. If not specifically mentioned therein, a design ambient temperature of 40°C for indoor, 50°C for outdoor and an altitude not exceeding 1000metres above mean sea level shall be considered.

The electrical bulk items described in this specification is intended for continuous duty at the specified ratings under the specified site conditions.

4.0 DESIGN AND CONSTRUCTION REQUIREMENTS

General

The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.

The electrical bulk items shall be rated for supply voltage and frequency as specified and shall be suitable for +10% supply voltage variations and +3% supply frequency variations where applicable.

All electrical bulk items shall be supplied with fixing hardware such as nuts, bolts & washers of stainless steel necessary for installation.

All electrical bulk items paint shade shall be as per Manufacturer's standard unless otherwise specified.

All electrical bulk items specified for installation in hazardous areas, shall be tested by CMRI and duly approved by PESO Nagpur or DGMS Dhanbad or any other applicable statutory authority. All indigenous FLP equipment shall also have valid BIS license as required by statutory authorities.

All Indoor electrical equipment enclosures shall be cleaned free of rust, given a coat of red-oxide primer and finished with two coats of epoxy-based paint of shade RAL 7032. Outdoor equipment's enclosure paint shade shall be 631 as per IS-5.

4.1 LOCAL CONTROL STATION

Each local control station shall be surface mounted consisting of but not limited to following:

Enclosure	:	Die cast aluminium alloy LM6 for hazardous area FRP type material for safe area
Enclosure IP rating	:	Min. IP 55 for Outdoor Area /Min. IP 42 for Indoor Area.
Type of Protection	:	Minimum Ex 'd' type for hazardous area
Control devices	:	Shroud ed start push button (Green), Mushroom head, stay put type

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO. MEC/05/E9/TS/11	Page 7 of 14
			REVISION: 0
			EDITION: 3
			padlocking, stop push button (Red), Local and Remote selector switch (if specified) Ammeter (If specified).
Gasket	:		Neoprene
Terminals	:		Copper suitable for termination of specified cable size, numbers as specified
Cable entries	:		As specified at bottom
Hardware	:		Stainless steel
Canopy	:		If specified for outdoor installation

Fully wired from circuit elements to pre-numbered terminals.

Accessories - Internal and external Grounding Terminal.

- “Start” pushbutton shall be non-maintaining with “Double Break” type contacts, one pair normally open and one pair normally closed.
- Mushroom head Stay put type “Stop” pushbutton shall be maintaining type contacts, one pair normally open and one pair normally closed.
- Ammeter shall be 62mm dia., taut band, moving iron type with suppressed scale to suit the motor starting current.
- Local/Remote selector switch shall be maintaining type contacts on selected position, one pair normally open and one pair normally closed.

4.2 WELDING RECEPTACLES with PLUG

Each welding receptacle with plug shall consist of but not limited to following items:

Type	:	4 Wire (3PH+N) with switch
Enclosure	:	Die cast aluminium alloy LM6 for hazardous area Fibreglass Reinforced Polyester (FRP) for safe area
Enclosure IP rating	:	Min. IP 55 for Outdoor Area / Min. IP 42 for Indoor Area.
Type of Protection	:	Minimum Ex ‘d’ type for hazardous area
Gasket	:	Neoprene
Terminals	:	Tin coated copper suitable for termination of specified cable size, numbers as specified
Cable entries	:	As specified at bottom
Hardware	:	Stainless steel
Canopy	:	If specified for outdoor installation

Fully wired from circuit elements to pre-numbered terminals

Accessories - Internal and external Grounding Terminal

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO. MEC/05/E9/TS/11	Page 8 of 14
			REVISION: 0
			EDITION: 3

4.3 CABLE GLANDS

Cable glands shall be of nickel-plated brass unless otherwise specified and shall be manufactured in accordance with IS/IEC 60529 and IS/IEC 60079-1.

The single compression type cable glands shall be used for indoor panels/equipment (e.g., substation, control room etc). The cable glands for outdoor terminations shall be whether protected, double compression type and shall have PVC shroud for additional whether protection.

Cable glands forming a part of relevant FLP enclosure, shall be FLP type, tested by CMRI or any other recognized independent testing laboratory and approved by PESO/DGMS or any other statutory authority as applicable. Indigenous FLP glands shall have valid BIS license as per the requirements of statutory authorities. The size of cable glands supplied shall be appropriate to the size of cable so that flame proofness of glands is retained.

Cable glands shall meet the requirements of IP-55 (minimum) for suitable weather protection.

Entry thread of cable gland shall be compatible to the entry thread provided in the equipment (BS, ET, NPT, PG as applicable). If required, suitable reducers/adapters shall be used.

Cable glands shall be manufactured to provide cable sealing of inner and outer sheaths and clamping of armour by special ring.

Cable glands shall be constructed in such a way that same gland can be used for all types of armouring.

Cable glands shall be provided with earth tag, lock nut and IP sealing washer.

Each cable gland shall be provided with PVC shrouds.

4.4 CABLE LUGS

The cable lugs shall be tinned copper or aluminium as specified, tubular, seamless compression type unless specified otherwise.

The type of cable lug shall be as follows.

- Single hole, ring type for power cable and earthing cable terminations.
- Pin type insulated or fork type insulated for small power and control cable terminations

4.5 HV TERMINATION and JOINTING KITS

HV termination kits shall be heat shrinkable, stress control type, indoor or outdoor as specified.

HV termination kits shall be designed to provide a complete moisture seal including the crotch area of 3C cables and complete re-jacketing of individual cores.

HV termination kits shall be provided with insulated right-angle boots (if specified), cable preparation kits, sealing compounds and other accessories required for complete termination of specified HV

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO. MEC/05/E9/TS/11	Page 9 of 14
			REVISION: 0
			EDITION: 3

cables.

HV termination kits shall provide creepage distances for indoor termination and outdoor termination in accordance with IS.

HV termination kits shall have provision for earthing of copper screen (solderless).

HV termination kits which shall be suitable for the cable size mentioned in cable schedule to outdoor equipment, transformer, switchgear, as specified

4.6 CABLE TRAYS

These shall be ladder type trays either prefabricated hot dip galvanized (610 gm per sq. meter) sheet steel trays or site fabricated angle iron painted trays as specified or prefabricated perforated cable trays.

- Pre-fabricated hot dipped galvanized ladder type trays - The cable trays shall comply with the requirements specified in installation details.
- Site fabricated angle iron trays - Angle iron cable trays shall be fabricated from standard rolled angle iron sections of size 75x75x8 mm for runners for supporting spans limited to 3000mm. Cross support shall be 25 x 6 mm MS flat for tray width upto 500 mm and 32 x 6 mm flat for tray of more than 500 mm wide and spacing between two cross supports shall not exceed 250 mm.
- Pre-fabricated hot dipped galvanized perforated type trays - The cable trays shall comply with the requirements specified in installation details

Vertical supports for both the prefabricated and site fabricated type trays shall be fabricated out of ISMC 100 and horizontal supports shall be with 65 x 65 x 6 mm angle iron sections. Outer most tier of all vertical cable trays shall be covered with GI sheet for protection against physical damage to cables.

Cable racks and trays shall be covered by removable top covers on upper most tier allowing adequate ventilation in following cases where:

- Mechanical damage of cables is likely to occur during maintenance in the plant.
- Oil or spillage of chemicals can be expected.
- Protection from exposure to sun is required.

GI cover sheet shall allow adequate ventilation to the cables and shall be in standard length of 3000 mm, flanged on both sides for fixing on cable tray. Covers shall be complete with required GI hardware.

If specified, pre-fabricated ladder type cable trays shall be suitable for concentrated load of one person (75 kg) standing on cable trays.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO. MEC/05/E9/TS/11	Page 10 of 14
			REVISION: 0
			EDITION: 3

4.7 LIGHTING and SMALL POWER DISTRIBUTION BOARDS

Distribution boards shall be made of 1.6mm thick sheet steel and shall be industrial type, dust and vermin proof. In case Distribution boards are located in Hazardous area, they shall be made of Die cast aluminium alloy LM6 and minimum Protection type shall be Ex 'd' suitable for Zone 1 & 2, Gas group IIA/IIB & temperature class T3 unless mentioned elsewhere. Distribution boards shall be indoor/outdoor type as specified. Indoor type distribution boards shall have IP42 degree of protection and shall be suitable for surface or flush mounting on wall surface as specified.

Distribution boards located outdoor shall be Min. IP55 weather protected and shall also have integral canopy for additional weather protection. The canopy shall be made of 2mm thick galvanized sheet steel or FRP where these are separate from the equipment.

Distribution boards shall have TPN incoming feeder and single phase or three phase outgoing feeders as specified. Distribution boards shall be equipped with phase and neutral busbars of required current carrying capacity. The outgoing feeders shall be provided with single pole miniature circuit breakers (MCBs) for safe areas and double pole MCBs for hazardous areas for single phase distribution and 4 pole MCCB/MCBs for 3-phase distribution. The incomer shall be with RCCB/RCBO unit for lighting and small power distribution and switch fuse unit for other auxiliary distribution unless otherwise specified.

Miniature circuit breakers shall be mounted in such a way that the operating levers projects outside the front bakelite cover plates for ease of operation. A hinged door to cover the operating knobs shall be provided. In addition, a circuit diagram indicating incomer details and outgoing details viz. circuit number, circuit rating, load connected and details of the load shall be pasted inside the distribution boards. Also a laminated copy of the diagram shall be provided inside the distribution boards in a suitably designed pocket.

Two external earthing studs for connection to the plant earthing grid shall be provided on the panel. Further, the distribution boards shall be provided with an earth bus bar with terminal studs for connection to the third core of each outgoing circuit. Each circuit phase and neutral shall be given ferrule numbers. Complete wiring inside the panel, shall be neatly bunched with PVC tape and button. Sufficient terminals shall be provided in the terminal block so as to ensure that not more than one wire (core) is connected to a terminal.

The distribution board shall have knock out holes or removable gland plate for the entry of incoming and outgoing conduits or cables.

All MCBs shall be of M9 category as per IS 8828 and sensitivity of ELCBs shall be 100 mA unless otherwise specified.

All switches or fuse switches shall be air break type provided with quick make/break manual operating mechanism.

Fuses shall be non-deteriorating HRC cartridge link type. Power fuses shall be pressure fitted type and shall preferably have ribs on the contact blades to ensure good line contact.

AC voltmeters and ammeters shall be provided in incoming feeder of distribution boards if specified. All AC ammeters and voltmeters shall be of digital type with accuracy class of 1.5 as per IS.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO. MEC/05/E9/TS/11	Page 11 of 14
			REVISION: 0
			EDITION: 3

Wherever the size of incoming cable to distribution boards is more than 35 sqmm a suitable cable adapter box shall be provided and attached to the distribution boards. The incoming cable leads shall be connected to terminal block (bolted type terminals) of required size. This terminal block shall be connected to TPN incomer unit through separate PVC insulated copper conductor wires/bus bars. Sufficient space shall be provided (200 to 250mm) between gland plate and the bottom of terminal block for easy termination

4.8 LIGHTING FIXTURES

Lighting fixtures shall be manufactured in accordance with IS 2418-1, IS 3323, IS 5081, IS 13021, IS 16101, IS 16102, IS 16103, IS 16104, IS 16107, IS/IEC 60529 and IS/IEC 60079.

Outdoor lighting fixtures shall have minimum IP55 degree of protection. Indoor lighting fixtures shall have minimum IP20 degree of protection.

Lighting Fixtures shall be suitable for termination of required cable sizes as indicated in lighting and small power layouts and installation details.

Lighting fixtures paint shade shall be as per Supplier's standard.

High energy efficient LED lighting fixtures shall be used preferably with aluminium housing, superior light output and integral driver.

Hazardous area lighting fixtures shall be with LED lamp with enclosures shall be made of Die cast aluminium alloy LM6 and minimum Protection type shall be Ex 'd' suitable for Zone 1 & 2, Gas group IIA/IIB & temperature class T3 unless mentioned elsewhere.

- Battery Room lighting fixtures shall be suitable for Zone 1 & 2, Gas group IIC & temperature class T3 unless mentioned elsewhere.
- All lighting fixtures shall be of high-power factor type i.e., at least 0.9 or more. Lighting fixtures have shall be energy efficient type with BEE level higher than 3 Star.
- All critical area lighting fixtures shall have inbuilt battery back-up of 30 minutes.

4.9 SMALL POWER RECEPTACLES

Small Power receptacles shall be manufactured in accordance with IS 1293, IS/IEC 60309, IS/IEC 60079.

Each receptacle shall consist of but not limited to following items

Type	:	3 Wire (1PH+N+G) with switch
Enclosure	:	Die cast aluminium alloy LM6 for hazardous area Fibreglass Reinforced Polyester (FRP) for safe industrial area ABS plastic for Safe non-industrial area.
Enclosure IP rating	:	Min. IP 55 for Outdoor Area / Min. IP 42 for Indoor Area.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO.	Page 12 of 14
		MEC/05/E9/TS/11	REVISION: 0
			EDITION: 3

Type of Protection : Minimum Ex 'd' type for hazardous area
Gasket : Neoprene
Terminals : Copper suitable for termination of specified cable/wire size, numbers as specified
Cable entries : As specified at bottom
Hardware : Stainless steel
Canopy : If specified for outdoor installation

Fully wired from circuit elements to pre-numbered terminals for Hazardous and Safe Industrial area.
Accessories -Internal Grounding Terminal

4.10 SWITCHES

Switches shall be manufactured in accordance with IS 3854, IS/IEC 60079. Each switch shall consist of but not limited to following items:

Type	:	1 pole to 4 pole as specified
Enclosure	:	Die cast aluminium alloy LM6 for hazardous area Fibreglass Reinforced Polyester (FRP) for safe area ABS plastic for Safe non-industrial area.
Enclosure IP rating	:	Min. IP 55 for Outdoor Area / Min. IP 42 for Indoor Area.
Type of Protection	:	Minimum Ex 'd' type for hazardous area
Gasket	:	Neoprene
Terminals	:	Copper suitable for termination of specified cable size, numbers as specified
Cable entries	:	As specified at bottom
Hardware	:	Stainless steel
Canopy	:	If specified for outdoor installation

Fully wired from circuit elements to pre-numbered terminals
Accessories - Internal Grounding Terminal

4.11 JUNCTION BOXES

Junction Box shall be manufactured in accordance with IS 8224, IS/IEC 60079. Each junction box shall consist of but not limited to following items:

Type : 2 way to 6 way as specified
Enclosure : Die cast aluminium alloy LM6 for hazardous area
Fibreglass Reinforced Polyester (FRP) for safe area
Enclosure IP rating : Min. IP 55 for Outdoor Area / Min. IP 42 for Indoor Area
Type of Protection : Minimum Ex 'd' type for hazardous area
Gasket : Neoprene
Terminals : Copper suitable for termination of specified cable size, numbers as

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO.	Page 13 of 14
		MEC/05/E9/TS/11	REVISION: 0
			EDITION: 3

Cable entries : specified
Hardware : As specified at sides / bottom / top depending on number of ways
Canopy : Stainless steel
: If specified for outdoor installation

Fully wired from circuit elements to pre-numbered terminals
Accessories - Internal Grounding Terminal

4.12 LIGHTING POLES

All Lighting poles shall be made of galvanized steel, designed for wind parameters as per IS 875 (part 3) and loading of specified lighting fixtures and shall comply with relevant standards.

The flood lighting poles wherever specified shall be provided with suitable mounting brackets with hardware for specified number of flood lighting fixtures, one hand hole at approx. 1m height having removable bolted cover, internal and external earthing studs.

The street lighting poles wherever specified shall be provided with suitable mounting brackets with hardware for specified number of street lighting fixtures, one hand hole at approx. 1m height having removable bolted cover, internal and external earthing studs.

The flood lighting, street lighting and ground poles shall be provided with suitable base plate and fixing material for fixing on concrete foundation. The fixing details and foundation loading details shall be provided.

4.13 Miscellaneous and Safety Equipment

Following equipment shall be supplied in substation, as per Indian Electricity Rules:

- Fire buckets filled with clean dry sand and ready for immediate use for extinguishing fires suitably mounted on G.I. stand and fire extinguisher (carbon dioxide, dry chemical extinguisher etc.) suitable for dealing with electric fires shall be conspicuously marked and kept.
- First aid boxes containing ointments and medicines for immediate treatment of injuries (As prescribed by Indian Red Cross Society or equivalent).
- Instructions of restoration of persons suffering from electric shock in English, Hindi and local language of the district shall be affixed in a conspicuous place.
- Danger boards (H.V., M.V.) shall be provided on transformer gate, switchboards, entrance to switchgear room and at other places as required by Purchaser.
- Safety insulation mats for operation and maintenance of electrical equipment.
- Ladders for maintenance of electrical equipment.

5.0 INSPECTION AND TESTING

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	ELECTRICAL BULK MATERIAL	DOCUMENT NO. MEC/05/E9/TS/11	Page 14 of 14
			REVISION: 0
			EDITION: 3

Inspection and testing requirements shall be in accordance with the respective equipment specification, applicable codes and standards indicated and also Vendor standard inspection and testing requirements. Purchaser reserves the right to witness all tests with sufficient advance notice from Vendor. The test reports shall be approved by Purchaser before dispatch.

Purchaser also reserves the right of inspection of any electrical works equipment / material during fabrication. Vendor shall furnish all necessary information concerning the supply to Purchaser.

All routine and acceptance tests shall be carried out at Vendor's / Manufacturer's work under his care and expense.

Type and special tests shall be carried out at Vendor's work or independent approved testing laboratory under his care and expense. Type and special test certificate of identical rating of equipment may be acceptable in lieu of actual type and special tests if approved by Purchaser.

All testing instruments shall be calibrated with proper validity and have traceability to National Standards.

6.0 PACKING AND DISPATCH

All the equipment shall be divided into several shipping sections for protection and ease of handling during transportation. The equipment shall be properly packed for selected mode of transportation i.e. by ship/rail or trailer. The panels shall be wrapped in polyethylene sheets before being placed in wooden crates /cases to prevent damage to the finish. Crates /cases shall have skid bottoms for handling. Special precaution notations such as Fragile, This side up, center of gravity, weight, Purchaser's particulars, Purchase number etc. shall be clearly marked on the package together with other details as per purchase order.

The equipment may be stored outdoors for long periods before installation. The packing should be suitable for outdoor storage in areas with heavy rains and high ambient temperature unless otherwise agreed.

REV: 0

EDITION: 3

TECHNICAL SPECIFICATION
FOR
HIGH MAST
DOCUMENT No. : MEC/05/E9/TS/12

Prepared & Issued by



ELECTRICAL SECTION
(Oil & Gas SBU)
MECON LIMITED

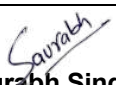
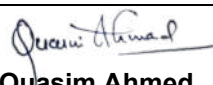
(A Govt. of India Undertaking)
13th & 15th Floor, North Tower, SCOPE MINAR,
Laxmi Nagar District Centre,
Delhi-110092 (India)

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	HIGH MAST	DOCUMENT NO. MEC/05/E9/TS/12	Page 2 of 10
			REVISION: 0
			EDITION: 3

INDEX

Sl. No.	Description	Page No
01.00	INTENT	4
02.00	CODES AND STANDARDS	4
03.00	GENERAL REQUIREMENTS	5
04.00	DESIGN AND CONSTRUCTION REQUIREMENTS	5
05.00	DRAWINGS AND DOCUMENTS	9
06.00	INSPECTION	9
07.00	PACKING AND DISPATCH	9

Rev	Date	Prepared by	Checked by	Approved by
0	11.07.2025	 Saurabh Singh	 Quasim Ahmed	Pankaj Shrivastava

© Copyright MECON Limited – All rights reserved.
 THIS DOCUMENT IS THE SOLE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED
 HEREIN. THIS IS NOT TO BE COPIED OR USED FOR ANY OTHER PROJECTS UNLESS EXPLICITLY PERMITTED BY
 MECON.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	HIGH MAST	DOCUMENT NO. MEC/05/E9/TS/12	Page 3 of 10
			REVISION: 0
			EDITION: 3

AMENDMENT STATUS

(OLD NUMBER OF STANDARD: MEC/TS/05/E9/12)

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Document Number replaced with New number as MEC/05/E9/TS/12	All	Rev 0/ Ed 3	11.07.2025		
2	Section re-name as Electrical Section (Oil & Gas SBU) Delhi	All	Rev 0/ Ed 3	11.07.2025		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	HIGH MAST	DOCUMENT NO.	Page 4 of 10
		MEC/05/E9/TS/12	REVISION: 0
			EDITION: 3

1.0 INTENT

The intent of this standard specification is to define the general requirements for design, manufacture, assembly and testing at manufacturer's works, packing, transportation and receipt at site with all materials and accessories of High Mast.

2.0 CODES AND STANDARDS

The work shall be carried out in the best workman like manner in conformity with this specification, the relevant specifications, codes of practice of Indian Standards Institution, approved drawings and instructions of Engineer-in-Charge or his authorized representative issued from time to time. In case of any conflict between the standards, the instruction of Engineer-in-Charge shall be binding.

The High mast shall comply in design, material, testing and performance according to relevant IS/IEC codes and standards. The latest revision of the publication referred to shall apply.

1. High mast Shaft – TR. No. - 7 – High Masts for Lighting and CCTV (2000 edition) of ILE, U.K, SABS 0225:1991
2. Wind Loading – IS 875 Part – 3, 1987.
3. High Tensile Steel Sheets – BS EN 10025:2004 grade S355 J0
4. Mild Steel – IS 2062
5. Galvanization – BS EN ISO 1461
6. Stainless steel Wire rope – IS 3459 / 2266
7. Trailing Cable – IS 9968 Part – 1
8. Motor – IS 325

The High mast & its accessories shall conform to the provisions of Indian Electricity Rules and other statutory regulations as applicable.

Wherever the requirements in this specification are in conflict with any of the above Standards, the requirements under this specification shall be binding.

In case of any contradiction between various referred standards/ specifications/ data sheet and statutory regulations the following order of priority shall govern. However, stringent of the below shall be followed

- Statutory regulations.
- Schedule of Rate
- Scope of Work/ Job specification.
- Design Basis.
- Data sheets.
- Standard Specification.
- Codes and standards.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	HIGH MAST	DOCUMENT NO.	Page 5 of 10
		MEC/05/E9/TS/12	REVISION: 0
			EDITION: 3

3.0 GENERAL REQUIREMENTS

The offered equipment shall be brand new with state of art technology and proven field track record.

Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment for at least for 20 years from the date of supply.

Vendor shall give a notice for at least one year to the Purchaser of equipment before phasing out the product/spares to enable the Purchaser for placement of order for spares and services.

SITE CONDITIONS

The High Mast shall be suitable for installation and satisfactory operation in outdoor installation as specified in the data sheet with humid and corrosive atmosphere.

The High Mast shall be designed to operate under site conditions as specified in the data sheet. If not specifically mentioned therein, a design ambient temperature of 50°C for outdoor and an altitude not exceeding 1000metres above mean sea level shall be considered.

4.0 DESIGN AND CONSTRUCTION REQUIREMENTS

Construction

The mast shall be manufactured from mild steel plate, cut and folded to form continuously tapered min. 20 sided polygonal profile. Each mast section shall not have any circumferential welding joint.

Sections should be fitted together on site, telescopically, in a manner that does not require additional welding. Steel (BSEN 10025, Grade-S-355) confirming with BS-4360 shall be used for the construction of the mast and welding processes shall confirm to BS-5135 and mast shall be hot dip galvanized internally & externally confirming to BS-729 / IS-4759,1984. Thickness of each section shall be as per the design calculation however any section shall not be less than 4.0mm.

There shall be only one longitudinal seam weld per section. Sections with more than one weld, circumferential or longitudinal, shall not be accepted. At site the sections shall be joined together by slip-stressed-fit method. No site welding or bolted joint shall be done on the mast. The minimum overlap distance shall be 1.5 times the diameter at penetration. The minimum top diameter shall be 150 mm. Bottom diameter and plate thickness shall be as per the structural requirements. Detailed design calculation of the mast shall be submitted for verification.

For the environmental protection of the mast, the entire fabricated mast shall be hot dip galvanised, internally and externally, having a uniform average thickness of 85 microns for plates with more than 5 mm thickness and 70 microns for 5 mm and less. Galvanising shall be done in single dipping method for better adhesion and life.

The mast structure shall be designed for an assumed maximum reaction arising from the maximum

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	HIGH MAST	DOCUMENT NO.	Page 6 of 10
		MEC/05/E9/TS/12	REVISION: 0
			EDITION: 3

wind speed (180 km per hour) and measured at a height of 10 mtrs above ground level. The design life of the mast shall be minimum 25 years. For design K1 shall be considered as 0.9 and K2 as terrain category 2 (1.07 for 20mtr and 1.12 for 30mtr) or as per the datasheet / site requirement, the more stringent shall be followed. Wind excited oscillation shall be damped by the method of constructions and adequate allowance made for the related stresses.

Base flange

The type of foundation for the proposed high mast shall conform to civil / structural scope of work / specifications.

The base flange shall be manufactured from steel plate free from laminations or incursions. The base shaft should penetrate the full depth of the base plate and should be welded both above and below. Gussets shall be located between each hole position, for additional strength.

Base compartment

An access opening of the base compartment with door provided and should be reinforced to maintain the strength of the mast. The opening shall be such as to permit clear access to equipment like winches, cable plug and socket, etc. The door should be weatherproof type with suitable locking arrangement.

The door opening shall be complete with a close fitting, vandal resistant, weatherproof door, provided with a heavy-duty double internal lock with special paddle key.

Size of door opening shall not be more than 1200 x 250 mm to avoid buckling of the mast section under heavy wind conditions.

Earthing terminal & earthing

Stainless Steel hexagonal head bolt, complete with saddle bracket should be located in readily accessible position in the base compartment to be used for earthing terminal. Proper double earthing shall be provided to the tower. Feeder pillar shall be independently double earthed.

Head frame

The head frame which is to be designed as a capping unit of the mast shall be of welded steel construction galvanised both internally and externally after assembly. The top pulley shall be of appropriate diameter, large enough to accommodate the stainless steel wire ropes and the multi-core electric cable. The pulley block shall be made of non-corrodable material, and shall be of die cast Aluminium Alloy (LM-6). Pulley made of synthetic materials such as Plastic or PVC is not acceptable. Self-lubricating bearings and stainless-steel shaft shall be provided to facilitate smooth and maintenance free operation for a long period. The pulley assembly shall be fully protected by a canopy galvanised internally and externally.

Close fitting guides and sleeves shall be provided to ensure that the ropes and cables do not dislodged from their respective positions in the grooves. The head frame shall be provided with guides and stops with PVC buffer for docking the lantern carriage.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	HIGH MAST	DOCUMENT NO.	Page 7 of 10
		MEC/05/E9/TS/12	REVISION: 0
			EDITION: 3

The whole head frame assembly shall be covered to the frame by stainless steel bolts.

Lantern Carriage

Fabrication

The lantern carriage shall be of double ring and of mild steel construction and shall be hot dip galvanized after assembly. The carriage shall be in the form of a double ring split on one diameter or in two halves and joined by bolt flanges with standard steel bolt enabling it to be assembled or removed from the shaft after erection. The inner lining of the carriage shall be provided with protective PVC arrangement, so that no damage is caused to the surface of the mast during the raising and lowering operation of the carriage

Junction Box

Junction boxes suitably located and housing connections to the lantern shall be provided to meet the design requirement to feed the lightings. The junction box shall also have provision for connection of the flexible mast electric cable. The junction box shall be constructed so as to insure complete protection against weather.

The aviation light fittings will also be fed through the junction box.

Wiring duct

Suitable wiring duct shall be provided which should carry electric wiring to the light fittings.

Electric cables

High mast shall be provided with flexible, multi core, copper conductor power cable. The cable shall be suitably sized to ensure proper flow of current with voltage drop within permissible limit (described elsewhere in the tender document).

Electrical disconnect

An electrical disconnect shall be provided at the base of the mast, comprising socket with coupling ring and threaded plug. High mast for hazardous location shall have flame proof male-female socket. It shall be possible that for lowering the lantern cartridge, the electrical cable is disconnected at the base and connected to the test lead so that it is free to travel within the mast and power supply can be maintained.

Winches

The mast shall be provided with double drum winch. The winch shall be capable of handling maximum anticipated load with sufficient safety margin. Suitable reduction gear box shall be provided which shall be filled with lubricant in the factory and should required no further attention at site. The gears shall be suitable reduction ratio and provision shall be made both for manual as well as power drive.

The drum shall be fabricated from steel. To ensure correct rope stacking, a minimum of one full layer

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	HIGH MAST	DOCUMENT NO.	Page 8 of 10
		MEC/05/E9/TS/12	REVISION: 0
			EDITION: 3

of rope shall remain on the drum, after the lantern carriage has been lowered to its lowest position. The double drum winch shall use an arrangement of two independent ropes and each rope shall have one end attached to the lantern carriage and the other end clamped to the winch drum. The control arrangement shall allow the two sets of gears and shafts for normal operating duty of raising and lowering. Additionally, a separate manual only function shall permit the lower drum to be rotated independently for leveling the lantern on both gear shafts and automatic gravity latches, which separately lock each drive shaft.

Stainless steel wire rope

All wire ropes shall be made from stainless steel confirming to IS-2365, 1963 & IS-3457, 1977 having a tensile strength of 165 Kgf / mm. The rope shall have a construction of 7/19 of steel core, to combine corrosion resistance with flexibility. The rope of 6 mm or more diameter shall be provided to cater to maximum safe working load at adequate safety factor. There shall not be any intermediate joints on the ropes. It shall be continuous from winch to head frame.

No intermediate joints/terminations, either bolted or else, shall be provided on the wire ropes between winch and lantern carriage.

Essential tools for operation

A) Power drive

The power drive shall be connected to the winch via a matching coupler. To protect the hoist rope system against overload, the coupler shall incorporate a torque limiting clutch, pre-set at the factory.

B) Test lead

Flexible multi core test lead shall be identical to the electric cable specified earlier. The conductor core shall be insulated with ethylene propylene rubber and the complete cable core shall be matching with the main electric cable. Each test lead shall be provided with locking type male plug at one end and female plug at the other end.

C) Winch winding and adjusting handle

For manual operation of the winch drum and for monitor adjustment of the lantern carriage, suitable handless shall be supplied.

D) Trailing cable

EPR insulated PCP sheathed copper cable of size min. 2.5 sq mm cable shall be provided. No of circuit shall be as per datasheet/SOR.

E) Feeder Pillar

Weather proof Feeder pillar shall be of CRCA sheet of thickness 1.6mm for non-load and 2.0mm for load bearing. Cable entry shall be from bottom and gland plate shall be 3.00 mm thick. Panel shall be suitable for IP-65.

For hazardous area flame proof Feeder pillar shall be provided made of LM6 Aluminium body as per the vendor design. CCOR/ PESO and CIMFR certificate shall be submitted for the feeder pillar. Make of panel shall be flame proof DB/ JB/ control station mentioned in the vendor list attached in tender

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	HIGH MAST	DOCUMENT NO.	Page 9 of 10
		MEC/05/E9/TS/12	REVISION: 0
			EDITION: 3

document.

In control schematic MCCB (Thermal magnetic release) shall be provided as isolator with ON/OFF/Trip indication, Interlock shall be provided between operation of fixture and motor. Motor shall be protected for overload by using suitable relay. Electrical interlock for upward and downward movement shall be provided. Auto-manual selector switch shall also be envisaged with electronic timer for operation in auto mode. Two nos. earthing stud shall be provided at FLP FP for termination of earth strip.

Lightning protection

Copper Lightning finial 1.2 mtr long shall be provided to the for lightening protection of high mast. It shall be bolted solidly to the head frame to get a direct conducting path to the earth through the mast. All material supply / erection for lightning protection shall be in contractor's scope.

Aviation lights

Aviation lights (twin type) shall be provided with suitable wiring.

5.0 DRAWINGS & DOCUMENTS

The offered high mast shall be a proven design. The design drawing and illumination distribution diagram shall be submitted to MECON for approval along with manufacturer's test certificates of following:

- Steel plates used for the fabrication of mast
- Steel wire rope
- Winch
- Foundation design calculation
- Calculation Withstanding of High mast with highest wind pressure

6.0 INSPECTION

Inspection and testing of equipment shall be carried out by the owner/ consultant at the works of the contractor on final product to ensure conformity of the same with the acceptable criteria of technical specification, approval draws. and reference national/ international standards.

The contractor shall submit Quality Assurance Plan (QAP) for respective equipment within 3 weeks of award of contract.

QAP shall be prepared and furnished by the contractor in MECON Form No. 11.20(4.4) F-10 along with their internal in process quality checks.

Routine test and type test certificate shall be furnished for review.

Acceptance test shall be witnessed by owner/consultant.

7.0 PACKING AND DISPATCH

All the equipment shall be divided into multiple sections for protection and ease of handling during transportation. The equipment shall be properly packed for the selected mode of transportation, i.e., by ship, rail or trailer. The equipment shall be wrapped in polythene sheets before being placed in crates/ cases to prevent damage to finish. The crates / cases shall have skid bottoms for handling.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	HIGH MAST	DOCUMENT NO. MEC/05/E9/TS/12	Page 10 of 10
			REVISION: 0
			EDITION: 3

Special notations such as 'Fragile', 'This side up', 'Centre of gravity', 'Weight', 'volume' 'Purchaser's particulars', 'P.O. no.' etc. shall be clearly and indelibly marked on the packages together with other details as per purchase order.

The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains and high ambient temperature unless otherwise agreed. In order to prevent movement of equipment/components within the crates, proper packing supports shall be provided.

REV: 0

EDITION: 3

**TECHNICAL SPECIFICATION
FOR
EARTHING and LIGHTNING PROTECTION**

DOCUMENT No. : MEC/05/E9/TS/13

Prepared & Issued by



**ELECTRICAL SECTION
(Oil & Gas SBU)
MECON LIMITED**

(A Govt. of India Undertaking)
13th & 15th Floor, North Tower, SCOPE MINAR,
Laxmi Nagar District Centre,
Delhi-110092 (India)

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 2 of 18
			REVISION: 0
			EDITION: 3

INDEX

Sl. No.	Description	Page No
01.00	INTENT	4
02.00	CODES AND STANDARDS	4
03.00	EARTHING SYSTEM	5
04.00	LIGHTNING PROTECTION SYSTEM	11
09.00	DRAWINGS AND DOCUMENTS	18

Rev	Date	Prepared by	Checked by	Approved by
0	11.07.2025	 Aashish Moyal	 Saurabh Singh	Pankaj Shrivastava

© Copyright MECON Limited – All rights reserved.
 THIS DOCUMENT IS THE SOLE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED
 HEREIN. THIS IS NOT TO BE COPIED OR USED FOR ANY OTHER PROJECTS UNLESS EXPLICITLY PERMITTED BY
 MECON.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 3 of 18
			REVISION: 0
			EDITION: 3

AMENDMENT STATUS

(OLD NUMBER OF STANDARD: MEC/TS/05/E9/13)

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Document Number replaced with New number as MEC/05/E9/TS/13	All	Rev 0/ Ed 3	11.07.2025		
2	Section re-name as Electrical Section (Oil & Gas SBU) Delhi	All	Rev 0/ Ed 3	11.07.2025		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 4 of 18
			REVISION: 0
			EDITION: 3

1.0 INTENT

The intent of this standard specification is to define the general requirements for design, manufacture, assembly and testing at manufacturer's works, packing, transportation and receipt at site with all materials and accessories of Earthing and Lightning Protection.

2.0 CODES AND STANDARDS

The work shall be carried out in the best workmanlike manner in conformity with this specification, the relevant specifications/codes of practice of Indian Standard Institution, approved drawings and instructions of the Engineer-in-Charge or his authorized representative issued from time to time. In case of any conflict between the standards, the instructions of Engineer-in-Charge shall be binding.

IEC 62305	Protection Against Lightning
IS 2309	Protection of building and allied structure against lightning
IS 3043	Code of practice for earthing
NBC 2016	National Building Code
NEC 2023	National Electric Code
OISD 180	Lighting Protection

Wherever the requirements in this specification are in conflict with any of the above Standards, the requirements under this specification shall be binding.

In case any contradiction between various referred standards/specification/data sheets and statutory regulation etc the following order of priority shall be govern -

- Statutory regulations.
- Schedule of Rate
- Scope of Work/ Job specification.
- Design Basis.
- Data sheets.
- Standard Specification.
- Codes and standards.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 5 of 18
			REVISION: 0
			EDITION: 3

3.0 EARTHING SYSTEM

GENERAL

Entire system shall be earthed in accordance with the provisions of the relevant IEC recommendations/ IS code of practice IS 3043 and Indian Electricity Rules, so that the values of the step and contact potentials in case of faults are kept within safe permissible limits. Parts of all electrical equipment and machinery not intended to be alive shall have two separate and distinct earth connections each to conform to the stipulation of the Indian Electricity Rules and apparatus rated 240V and below may have single earth connections.

The stations shall be equipped with an equipotential meshed grounding network. All exposed conductive parts or elements of the station systems will be connected to this network. The earthing systems of the various stations are part of the protection systems for electrical power supply, instrumentation, control and supervisory system. The earthing system consists of the main grounding grid, the grounding rods, the building foundation grounding and the equipment grounding.

Supply of all other erection/consumable required to complete the installation shall be the responsibility of the contractor. All hardware used for earthing shall be hot dip galvanized.

Any other items not specifically mentioned here but necessary for completeness of job shall be in the scope of contractor & shall be supplied by contractor without any extra cost.

All shops and buildings as well as the electrical sub-stations and electrical rooms shall be provided with a ring main earthing system each. Individual ring main earthing systems shall again be interconnected as a network.

For stations, which are to be extended, the existing earthing system shall be considered. The layout of new earthing system shall match to the existing installations. The new and the existing grounding network must be interconnected at two (2) locations, at least.

The ring earthing system around each building shall be laid at a distance of approximately 1.5 m from the building and at a depth of approximately 0.8m. The ring shall be bonded at intervals to the building steel structures, reinforcement of building columns and also to pipes, wherever they are crossing. The earth ring shall further be connected at intervals to deep earthing electrodes to achieve a combined earth resistance of less than one ohm.

The grounding network system will be installed in different locations have different soil characteristics according to the location of the stations. Before design and installation of the grounding network the actual soil conditions in the station areas must be determined by adequate soil resistance measurements by the contractor & submit for review & approval.

Station earthing should have low earth resistance, low touch & step potential.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 6 of 18
			REVISION: 0
			EDITION: 3

EARTHING CONDUCTOR

The main grid conductor shall be hot dip galvanized G.I. Flat or PVC insulated copper conductor, Size & type of conductor shall be as marked on the drawings/as mentioned in the scope of work/design basis. Thickness of hot dip galvanizing shall not be less than 80 microns.

DESIGN REQUIREMENT

The earth resistance of the overall interconnected station grounding network shall not exceed 1 Ω .

For the purpose of dimensioning the earthing lines/conductors, the duration of the earth fault current shall be taken as 0.3 seconds.

All exposed metal part such as HT/LT switchgear, DP/FP structure, distribution board, metal clad switchgear enclosure, lamp brackets, lamp holder, plug sockets, lighting poles, junction boxes, high mast etc shall be properly earthed by connecting these to the earth electrode by means of GI wire/Flat or PVC insulated Cu conductor of approved size to pass the fault current safely to earth in case of any fault.

For different floors in a building, localized ground mats shall be formed and connected to the ground earthing ring through vertical risers. The earthing mat shall be common to both power and lighting installations.

For the UPS, the SCADA and telecommunication systems with their equipment a separate grounding network with sufficient cross-section to avoid interference shall be installed. This grounding network shall be connected to the common station grounding network on one (1) separable and indicated connection point, within the electrical building or equipment container/enclosure.

Before design and installation of the grounding network the actual soil conditions in the station areas must be determined by adequate soil resistance measurements.

The required conductor spacing, the total length of the grounding grid and the required grounding material cross-section shall be calculated under consideration of the maximum earth fault current, to maintain touch and step voltages within reasonable limits. The impedance of the fault current path and protective devices shall be chosen that the faulted circuit will be disconnected from the supply within the required time. A respective grounding calculation with report shall be performed for each station and is to be submitted to the Client/MECON for approval.

Multiple connections of grounding conductors shall only be carried out above ground. For these connections the respective grounding bars are to be installed. Extensions of single grounding conductors can be permitted below ground under use of compression connectors or welding connections, with repair painting and coating of the connection point.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO.	Page 7 of 18
		MEC/05/E9/TS/13	REVISION: 0
			EDITION: 3

All connections of conductors on equipment shall be performed with pressure type lugs or connectors and threaded bolts, screws, spring-washers and washers. Special care must be taken to avoid the arising of a chemical element. Connections between bare copper and iron parts must be protected in a special manner and shall only be executed on above-ground connection points (grounding bars) or inside of pits.

The power supply cables (LT) from the sub-station and the distribution cables to individual motors shall have 4/3.5 cores. LT power supply cables shall have four cores and the fourth core shall have cross-sectional area of 50% of the other cores generally. The fourth core of the main supply lines shall be connected to the solidly earthed neutral bar in the substation switchgear as well as at the earth bars in MCC/distribution boards.

Separate electronic earthing system shall be provided for all electronic equipment like PLCs, weighing panel, computer etc.

EARTHING NETWORK

The earthing installation shall be done in accordance with the earthing drawings and the standard drawings of reference attached with this document. The entire earthing system shall fully comply with the Indian Electricity Act and Rules. The contractor shall carry out any changes desired by the Electrical Inspector or the owner, in order to make the installation conform to the Indian Electricity Rules at no extra cost. The exact location on the equipment shall be determined in field, in consultation with the Engineer-in-Charge or his authorized representative. Any changes in the methods, routing, size of conductors etc shall be subject to approval of the Owner/ Engineer-in-Charge before execution.

Excavation and refilling of earth, necessary for laying underground earth bus loops shall be the responsibility of the contractor.

The main earth grid shall be laid at a depth of minimum 800 mm below grade level. Wherever RCC cable trenches are available, the earth lead shall be laid in the trenches and shall be firmly cleared to the walls of concrete lined trenches. The earthing strip shall be protected against mechanical damage.

A common grounding system network (Main earthing grid) will be made underground by using 50 mm x 6 mm/ 75x10 mm GI earthing strip connected to earth electrodes in loop-in & loop-out system and connecting the electrical equipment to network. In RCC cable trench one number earth strip of size 50 x 6 mm shall be run throughout the length of the trench.

Earthing system around each building shall be laid at distance approximately 1.5 meter from the building & at a depth of approximately 0.8m. The ring shall be bonded at intervals to the building steel structure, reinforcement of building columns & pipes wherever they are crossing. The earth ring shall further be connected to deep earthing electrodes to achieve a combined earth resistance of less than One or Two ohm as specified earlier.

In process unit areas, the earthing cable shall be run along cable trays wherever specified in the layout

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 8 of 18
			REVISION: 0
			EDITION: 3

drawings. The earthing cable shall be suitably cleated and electrically bonded to the cable tray at regular intervals.

Joints and tapping in the main earth loop shall be made in such a way that reliable and good electrical connections are permanently ensured. All joints below ground shall be welded and suitably protected by giving two coats of bitumen and covering with Hessian tape. All joints above ground shall be by means of connectors/ lugs as far as practicable. Tee connectors shall be used for tapping, earth leads from the main earth loop wherever it is installed above ground. Earthing plates shall be provided for earthing of two or more equipment at a place from earth grid. Where aluminium cable risers are to be connected to the underground GI earth bus, the aluminium cable riser shall be taken to the nearest earth pit and terminated through a bolted joint. If this is not practicable, then G.I. risers shall be brought above grade and a bolted joint shall be made between this GI riser and the aluminium cable termination. This G.I. Riser shall be protected applying two coats of bituminous paint/bitumen on the exposed portion.

Conduits in which cables have been installed shall be effectively bonded and earthed. Cable armours shall be earthed at both ends.

INSTALLATION OF EARTH ELECTRODES

Earth pipe electrodes shall be installed as shown in the earthing layout drawings shall be in accordance with the standard drawings, specification and IS: 3043. Their location shall be marked to enable accurate location by permanent markers.

All earth electrodes shall preferably be driven to sufficient depth to reach permanently moist soil. Electrodes shall preferably be situated in a soil which has a fine texture and which is packed by watering and ramming as tightly as possible. Wherever practicable, the soil shall be dug up, all lumps broken and stones removed from the immediate vicinity of the electrodes.

All earth electrodes shall be tested for earth resistance by means of standard earth test meter. The tests shall take place in dry months. If necessary, a number of electrodes shall be connected in parallel to reduce the earth resistance, shall be in the scope of contractor. The distance between two electrodes shall not be less than twice the length of electrode.

The electrodes shall have a clean surface, not covered by paint, enamel, grease or other materials of poor conductivity.

Tentative no of earth pits shown in drawing are only for reference to the contractor. The exact location and number of earth electrodes required at each location shall be determined in the field in consultation with the owner/Engineer-in- Charge, depending on the soil strata and resistivity, to meet the ohmic values prescribed in this specification. The contractor shall design the earthing system accordingly & submit for review & approval.

Earth Electrodes shall be located avoiding interference with road, building foundation, column etc.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 9 of 18
			REVISION: 0
			EDITION: 3

Individual earth electrode shall be provided for each lightning arrestor and lightning mast. The electrodes shall be so placed that all lightning protective earths may be brought to earth electrode by a short and straight a path as possible to minimize surge impedance.

The disconnect facility shall be provided for the individual earth pits to check their earth resistance periodically. All the earth electrodes shall be suitably numbered and this should be indicated in as built drawings.

CONNECTION

All electrical equipment is to be doubly earthed by connecting two points on equipment to a main earthing ring. The earthing ring will be connected via links to several earth electrodes. The earth grid formed shall be a closed loop as shown in the drawing with earth electrodes connected to the grid with double strip connection. The cable armour will be earthed through the cable glands.

In hazardous areas all major process equipment shall be connected to the earthing ring by means of anti-loosening connections and all pipelines will be bonded and earthed on entering the battery limit of the process area.

The following shall be earthed.

1. Transformer neutrals & body
2. Double Pole & Four Pole structures
3. CT/PT neutrals
4. Neutral Grounding Resistors
5. Lightning Arrestors
6. All switchgear and their earth buses, bus duct
7. Motor Frames
8. Bud ducts
9. Cable trays
10. UPS, Telecommunication system, RTU's, Control panels & other instruments etc.
11. Non-current carrying metallic parts of electrical equipment such as switchgear, switch racks, panel boards, motor control centres, lighting, power and instrument panels, push button stations, cable trays, pipes, conduits, terminal boxes, etc.
12. All fences, gates/enclosures, housing electrical equipment
13. All steel structures, rails etc. including bonding between sections
14. Shield Wire
15. Structural steel and Columns
16. Loading racks
17. Lighting Mast, poles
18. Lightning rods (Mast)

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 10 of 18
			REVISION: 0
			EDITION: 3

19. Tanks and vessels containing flammable materials.
20. Rotating parts of the agitators, pumps etc. through spring loaded brushes of suitable grade.
21. Earth continuity conductor shall be provided for flanges.

Conductor size for connection to various equipment shall be as indicated on Earthing Layout Drawings/ shall be calculated by Bidder during the detail engineering.

Two distinct conductors directly connected to independent earth electrodes, which in turn shall be connected to the earth and earth system. The earth connection shall be properly made. A small flexible aluminium cable loops to bridge the top cover of the transformer and the tank shall be provided to avoid earth fault current passing through fastening bolts when there is a Lightning surge, high voltage surge or failure of the bushings.

The shield wire shall be connected with the main grid solidly and not through supporting steel structures.

All paint, scale and enamel shall be removed from the contact surface before the earthing connections are made.

All earthing connections for equipment earthing shall be preferably from the earth plate mounted above ground. In case of G.I. Earth Loop all underground "T" connections shall be of the same size as main loop however in case of PVC insulated aluminium conductor loops underground joints shall be completely avoided. Connections to motors from earth plate or main loop conductor brought above ground shall not be less than following:

Anchor bolts or fixing bolts shall not be used for earthing connection.

All hardware used for earthing installations shall be hot dip galvanized or zinc passivated. Spring washers shall be used for all earthing connections of equipment.

Lighting fixtures shall be earthed through the extra core provided in the lighting cable for this purpose.

TESTING OF EARTHING SYSTEM

Earthing systems/connections shall be tested as follows:

Resistance of individual electrodes shall be measured after disconnecting it from the grid.

Earthing resistance of the grid shall be measured after connecting all the electrodes to the grid. The resistance between any point on the metallic earth grid and the general mass of earth shall not exceed 1 ohm.

The resistance to earth shall be measured at the following:

- 1) At each electrical system earth or system neutral earth.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 11 of 18
			REVISION: 0
			EDITION: 3

- 2) At each earth provided for structure lightning protections.
- 3) At one point on each earthing system used to earth electrical equipment enclosure.
- 4) At one point on each earthing system used to earth wiring system enclosures such as metal conduits and cable sheaths or armour.
- 5) At one point on each fence enclosing electrical equipment.

Measurement shall be made before connection is made between the ground and the object to be grounded.

4.0 LIGHTNING PROTECTION SYSTEM

Lightning protection system shall generally comprise air termination system (lightning finials, air terminals or collector rods, roof conductors or collector lines), down conductor system (down conductors & test links) and earth termination system (earth electrodes along with pits and strips). These individual elements of an LPS should be connected together using appropriate lightning protection components to ensure that in the event of a lightning current discharge to the structure, the correct design and choice of components will minimize any potential damage.

The number, types, materials and sizes shall be in accordance with the drawings. All lightning arrestor earth leads of the buildings and plant units shall be connected to the cage ring.

All buildings and plant structures vulnerable to lightning strokes owing to their height or exposed situation shall be protected against atmospheric flash-overs and lightning strokes in such a manner as to eliminate any danger to the personnel employed therein.

Lightning affecting a structure can cause damage to the structure itself and to its occupants and contents, including failure of internal systems. The damages and failures may also extend to the surroundings of the structure and even involve the local environment. The scale of this extension depends on the characteristics of the structure and on the characteristics of the lightning flash.

RISK ASSESSMENT

IEC 62305 consists of the following parts, under the general title Protection against lightning:

- Part 1: General principles
- Part 2: Risk management
- Part 3: Physical damage to structures and life hazard
- Part 4: Electrical and electronic systems within structures

The lightning current is the source of damage. The following situations shall be taken into account, depending on the position of the point of strike relative to the structure considered:

- S1: flashes to the structure;
- S2: flashes near the structure;

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 12 of 18
			REVISION: 0
			EDITION: 3

- S3: flashes to the services connected to the structure;
- S4: flashes near the services connected to the structure.

Each source of damage may result in one or more of three types of damage:

- D1 Injury of living beings due to step and touch voltages
 - D2 Physical damage (fire, explosion, mechanical destruction, chemical release) due to lightning current effects including sparking
- D3 Failure of internal systems due to Lightning Electromagnetic Impulse (LEMP)

The following types of loss may result from damage due to lightning:

- L1 Loss of human life
- L2 Loss of service to the public
- L3 Loss of cultural heritage
- L4 Loss of economic value

Damages & loss in a structure according to different points of strike of lightning:

<i>Point of strike</i>	<i>Source of damage</i>	<i>Type of damage</i>	<i>Type of loss</i>
Structure	S1	D1 D2 D3	L1,L4 L1,L2,L3,L4 L1,L2,L4
Near a structure	S2	D3	L1,L2,L4
Service connected to the structure	S3	D1 D2 D3	L1,L4 L1,L2,L3,L4 L1,L2,L4
Near a service	S4	D3	L1,L2,L4

In order to evaluate whether or not lightning protection of an object is needed, a risk assessment in accordance with the procedures contained in IEC 62305-2 shall be made. The following risks shall be taken into account, corresponding to the types of loss:

- R1: risk of loss of human life;
- R2: risk of loss of services to the public;
- R3: risk of loss of cultural heritage.

Protection against lightning is needed if the risk R (R1 to R3) is higher than the tolerable level RT

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 13 of 18
			REVISION: 0
			EDITION: 3

$$R > RT$$

In this case, protection measures shall be adopted in order reduce the risk R(R1 to R3) to the tolerable level

$$R \leq RT$$

Risk assessment shall be carried out by the Bidder and submitted for the review and approval.

PROTECTION CONCEPT

Non-isolated concept of lightning protection system is applied for all structures.

External lightning protection system

The main and most effective measure for protection of structures against physical damage is considered to be the lightning protection system (LPS). It usually consists of both external and internal lightning protection systems.

An external LPS is intended to a) intercept a lightning flash to the structure (with an air-termination system), b) conduct the lightning current safely towards earth (using a down-conductor system), c) disperse the lightning current into the earth (using an earth-termination system).

Internal lightning protection system

An internal LPS prevents dangerous sparking within the structure using either equipotential bonding or a separation distance (and hence electrical insulation) between the external LPS components and other electrically conducting elements internal to the structure.

Since, we are using the structure to be protected as natural lightning protection component, there will be a partial flow of lightning current across it and therefore the electrical equipment inside the structure becomes vulnerable to this lightning current and shall be installed with at least Type 1+2 Surge Protection Devices (SPD) rated to discharge 10/350microsec lightning impulse current. 1

The Mains LT power supply panel, sub-distribution panel, PDB, PCC, MCC panels for pumps & compressors etc are to be installed with Type 1+2 SPD.

The electrical fittings on the roof of the sheds like light fixtures etc. are also to be installed with Type 1+2 SPD's.

The various earthing grids like lightning earth pits, electrical safety earth pits, instrumentation earth pits shall be directly interconnected to form an equi-potential surface during the event of lightning strikes. The direct connection is to be made using GI flats of sufficient size. And places where direct interconnection of various earth pits is not possible due to operational reason, isolating spark gap (ISG) is to be used for establishing the interconnection to meet the operational requirement of various earth pits

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 14 of 18
			REVISION: 0
			EDITION: 3

Air termination system

The role of an air termination system is to capture the lightning discharge current and dissipate it harmlessly to earth via the down conductor and earth termination system. Therefore, it is vitally important to use a correctly designed air termination system. BS EN/IEC 62305-3 advocates the following, in any combination, for the design of the air termination:

- Air rods (or finials) whether they are free standing masts or linked with conductors to form a mesh on the roof
- Catenary (or suspended) conductors, whether they are supported by free standing masts or linked with conductors to form a mesh on the roof
- Meshed conductor network that may lie in direct contact with the roof or be suspended above it (in the event that it is of paramount importance that the roof is not exposed to a direct lightning discharge)

Air terminals shall be mounted on top of buildings or structure as required. All air terminals shall be inter-connected with roof conductors, pipes, hand rails or any other metallic projection above the roofs shall also be bonded to the roof conductors. All metallic chimneys, ducts and the like above the roof of the structure shall be bonded to and form part of the air termination network. Vertical air termination points shall project at least 30 cm above the object on which it is fixed.

The three basic methods recommended for determining the position of the air termination systems are:

- The rolling sphere method
- The protective angle method
- The mesh method

Down conductors from air terminals or from roof conductors shall be routed as directly as possible to the test links on earth buses, with minimum bends.

Four protection levels have been determined based on certain parameters and each level has a fixed set of maximum and minimum lightning current parameters.

LPL	I	II	III	IV
Maximum current (kA)	200	150	100	100
Minimum Current (kA)	3	5	10	16

Each Lightning Arrestor shall be connected to a separate electrode located as close as possible to it and within the fenced area for each set of arrestors. The two nos. electrodes for each set of arrestors shall be

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 15 of 18
			REVISION: 0
			EDITION: 3

spaced about 5 meters apart so that they are all within the enclosing fence. Each of these electrodes shall be connected to the main earth grid.

All provisions regarding connections of conductors for equipment earthing system shall also apply to lightning protection system.

In corrosive atmospheres, plumbing metal for corrosion protection shall cover lightning finials or air terminals.

The layout and design of lightning protection systems for building extensions or new buildings and structures provided within existing station areas shall match the existing design.

All connections between the different parts of lightning protection systems and the connections to the earthing system must be performed in a manner such that the arising of chemical elements will be avoided.

Minimum Lightning Protection Level-II shall be considered for the Oil & Gas installations.

Natural Components of Collectors

Metal cladding, metal roof structures, metal components of roof structures, gutters and railings may be considered as natural components of collectors as per standard requirements.

The requirements of the standards, such as the following, have to be considered:

- Parts must be permanently conductively connected,
- Minimum thickness of the metal involved,
- Cross-sections of the parts.

Installations with metal casings need not to be fitted with collectors taking into consideration the above-mentioned minimum requirements.

Protective coatings or insulation between metal parts shall be electrically bridged.

Mesh Type Collectors

Buildings shall be provided with mesh-type collector lines. Protruding roof superstructures, such as ladders, chimney stacks, pipes, antenna mounting brackets, etc. and other metallic parts of buildings which are located near the roof (e.g. louvers of ventilation openings) must be directly connected to the collector lines.

This method is suitable where plain surfaces require protection if the following conditions are met:

Air termination conductors must be positioned at roof edges, on roof overhangs and on the ridges of roof with a pitch in excess of 1 in 10 (5.7°).

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 16 of 18
			REVISION: 0
			EDITION: 3

No metal installation protrudes above the air termination system.

Modern research on lightning inflicted damage has shown that the edges and corners of roofs are most susceptible to damage. The air rods should be spaced not more than 10 m apart and if strike plates are used as an alternative, these should be strategically placed over the roof area not more than 5 m apart.

Class of LPS	Mesh size (m)
I	5 x 5
II	10 x 10
III	15 x 15
IV	20 x 20

Collector Rods

Collector rods shall be used for roof superstructures featuring mechanically or electrically operated equipment, such as ventilators and non-conductive parts projecting from the mesh plane by 0.3 m. The angle of protection and a certain minimum distance have to be observed.

Outdoor electrical facilities for HVAC or other purposes not located in the protective area of earthed structures, installations or buildings, including exposed electrical equipment shall be protected by collectors.

Buildings with sheet metal roofs where the thickness of the sheet is smaller as the required value, the collector mesh must be equipped with collector rods of sufficient quantity and length to avoid lightning strokes in the sheet metal.

Down Conductors

Down conductors shall be selected in a manner such that there are several parallel current paths between the collector and the earthing system. The length of each down conductor is to be kept as short as possible.

Steel structures and steel columns of buildings may be used as down conductor, if the minimum sizes according to the standards are guaranteed. In each case the connections with the earthing system and collectors respectively must be visible and removable.

Starting from the corners of the structure involved, conductors should be distributed around the exterior as evenly as possible. They must be configured in such a way as to constitute the direct continuation of the collector. The minimum distance between conductors and doors, windows and other apertures must be 0.5 m.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 17 of 18
			REVISION: 0
			EDITION: 3

If not already connected with the collectors or with the internal potential equalisation, larger metal parts mounted in/on the building outer walls (e.g. frames of doors, ventilation louvers) shall be terminated on the down conductors.

The down conductor spacing should correspond with the relevant class of LPS :

Class of LPS	Typical Distances (m)
I	10
II	10
III	15
IV	20

All down conductors which are connected to the earthing system must be provided with an accessible isolating point for measuring purposes. For termination the grounding bars of grounding loops shall be used, preferably. No conductors are required for outdoor metal structures of adequate size.

Lightning Equipotential bonding

Equipotential bonding is simply the electrical interconnection of all appropriate metallic installations/parts, such that in the event of lightning currents flowing, no metallic part is at a different voltage potential with respect to one another. If the metallic parts are essentially at the same potential then the risk of sparking or flashover is nullified. Bonding can also be accomplished by the use of surge protective devices (SPDs) where the direct connection with bonding conductors is not suitable.

Bill of Material

The detailed bill of material for both external and internal LPS shall be provided for approval with technical specification of various lightning protection components.

It is to be noted that the lightning protection components are to be tested as per applicable IEC/EN 62561 standards for external LPS components and IEC 61643-11 for SPD's.

TESTS OF LIGHTNING PROTECTION SYSTEM

After erection of the earthing and lightning protection system all installations shall be tested in accordance with applicable regulations

The following tests shall be carried out, at least:

- Measures against corrosion protection and arising of chemical elements,
- Check of all connections,
- Measurements of earthing system resistance,

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	EARTHING and LIGHTNING PROTECTION	DOCUMENT NO. MEC/05/E9/TS/13	Page 18 of 18
			REVISION: 0
			EDITION: 3

- Measurements of lightning protection system conductivity,
- Check of mechanical details,
- Compliance with specifications.

The aim of the tests is to ensure the proper function of the complete scope. The measuring results and the locations of the measuring points have to be indicated in respective drawings as a basis for future measurements.

5.0 DOCUMENTATION

Complete documentation shall be provided for the design, construction, testing, maintenance and repair of the earthing and lightning protection systems and their components.

The documentation shall be in English language.

The following drawings/documents shall be submitted for approval within 3 weeks of award of contract.

- Soil resistivity survey report
- Technical data sheets
- Earthing design calculations
- Lightning protection design calculations
- Earthing grid layouts
- Construction drawings
- Spare parts list
- Operation and maintenance manuals
- Test reports

The documents listed above shall be handed over for approval. Special attention has to be given to the fact, that documentation must be submitted with sufficient time allocated for approval prior to manufacturing / assembly. The documentation has to be prepared in accordance with the relevant ISO standards. The final documentation shall be delivered on paper in sufficient number and with exception of the signed protocols in electronic form, also. The type of the electronic files and the number of copies shall be agreed with the Client.

After commissioning & testing of earthing system contractor shall submit the following document to Client/MECON for As-Built status in hard copy (5 set) plus one soft copy.

- Soil resistivity survey report
- As built earthing grid layouts & earth electrode installations
- Construction drawings

TECHNICAL SPECIFICATION
FOR
INSTALLATION OF ELECTRICAL EQUIPMENT

DOCUMENT No. : MEC/05/E9/TS/14

Prepared & Issued by



ELECTRICAL SECTION
(Oil & Gas SBU)
MECON LIMITED

(A Govt. of India Undertaking)
13th & 15th Floor, North Tower, SCOPE MINAR,
Laxmi Nagar District Centre,
Delhi-110092 (India)

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 2 of 29
			REVISION: 0
			EDITION: 3

INDEX

Sl. No.	Description	Page No
01.00	INTENT	4
02.00	CODES AND STANDARDS	4
03.00	ELECTRICAL EQUIPMENTS	5
03.01	SWITCHBOARD	6
03.02	BUSDUCT	9
03.03	TRANSFORMER	9
03.04	MOTORS	12
03.05	CABLES	14
03.06	LIGHTING	19
03.07	EARTHING	23
03.08	LIGHTNING PROTECTION	27
03.09	BATTERIES	27
03.10	NEUTRAL EARTHING RESISTOR	27
03.11	WELDING RECEPTACLES	27
03.12	PUSH BUTTON/CONTROL STATIONS	27
03.13	Misc. Items	27
03.14	LIST OF CONSTRUCTION EQUIPMENTS	28

Rev	Date	Prepared by	Checked by	Approved by
0	11.07.2025	 Shifa Jindal	 Saurabh Singh	Pankaj Shrivastava

© Copyright MECON Limited – All rights reserved.
THIS DOCUMENT IS THE SOLE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED HEREIN. THIS IS NOT TO BE COPIED OR USED FOR ANY OTHER PROJECTS UNLESS EXPLICITLY PERMITTED BY MECON.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 3 of 29
			REVISION: 0
			EDITION: 3

AMENDMENT STATUS

(OLD NUMBER OF STANDARD: MEC/TS/05/E9/14)

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Document Number replaced with New number as MEC/05/E9/TS/14	All	Rev 0/ Ed 3	11.07.2025		
2	Section re-name as Electrical Section (Oil & Gas SBU) Delhi	All	Rev 0/ Ed 3	11.07.2025		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 4 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

1.0 INTENT

The intent of this standard specification is to define the general requirements for design, manufacture, assembly and testing at manufacturer's works, packing, transportation and receipt at site with all materials and accessories of Electrical Equipment Installation.

2.0 CODES AND STANDARDS

The equipment shall comply with the requirements of latest revision of following standards issued by BIS (Bureau of Indian Standards), unless otherwise specified:

IS 5	Colours for ready mixed paints and enamels
SP30 (BIS)	National Electrical Code 2011
IS 816	Code of practice for use of metal arc welding for general construction in mild steel
IS 1239	Steel tubes, tubulars and other wrought steel fittings
IS 1255	Code of practice for installation and maintenance of power cables up to and including 33kV rating
IS 1364	Hexagon head bolts, screws and nuts of product grades A and B
IS 1573	Electroplated coatings of zinc on iron and steel
IS 2309	Code of practice for the protection of buildings and allied structures against lightning
IS 2629	Recommended practice for hot dip galvanizing of iron and steel
IS 2633	Methods for testing uniformity of coating of zinc coated articles
IS 3043	Code of practice for earthing
IS 3618	Phosphate treatment of iron and steel for protection against corrosion
IS 4759	Hot-dip zinc coatings on structural steel and other allied products
IS 6005	Code of practice for phosphating of iron and steel
IS 7689	Guide for the control of undesirable static electricity
IS 7816	Guide for testing Insulation resistance of rotating machines
IS 10028: Part 2	Code of practice for selection, installation and maintenance of Transformers: Part 2 - Installation
IS 10118: Part 3	Code of practice for selection, installation and maintenance of switchgear

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 5 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

and control gear: Part 3 -Installation

OISD-RP-110	Recommended practices on static electricity
OISD-STD-137	Inspection of Electrical Equipment
OISD-RP-147	Inspection and safe practices during electrical installations

In addition to the above it shall be ensured that the installation conforms to the requirements of the following as applicable:

1.1.1	Indian Electricity Act and Rules.
1.1.2	Regulations laid down by CEA/Electrical Inspectorate.
1.1.3	Regulations laid down by PESO/ DGMS (as applicable).
1.1.4	The petroleum rules (ministry of Industry Government of India).
1.1.5	Any other regulations laid down by central/state/local authorities
and Insurance agencies.	

In case of imported equipment standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian standards.

The equipment shall also confirm to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.

In case of any contradiction between various referred standards/ specifications/ data sheet and statutory regulations the following order of priority shall govern. However, the stringent of the below shall be followed.

- Statutory regulations.
- Schedule of Rate
- Scope of Work/ Job specification.
- Design Basis.
- Data sheets.
- Standard Specification.
- Codes and standards.

3.0 ELECTRICAL EQUIPMENTS:

Prior to start of installation of the electrical equipment contractor shall verify that equipment and complete materials have been received. Handling, shifting to required site location, installation, testing and commissioning of all electrical equipment shall be done by vendor/contractor with utmost care as per the scope matrix between the site installation contractor and respective equipment vendor attached in each tender. Manufacturer's instructions and the requirements given in their technical manuals shall be strictly adhered. The substation/switchgear room wherein the equipment shall be installed shall be

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 6 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

kept clean, dry and free from all debris. Panel floor cut-outs not in immediate use shall be suitably covered to avoid any mishap. When handling the switchboard panels, care shall be taken to observe the correct lifting arrangements and to make sure that slings are attached to the manufacturer's designated lifting arrangements and to make sure that slings are attached to the manufacturer's designated lifting points. No parts shall be subjected to undue strains or sudden stresses which could cause damage to the equipment.

The lifting position mark indicated on packing casing shall be adhered to strictly, for keeping it in required vertical position.

Contractor shall check and report to the Purchaser about any damaged item and / or missing component for getting the same replaced as per specifications. During installation, all accessories and loose items shall also be inspected by the contractor before their assembly/mounting.

In case of any modifications/replacement of existing equipment or Tie-ins with existing Electrical systems, approvals shall be obtained from Purchaser before any work to be implemented. The tie-in and shutdown philosophy shall be developed by Contractor in coordination with production, operation and maintenance department. Detailed Task Risk Assessment (TRA) shall be developed by the Contractor for all modifications/replacement or tie-ins activities and shall be approved by all concerned authorities.

The following philosophies provide the frame work for modifications/ replacement or tie-in approach:

- a) The existing facilities shall continue to operate normally. Contractor shall verify the requirements for modifications, replacement and interface or tie-in with existing / new electrical systems.

In general, a planned construction campaign shall be scheduled to facilitate the modifications/replacement or tie-in work. However, preparation for modifications/replacement or tie-in work can be proceed on an opportunistic or scheduled shutdown prior to the planned construction campaign in consultation with Purchaser. Associated shutdown co-ordination shall be carried out by the Contractor as per Purchaser procedure to complete the modifications/replacement of existing electrical equipment or tie-in hook up for all electrical systems.

3.1 SWITCHBOARD:

The term switchboard here includes all HV / MV/ LV switchboard panels, motor control centres, power and lighting distribution boards, UPS panels, ACDB, charger panels, DCDB etc. The switchboard panels shall be handled with care, avoiding any impact to the equipment. Dragging of the panels directly on floor shall be avoided. Roller bars may be used for shifting of panels: Use of a crane and trailer shall be made for handling of equipment. The switchboard panels shall be properly supported on the truck or trailer by means of ropes to avoid any chance of tilting. The switchboards shall be lifted after ensuring that panel supports, nuts and bolts are all intact and tightened. While lifting the panels in packed conditions utmost care shall be taken to avoid any damage to insulators, bushings, metering and protective equipment. The panels shall be preferably kept inside the packing cases till foundations are ready.

The switchboard panels shall be installed on prepared foundations or floor cutouts. Steel base channels shall be welded to inserts provided in floor slab. Cross members shall be provided at the
@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 7 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

junctions of each shipping section and other places as required. Alternatively, when the floor is being-laid, base channel frame of panels supplied by the vendor shall be grouted and levelled in cement concrete. It shall be ensured that the base plate level of HV switchboard shall match with the finished floor level. The foundation pockets and the grouted bolts shall be cured for a minimum period of 48hours.

The switchboard panels shall be taken out from the packed cases and shifted one by one to its proper place. All the panels shall be assembled, aligned and levelled: Alignment of panels shall be checked in both longitudinal and lateral directions. It shall be ensured that panel to panel coupling bolts, bus bar links etc. fit properly without any strain on any part. No new holes for jointing of the panels other than those recommended by the vendor shall be drilled. No gaps shall be left between the panels. The lifting, racking in and out operation of the breaker and all other motions shall be free from any obstruction.

The panels shall be checked for correct vertical position using pendulum weight and spirit levels. The switchboard panels shall be tack welded at suitable intervals at base channel.

After erection of switchboard panels, all uncovered portions of floor cutouts shall be covered with 6 mm thick removable chequered plates finished with floor level. The design of the chequered plates shall be such that the maximum allowable deflection is $L/200$ (where L is the span of the chequered plates in metres) for a live load of 500 kg. /sq. meters. Suitable lifting arrangements shall be provided for chequered plates: The chequered plates shall be painted with a coat of red oxide zinc chromate primer after proper surface preparation as per specifications. Where specified, panels cutouts provided for future use shall be filled with lean concrete.

After completion of erection of switchboards, all the cubicles, switchboard components such as switches, starters, C.T. and P.T. chambers, busbar chamber shall be cleaned and checked for tightness of all the components. Vacuum circuit breakers shall be checked for integrity of bottle seals. All loosely supplied items shall be fitted up. Bus bar sections or links shall be inserted and where specified, of high voltage equipment shall be insulated. Interconnection wiring between shipping sections shall be made by vendor. All the wiring connections shall also be checked. Phase sequence and polarity of PTs and CTs shall be checked. Contact resistance of all busbar joints and contactors shall be checked. Insulator shall be checked for any damage. All the starters, switches, contacts shall be cleaned with C.T.C. where required. All the moving parts shall be checked for easy and free movement. Hinges of panel doors shall be lubricated to give free and noise free movement. All openings shall be kept completely closed to avoid ingress of any foreign particles inside the panel.

Functional scheme verification of individual feeder shall be carried out and minor wiring modifications in the panel wiring, if required shall be done as per the directions of Purchaser. Special attention shall be paid to CT circuits polarity, wiring continuity and correctness in the protection as well as measurement circuits. Auto transfer scheme shall be simulated and verified. During the course of scheme verification tests, defective components if any shall be taken out, after bringing to the notice of Purchaser. The same shall be replaced by component supplied by Purchaser.

Where switchboard is damp or having a low IR value due to damaged insulators/ bushings/any @MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 8 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

other insulated parts, or any other reason, the entire switchboard shall be dried. up according to the instruction of the Purchaser for the I.R value to improve to a state level for commissioning. Care shall be taken to protect the surrounding insulation from direct local heating during the drying up process.

All the metering instruments, protective relays and other relays and contactors shall be tested as per manufacturer's recommendations and according to the instructions of the Purchaser. Protection relays shall be inserted and connected and settings adjusted as required by the Purchaser.

All moving parts, of closing/tripping mechanism, racking in and racking out mechanism, spouts and shutter closing mechanism shall be checked for proper operation. All the auxiliary contacts of breaker shall be checked-up, cleaned and contact pressure measured.

All the control wiring, PTs, bushings, bus bars, other live parts of switchgear, incoming and outgoing cables shall be meggered.

Electrical simulation tests shall be carried out for all the protective, alarm and annunciation relays and external interfaces to ascertain proper functioning.

Safety insulation mats of approved make and of required voltage grade shall be provided in the sub-Station.

Pre-Commissioning Checklist:

Before commissioning any switchboard, following points shall be checked and ensured for safe energizing of the switchboard:

That the installation of equipment to be commissioned is complete in all respects with its auxiliaries and all other mounting including earthing. Openings in floor within and outside panels have been sealed off. All cover and door gaskets are intact to make the enclosure vermin proof.

- All the metering instruments have been checked and found in working order. Indicating lamps are healthy and are in correct position. All power and control fuses are of proper rating.
- That the polarity test and ratio test of all the P.T.s and C.T.s is complete and phase sequence of C.T.s conforms to the correct vector group connections. Wiring continuity and correctness are ensured in the protection and measurement circuits. Polarity of D.C. supply for all the circuits is correct.
- That the high voltage tests of incoming and outgoing cables have been conducted and results are satisfactory.
- That all the protective relays including both conventional and microprocessor based numerical relays have been tested for secondary injection tests. (Primary injection tests shall be carried out for differential protection, Restricted Earth fault protection and thermal overload at full / reduced current to ensure correctness of complete wiring). Relay settings, status indications, fault annunciations, data logging, display of switchboard SLDs shall be verified from MMI in case the same is provided.
- That I.R. Value has been recorded for bus bars, circuit breaker, incoming and outgoing cables, control wiring and potential transformers. Where required joint resistance of bus bars have been recorded and found to be satisfactory. All the surroundings and panels have been cleaned and temporary earth

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 9 of 29
			REVISION: 0
			EDITION: 3

leads have been removed. Timing & CRM test for breakers to be conducted. Hi-Pot IR & PI wherever applicable to be done & recorded

3.2 BUSDUCT:

The bus ducts as per issued drawings will be supplied in parts and all the parts shall be assembled and the bus bar connections shall be made at site. The insulators in bus ducts shall be inspected for any possible damage during transit and the defective ones shall be replaced. The insulators shall be cleaned. Contact surface of bus bars, bus bar bolts and nuts shall be thoroughly cleaned. Petroleum jelly shall then be applied and bolted connection made. The bus duct enclosure shall be checked for earth continuity and then earthed at two places. The bus duct shall be properly supported between switchgear and transformer. The opening in the wall where the bus duct enters the switchgear room shall be completely sealed to avoid rain water entry. Expansion joints, flexible connections etc. supplied by the manufacturer of the bus duct shall be properly connected. The bus duct levelling shall be checked with spirit level and pendulum weight.

3.3 TRANSFORMER:

Transformers on receipt at site shall be unloaded by means of crane or lifting devices of adequate capacity. All lifting lugs shall be used to avoid unbalanced lifting and undue stresses on lugs. Lifting lugs if any provided for partial lifting (e.g., for active part, conservator) etc. shall not be used for lifting complete transformer. Parts other than those identified for lifting of the transformer shall not be used for lifting. While slinging, care shall be taken to avoid slings touching other parts.

Before lifting transformer, it shall be ensured that all cover bolts are tightened fully. In case when it is necessary to use jacks for lifting, projections provided for the purposes of jacking shall be used. Lifting jacks shall not be used under the valves or radiator tubes. For transporting transformers from stores to site, the transformers shall be loaded on a suitable capacity truck or trailer. The transformers shall be properly supported by steel ropes and stoppers on the trailer to avoid tilting of the transformers in transit due to jerks and vibrations. At no instance the transformer shall be kept on bare ground. Where it is not possible to unload the transformer directly on a foundation, it shall be unloaded on a properly built wooden sleeper platform. A transformer shall never be left without putting stoppers to the wheels.

Transformer shall be examined, for any sign of damage in transit. Particular attention shall be given to the following in this regard:

- Dents on tank wall or cooling tubes.
- Damage to protruding parts like valves, sight glass etc.
- Loosening of bolts due to vibration in transit.
- Cracked or broken bushings.
- Oil leakage particularly along welds.

If anything, adverse is noted the same shall be brought to the notice of Purchaser.

Contractor shall examine the transformer base, oil pit, tire walls and foundations laid by the civil
@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 10 of 29
			REVISION: 0
			EDITION: 3

contractor. It shall be ensured that oil spills cannot propagate along cable trenches. Any discrepancy noted will be brought to the notice of Purchaser. Transformers shall be placed on channels or rails over concrete foundations. The transformers shall be levelled, aligned and checked for free movement on the channels or rails. Stoppers shall be provided to the transformers immediately to prevent any movement. Normally transformers upto 1000kVA rating shall be received duly fitted with radiator tubes, conservator tanks, valves, wheels and other accessories. While the transformers of above 1000kVA rating may be supplied with loose accessories. All the accessories like radiators, cooling fans, valves, conservator tanks, explosion vent pipe, bushings and other devices which are supplied in different packages shall be checked for any transit damage and cleaned thoroughly before fixing on the transformer. All loosely supplied parts shall be assembled as per manufacturer's instruction manuals/ drawings and documents. All the connections for C.T.s bushings and other wiring shall be checked for tightness and correctness before replacing the lid or tightening all the bolts.

Topping of transformer with oil:

Before topping up with oil, transformer shall be fitted with all accessories such as valves, gauges, thermometers etc. Oil samples shall be taken from each drum and tested for determination of dielectric strength. Any sign of leakage of the barrel or of its having been opened shall be recorded and reported. It is necessary to filter the oil before the transformers are filled. It shall be ensured in oil filling operation that no air pockets are left in the tank and that no dust or moisture enters the oil. All air vents shall be opened. Oil shall be filled through a streamline oil filter using metal hose. To prevent aeration of the oil, the transformer tank shall be filled through the bottom drain valve. In a transformer with conservator tank, the rate of oil flow shall be reduced when the level is almost upto the bottom of the main cover to prevent internal pressure from rupturing the pressure relief-pipe diaphragm. Sufficient time shall be allowed for the oil to permeate the transformers and also for the locked -up air bubbles to escape. Any air accumulation in the buchholz relay shall be released.

Transformer Oil

a) Sample of oil from the transformer shall be taken from the bottom of the tank.

b) Testing of Oil:

For dielectric test, the oil shall be tested as described in IS 335. The oil shall also be tested for acidity in accordance with the methods prescribed.

Drying out of the transformers, if required, shall be carried out and record maintained in accordance with IS 10028. Normally a streamline filter shall be used for drying-up. I.R. value versus time of both windings shall be recorded during the drying-up process.

Precautions when drying

a) The maximum sustained temperature to which transformer oil may be subjected shall be limited to 80°C.

b) The transformer shall be carefully monitored throughout the drying out process and all observations shall be carefully recorded.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 11 of 29
			REVISION: 0
			EDITION: 3

- c) Drying out shall be continued so that the insulation resistance as prescribed in the standard code of practice is attained and the value remains constant for more than 12 hours. However, a minimum number of cycles shall be done for each transformer as found necessary by the Purchaser. Generally, a megger reading of 2 megohms / kV at 60° C temp with a 5kV Megger may be a rough indication for stopping the dehydration.

The following work on transformers shall be performed by the vendor if specifically called for:

- Before finally commissioning the transformer, it may sometimes be desired to run it for a few hours on short-circuit, applying a low voltage, approximately equal to the impedance voltage of the transformer. During this process, regular readings of the insulation resistance of the winding to earth and winding to winding and temperature against time shall be recorded.
- Testing of radiator tubes for any leakage and rectifying these by welding/brazing.

Pre-commissioning Checklist:

Before commissioning of any transformer, the following points shall be checked for safe energisation of the transformer:

- That all the accessories have been fixed properly and transformer body and neutral are properly earthed. The transformer dehydration is over and results are satisfactory and approved by the Purchaser. In case transformers are idle for more than one month after dehydration, transformer oil has been given at least two circulations.
- That the oil level, in the transformer conservator tank and all the bushings is upto the marked point and the oil has been tested for dielectric strength and acidity.
- That the silica gel is in reactivated condition. The breather pipe is clear from any blocking and contains oil upto the proper level.
- The explosion vent diaphragm does not have any dents. Accumulation of any oil and air had been released.
- That the operation of off-load and on-load tap changers on all the tap positions is satisfactory. The mechanical parts of the on-load tap changer are lubricated. Motor IR value has taken and found satisfactory. Tap position mechanical indicator on the transformer and tap position indication meter on the control panel are reading the same tap positions. Tap changer limit switches are operating satisfactorily on the maximum and minimum tap positions. On-load tap changer contact pressure and resistance is as per manufacturers recommendations. Oil level of tap changer tank is upto the required level and oil has been tested for dielectric strength. The tap setting on which the off-load tap switch is locked shall be recorded. Generally, the off-load tap switch shall be kept on nominal tap.
- That the buchholz relay has been tested and checked up for any friction in the movement, and floats are free, all the other protective relays, alarm and annunciation relays have been tested.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 12 of 29
			REVISION: 0
			EDITION: 3

- g) That all the metering equipment have been tested and polarity test of P. T's and transformer winding is satisfactory. Phase sequence and connections have been checked for proper vector group.
- h) That the ratio test and winding resistance on all the tap positions is satisfactory.
- i) That gaps of arcing horns for the bushings where provided are in order and earth connections for the surge diverters have been checked
- j) That the winding and oil temperature thermometer pockets contain oil and the winding and oil temperature settings on dial gauges are in order.
- k) That the transformers fitted with fans for forced air cooling have been checked up for automatic starting and stopping of the fans and air is placement as been verified (If applicable).
- l) That the simulation tests for all external interface connection alarm, annunciation and trip circuits have been checked and are in order.
- m) That the insulation resistance of all the control circuits and IR value of the transformer windings and all the incoming and outgoing cables have been checked.
- n) That all the valves in the cooling system and valve between the buchholz relay and the conservator tanks are in open position.
- o) That the setting of all the protective relays is at the desired value and D.C. Trip supply is healthy.

Observations after Commissioning

After switching on the transformer, the following points shall be observed and recorded.

- a) The inrush magnetizing current and no-load current.
- b) Alarm, if any, or if any relay flag has operated.
- c) Voltage and current on all the three phases.
- d) Transformer hum or abnormal noise.
- e) Circulation of oil and leakages.
- f) Record current, voltage, cooling air temperature, winding temperature and oil temperature readings, hourly for 24hours.
- g) Cable end boxes, for any over-heating.

3.4 HV and MV MOTORS:

All the motors generally would be erected by the mechanical contractor.

Contractor shall keep the motor space heater energized as per the directions of Purchaser. Contractor shall measure the insulation resistance of motor windings. Insulation resistance of the motors shall be measured between the

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 13 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

winding of the machine and its frame by means of a 500 / 1000V Meggar in case of 415V motors. A minimum value of 1 megohm for 415V motors shall be considered a safe value. In case of lower I.R. Value, the insulation value shall be improved by any of the following methods as directed by the Purchaser.

- Blowing hot air from external source.
- Putting the motor in oven:
- Placing heaters or lamps around and inside after making suitable guarding and covering arrangements so as to conserve the heat.

In case the insulation is low, the following method of drying has to be adopted, after consultation with Purchaser. During drying the temperature rise of winding shall not exceed the permissible value for the class of insulation used:

- By locking the motor so that it cannot rotate and then applying such a low voltage to the stator terminals so as to pass full load current in the stator keeping the stator winding temperature below 90° C. In this case a close watch shall be kept for any possible overheating and I.R. Values vs. temperature shall be plotted and heating continued till I.R. value becomes steady.
- By blasting hot air from external source, Maximum temperature of winding while drying shall be 70° C to 80°C (thermometer) or 90° C to 95° C by resistance method. Heating shall be done slowly first till steady temperature of winding is reached after 4 to 5 hours, and for large machines after 10 hours. A record has to be kept for drying process, with half an hour reading and, till steady temperature is reached. In case it is essential, the drying process can be supplemented by blower.

It shall be sure that the motor leads are correctly connected in the terminal box, as indicated in the 'Name Plate'. The covers of all terminal boxes shall be properly fixed, the gaskets intact. The control circuit shall be tested for proper functioning as per circuit diagram.

In case of synchronous machines, slip rings and brush gear shall be polished and brushes shall be fixed in their holders with clearance and pressure as recommended by the manufacturers.

Before commissioning, the ventilation and cooling system of the motor must be inspected. In case of motor with forced ventilation the air inlet shall be examined to ensure that it is free from moisture and any foreign material. It shall also be ensured that recommended flow and pressure of air is available to produce the required cooling effect.

The motor control gear shall also be carefully examined, the over-load settings may be reduced or time lags bypassed from protective gear to ensure rapid tripping of switchgear in event of faults. The direction of rotation of a new motor specially of large capacity, and phase sequence of supply shall be kept in view while joining and connecting to the motor terminals.

Finally, the motor shall be started on no-load after decoupling, and shall be allowed to run for a minimum period of 4 hours, or for a time as instructed by Purchaser. Attention shall be given to the proper running of the bearings, vibration or unusual noises if any. Voltage, starting current, no-load current, stator

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 14 of 29
			REVISION: 0
			EDITION: 3

winding and bearing temperature & vibrations shall be recorded after every 1 hour during this test. Direction of rotation shall be checked and recorded. Normally the motors run in clockwise direction as viewed from the driving end with reference to the phase sequence R,Y,B.

After switching off the motor, the insulation resistance of the motor shall be recorded under hot and cold conditions.

If the no load test run is found satisfactory, the motor shall be allowed to run for 8 hours and all readings shall be recorded.

The following work on motors, may be performed by the contractor if specifically called for.

- The proper level of bearing oil has to be checked. The condition of grease in bearings shall be checked and in case it is necessary, complete replacement of bearing with specified grade of grease after proper cleaning of the bearing shall have to be done. Wherever external greasing facility exists, the condition of grease may be checked by pumping some new grease of specified grade at start. If the grease coming out is deteriorated grease shall be replaced.
- All the motors, motor exciter set and induction generators directly coupled or coupled through reduction gears shall be checked for abnormal vibration, if any Large rated HV motors with journal type bearings are liable to get damaged from shock, rough handling during transit. Any minor defect in a race or roller may give rise to considerable amount of vibration and noise. Contractor shall check and bring to the attention of Purchaser any defect noticed in this regard.
- Due care shall be taken to avoid any damage to bearing insulation wherever provided.

3.5 CABLE INSTALLATION

General

Cable installation shall include power, control and lighting cables. These shall be laid in trenches/cable trays as detailed in the power layout drawings. Cable routing given on the power layout drawings shall be checked in the field so as to avoid interference with other services such piping, instrumentation, civil, structural, mechanical etc. Any change in routing shall be done to suit the field conditions suitably interfacing with other services wherever deemed necessary, after obtaining approval of Purchaser.

High voltage, medium voltage power and control cables shall be separated from each other by adequate spacing or by running through independent pipes, trenches or cables trays, as shown on power layout drawings/installation details. Details of cable routes and cable spacings not shown in detail drawing shall be determined by the Contractor and approved by the Purchaser.

When single core cables are laid in flat formation, the individual cable fixing clamps and spacers shall be of non-magnetic material. As a general practice, the sheath of single core cables shall be earthed at one point to keep sheath at earth potential unless otherwise stated. Single core cables, when laid in trefoil formation shall be braced by suitable clamps at a distance, not exceeding 3 meters along the cable routing.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 15 of 29
			REVISION: 0
			EDITION: 3

If straight through joints are required to be provided on single core cables, armour shall be broken at joints as per Supplier's recommendations. For single core cables, armour shall be earthed at one end for the cable run length as per Supplier's recommendation.

Minimum spacing of 300 mm between power, control cables and Telephone, Communication, Fire alarm cables shall be maintained.

The lengths indicated in the cables schedule are only approximate. The Contractor shall ascertain the exact length of cable for a particular feeder by measuring at site. All cable routes shall be carefully measured. Before the start of cable laying, the Contractor shall prepare cable drum schedule and get that approved by Purchaser to minimize/avoid straight through joints and then the cables cut to the required lengths, leaving sufficient lengths for the terminations of the cable at both ends. The various cable lengths cut from the cable reels shall be carefully selected to prevent undue wastage of cables. Extra loop length shall be given for feeder cables where required as per the directions of Purchaser to meet contingencies.

Cables shall be laid in directly buried trench or in RCC trench (underground trench) or in cable tray along pipe sleepers or in overhead trays as shown on power layout drawings.

Overhead trays shall be installed 2700 mm (minimum) above grade level. At road crossings overhead trays shall be installed at 7000 mm (minimum) above level or cables shall be routed cable tray culvert/Electrical Road crossings as per power layout drawings.

Sufficient care shall be taken while laying cables to avoid formation of twist, sharp bend etc. in order to avoid mechanical injuries to cables. Rollers shall be used for pulling of cables.

Cable installation shall provide minimum cable bending radii as recommended by cable Supplier.

Cables shall be neatly arranged in the trenches/trays in such a manner that criss-crossing is avoided and final take off to the motor/switchgear is facilitated. Arrangement of cables within the trenches/trays shall be in line with power layout drawings. Cable routing between cable trench and equipment/motors shall be taken through GI pipe sleeves of adequate size. Pipe sleeves shall be laid at an angle of maximum 45 to the trench wall. Bending radii of pipes shall not be less than 8D. It is to be ensured that both the ends of GI pipe sleeves shall be sealed with approved weather proof sealing plastic compound after cabling. In places where it is not possible, cables shall be laid in smaller branch trenches.

All cables shall be identified close to their termination point by cable tag numbers as per cable schedule. Cable tag numbers shall be punched on aluminium straps (2mm thick, 20 mm wide and of enough length) securely fastened to the cable and wrapped around it.

Each underground cable shall be provided with cable tags of lead securely fastened every 30 m of its underground length with at least one tag at each end before the cable enters/leaves the ground. In unpaved areas, cable trenches shall be identified by means of cable markers as per installation drawing. These cable markers shall be placed at location of changes in the direction of cables and at intervals of not more than 20 m and also at cable straight through joint locations.

All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of cables shall be taped with an approved PVC end cap or rubber

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 16 of 29
			REVISION: 0
			EDITION: 3

insulating tape.

Each row of cables shall be laid in place and before covering with sand. All wall opening/pipe sleeves shall be effectively sealed after installation of cables to avoid seepage of water inside building /lined trench. Every cable shall be given an insulation test in presence of Purchaser before filling the cable trench with sand. Any cable which is found defective shall be replaced.

Where cables pass through foundation walls, the necessary openings shall be provided in advance for the same by another agency. However, should it become necessary to cut holes in existing structures for example floor slab etc., the Contractor shall determine their location and obtain approval of the Purchaser before carrying out the same.

Cables for road crossings shall be taken through ERC (Electrical Road Crossing) as shown in the power layout drawings.

At road crossing and other places where cables enter pipe sleeves adequate bed of sand shall be given so that the cables do not slack and get damaged by pipe ends.

Wherever cable trench crosses storm water, waste water channel/drain, cables shall be taken through PVC/RCC pipes. Where cables are required to cross drains of depth more than 1200 mm, cables shall be taken over the drain on cable trays supported suitably using ISMC 150/200 sections.

Ends of cables leaving trench shall be coiled & capped and provided with protective cover till such time the final termination to the equipment is completed.

Cables laid direct inground

Cables shall be laid underground in excavated cable trenches where specified in cable layout drawings. Trenches shall be of sufficient depth and width for accommodation of all cables. Cables shall be properly spaced and arranged with a view of heat dissipation and economy of design. Maximum number of cable layers in trench shall be preferably limited to 5 layers.

Minimum depth of cable trench shall be 750 mm for medium voltage and 900 mm for H.V. Cables. The depth and the width of the trench shall vary depending upon the number of layers of cables

Cables shall be laid in buried trenches at depth as shown in the power layout drawings. It is to be insured by the Contractor that the bottom of buried trenches shall be cleared of all rocks, stones and sharp objects before cables are placed. The trench bottom shall be filled with a layer of sand. This sand shall be levelled and cables laid over it. These cables shall be covered with 150 mm of sand on top of the largest diameter cable and sand shall be lightly compacted. A flat protective covering of 75 mm thick second-class red bricks shall then be laid and the remainder of the trench shall then be back – filled with soil, rammed and levelled.

Cables laid in concrete trench

Cables shall be laid in 3 or 4 tiers in concrete trench as shown on power layout drawings. Concrete cables trenches shall be filled with sand in hazardous area to avoid accumulation of hazardous gases and oil. RCC covers of trenches shall be effectively sealed to avoid ingress of chemical and oil in process area. Removal of concrete covers where required for the purpose of cable laying and

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 17 of 29
			REVISION: 0
			EDITION: 3

reinstating them in their proper position after cables are laid shall be done by Contractor.

All wall opening /pipe sleeves shall be effectively sealed after installation of cables to avoid seepage of water.

Above ground cables

a) Cables installed above grade shall be run in cable trays, clamped on walls, ceiling or structures and shall be run parallel or at right angles to beams, walls or columns. Cable routing shall be planned to be away from heat sources such as hot piping, gas, water, oil drainage piping, air- conditioning duct etc. Each cable tray shall contain only one layer of cables as far as possible for power cables. However, control cables may be laid in double layer in the cable trays.

b) Individual cable or small group of cables (upto 3 to 4 cables) which run along structures/walls etc. shall be clamped by means of 16 SWG GI saddles on 25 x 6 mm saddle bars. Alternatively small group of cables can be taken through 100/150 mm slotted channel tray/ISMC100.

Cables shall be supported so as to prevent sagging. In general, distance between supports shall be approximately 300 mm for cables upto 25 diameters and maximum 450 mm for cables larger than 25 mm dia. To prevent the sagging of cables.

c) Cable laid on supporting angle in cable trenches, structures, columns and vertical run of cable trays shall be suitably clamped by means of G.I. saddles/clams, whereas cables in horizontal run of cable trays shall be tied by means of nylon cords. Distance between supporting angles shall not exceed 600mm.

d) All cable trays (other than galvanized trays) and supporting steel structures shall be painted before laying of cables. The under surfaces shall be properly degreased, derusted, descaled and cleaned. The painting shall be done with one coat of red oxide zinc chromate primer. Final painting shall be done with two coats of approved bituminous aluminum paint unless otherwise specified.

e) Where cables rise from trench to motor, lighting panel, control station, junction box etc., they shall be taken in GI pipe for mechanical protection upto a minimum of 300 mm above grade. Cable ends shall be carefully pulled through conduit to prevent damage to cable.

f) All G.I. Pipes shall be laid as per layout drawings and site conditions. Before fabrication of various profiles of pipes by hydraulically operated bending machine (which is to be arranged by the Contractor) all the burrs from the pipes shall be removed. GI Pipes having bends shall be buried in soil/concrete in such a way that the bend shall be totally concealed. For G.I. pipes buried in soil, bitumen coating shall be applied on the buried lengths. Installation of G.I. pipes shall be undertaken well before paving is completed and necessary co-ordination with paving agency shall be the responsibility of Contractor.

Following guide shall be used for sizing of G.I. pipe.

- i) 1 cable in a pipe - 53 % of pipe cross-sectional area occupied by cables.
- ii) 2 cables in a pipe - 31 % of pipe cross-sectional area occupied by cables.
- iii) 3 cables in a pipe - 43 % of pipe cross-sectional area occupied by cables.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 18 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

iv) 4 and above cables in a pipe - 40 % of pipe cross-sectional area occupied by cables.

After the cables are installed and all testing is complete, conduit ends above grade shall be plugged with a suitable weatherproof plastic compound / bitumen / suitable sealing compound. Alternatively, rubber bushes shall be employed for the purpose of sealing

Terminations

- a) All HV and MV cables shall be terminated at the equipment by means of single/double compression type cables glands as specified suitable for the cable size. They shall have a screwed nipple with conduit electrical threads and check nut. The cables shall be identified close to their termination points at both the ends of cable (cable numbers shall be punched on aluminium strips 2mm thick and securely fastened to the cables wrapped around it) and also along the route at recommended intervals, by cable tag numbers.

All cable entries for outdoor termination shall be preferably through bottom. Outdoor cable termination through top of equipment shall not be permitted.

- b) Power cables cores wherever colour coding is not available shall be identified with red, yellow and blue PVC tapes. Where copper to aluminum connections are made, necessary bimetallic washers shall be used.
- c) In case of control cables, all cores shall be identified at both ends by their terminal numbers by means of PVC ferrules suitable for core size. Wire numbers shall be as per schematic/wiring/inter-connection diagram. All unused spare cores of control, cables shall be neatly bunched and ferruled with cable tag at both ends, for future use.

For trip circuit identification additional red ferrules shall be used only in the particular cores of control cables at the termination points in the Switchgear/Control panels and Control Switches.

- d) Contractor shall drill holes for fixing glands wherever necessary. Gland plate shall be of non-magnetic material/aluminium sheet in case of single core cables. All unused cable entries on equipment/panels shall be plugged/sealed.
- e) The cable shall be terminated at electrical equipment /switchboards through glands of proper size. The individual cores shall then be dressed and taken along the cables ways or shall be fixed to the panels with polyethylene straps. The cable glanding shall be done as per Supplier's instructions. Cable armour shall not be exposed after termination is complete. In case of termination of cables at the bottom of a panel over a cable trench having no access from the bottom close fit holes shall be drilled in the gland plate for all the cables in one line, and then gland plate shall be split in two parts along the centre line of holes. After fixing bottom plate, uncovered cable holes/gaps shall be sealed with cold setting compound.
- f) Crimping of lugs to cable leads shall be done by hand crimping/hydraulically operated tool as per requirement. Insulation of the leads shall be removed before crimping. Conductor surface shall be cleaned and shall not be left open. Suitable conducting jelly shall be applied on the conductor lead. Lugs shall enclose all strands of cable core. Cutting of strands shall not be allowed.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 19 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

- g) HV cables shall be terminated with heat shrinkable termination kits, indoor or outdoor type as specified by approved HV cable jointers. Supplier's instructions shall be followed for applying heat shrinkable termination kits.
- h) The Contractor shall bring to the notice of Purchaser any mismatch in cable glands, lugs provided with the equipment vis-à-vis to the cable size indicated in cable schedule for taking corrective action.
- i) The cable joints in power and control cables shall be avoided as far as possible. In case a joint is unavoidable, the following shall be insured:
 - i) The number of joints shall be restricted to minimum as far as possible.
 - ii) The location of joints shall be identified with permanent markers.
 - iii) No joints shall be allowed in hazardous areas without the approval of Purchaser.
 - iv) No joints will be allowed in the Cable seller.

The jointing and termination of medium voltage power cables shall be carried out by trained personnel only. Jointing and termination of high voltage cables shall be done by skilled and experienced jointer duly approved by Purchaser. Only type tested termination kits of approved make shall be used.
- j) No unauthorized repairs, modifications shall be carried out on the hazardous area equipment terminal boxes and junction boxes. Damaged enclosures of hazardous area equipment shall be brought to the notice of Purchaser by Contractor. After termination is complete, all the bolts, nuts, hardware of terminal box shall be properly placed in its position and tightened.
- k) Where required, cable sealing boxes intended to be used with the apparatus shall be filled with solid setting type bituminous compound unless otherwise specified

3.6 LIGHTING INSTALLATION

General

The lighting fixtures in the plant shall be fed from lighting and small power distribution board. All outdoor lighting shall be group controlled manually or through photoelectric synchronous timer. Lighting wiring between distribution boards and lighting fixtures shall be done with 3-core (phase, neutral and earth) Cu/XLPE/SWA/PVC cable for plant areas and substation building. Wiring in the other building shall be done by means of 3-core Cu/PVC cables, or PVC insulated copper conductor wires in conduit/Metsec channel as specified. All joints of conductors in Switch boards/JBs Fittings shall be made only by means of approved mechanical connectors (nylon/PVC connectors). Bare twisted joints shall not be permitted anywhere in the wiring system.

The lighting and small power layouts furnished by Purchaser will indicate approximate locations of lighting fixtures. The Contractor shall determine, with approval of Purchaser, the exact locations of each

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 20 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

fixture in order to avoid interference with other services such as piping, instrumentation, civil, structural, mechanical etc and also with a view to obtain as much uniform illumination as practicable, and to avoid objectionable shadows. Conduits shall be laid out by the Contractor to suit field conditions suitably interfacing with other services and as per directions of the Purchaser.

On walkways, platforms and other outdoor area, lighting fixtures shall be located nearer to landing of stairs or ladders, gauges, flowmeters, panel boards and other equipment to provide proper illumination.

The minimum height of any lighting fixture shall be preferably not less than 2.5 meters above the floor level.

All outdoor cable terminations to outdoor junction boxes, panels, socket outlets etc. shall be through bottom or from side. Top entries for cables shall be avoided to avoid water entry. All cable glands for outdoor terminations shall be double compression type and the gland shall be covered with PVC or rubber boot shroud. All unused cable entries shall be plugged with suitable blanking plugs.

Mounting height of equipment shall be as under:-

Top of Switch Box	:	1200 mm from FFL (Finished floor level) Bottom of
Lighting/Power Panel	:	1500mm from FL
5/15Amp. Receptacle	:	300mm from FFL unless otherwise specified (1200 mm for process areas and industrial sheds)
Lighting fixture	:	As indicated in lay outdrawing
Exhaust fan	:	In the cutout provided / as indicated in Layout drawings.

Fixtures shall be firmly supported from the structures. Support clamps etc. may be bolted or welded to the existing steel work or metal inserts. In case of concrete structures, where metal inserts are not available, fixtures shall be suspended from concrete surfaces with the help of anchor fasteners. In such cases special care shall be taken to see that anchoring is firm. In places where ceiling fans are provided, lighting fixtures shall be suspended below the level of fan to avoid shadow effect.

Circuit cables in a group shall be cleated to structure by using galvanised strip clamps or cable run in cable trays wherever trays are available. Spacers and cleats shall be of required size to accommodate the cables. All hardware shall be galvanised. Underground lighting cables (in paved areas) shall be taken in suitable G.I. sleeves buried at a minimum depth of 300 mm from FFL. GI pipe sleeves shall be extended to 300 mm above FFL. Exact termination/layout of G.I. pipes (for protection of cables) shall be decided at site as per site convenience in consultation with Purchaser.

Wiring for all outlet sockets shall be done with 3 cores of equal sizes for phase, neutral and earth. The terminals of switch sockets shall be suitable to receive the size of wire specified.

All lighting fixtures shall be provided with terminal block with required terminals suitable for connection of wire upto 2.5sq.mm copper conductor.

The cable shall be straightened after unwinding it from the drum. All cables be clamped/laid in straight run @MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 21 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

without any sag and kink.

For location where fan points are shown, fan hooks with junction box shall be provided during concreting. Where fan hooks and J.Bs. are provided separately JB shall be located within a distance of 300mm from hook for mounting of ceiling rose.

Industrial type plug sockets with 20A switch or rating as specified shall be provided at a height of 500mm from FFL for window AC units. Socket outlets and plugs for installation in MCC room, DG room, etc. shall be of industrial metal clad type.

Wiring for exhaust fans shall be terminated in receptacles as specified in layout drawing and the connection from receptacle to the exhaust fan shall be by means of a flexible cord equivalent in size to the main run of wires. Switch for exhaust fan shall be located in a separate switch board along with other switches

Conduit System

Surface or concealed conduit system of wiring shall be adopted, as specified in the drawings. Required number of pull boxes shall be used at intervals to facilitate easy drawing of wires. Separate conduit shall be run for lighting and power circuits. Further, conduits for Normal lighting/Emergency lighting/DC critical lighting shall be separate. Conduit layout shall be decided at site as per site conditions. Drop conduits for switch boards shall be decided by Contractor as per wall locations shown in Architectural drawings. All exposed run of conduits on surface, shall be vertical or horizontal.

Only threaded type conduit fittings shall be used for metallic conduit system. Pin grip type or clamp type fittings are not acceptable. Conduit ends shall be free from sharp edges or burrs. The ends of all conduits shall be reamed and neatly bushed.

Conduit shall be of minimum 25mm dia. Maximum number of wires permissible in a conduit shall be seven for wire size of 2.5 sq mm.

The exposed outer surface of the conduit pipes, including all accessories forming part of the conduit system, shall be adequately protected against rusting. In all cases, bare threaded portion of conduit pipe shall not be exposed unless such bare threaded portion is treated with anti-corrosive preservative or covered with approved plastic compound.

Conduit connection to outlet boxes shall be by means of screwed hubs or check nuts on either side. Where concealed wiring is done, junction boxes (65mm deep) shall be used so as to rest on shuttering properly. All conduit connections shall be properly screwed and Junction box covers shall be properly fitted so as to avoid entry of concrete slurry.

Where concealed wiring is to be adopted, conduits shall be laid in time before concreting of the slab. Pull wire (GI or steel) shall be provided inside conduit for the ease of wire pulling. The Contractor shall coordinate his work with other agencies involved in the civil works in such a way, that the work of the other agencies is not hampered or delayed. Vertical conduit runs shall be made in wall before plastering is done so as to avoid chasing. Where chases are made for conduit run Contractor shall fill these chases or any other openings made by them after completing the work and patch the surface. During

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 22 of 29
			REVISION: 0
			EDITION: 3

installation, care shall be taken to see that proper covers are provided to prevent rusting of conduits. Locations of all point outlets, junction boxes shall be marked with brick powder or sand so that these are easily identified after shuttering removal. As built conduit layout drawing shall be submitted by Contractor after completion of the work.

All junction boxes, bends and other accessories shall be of the same material as that of conduit and shall have the same protective coatings.

After erection, the entire conduit system shall be tested, for mechanical and electrical continuity and shall be permanently connected to earth by means of approved type of earthing clamps.

Hazardous Area Installation

Wiring in hazardous area shall be done by using minimum 2.5mm² copper conductor armoured cable. Circuit wiring feeding hazardous areas shall be controlled by two pole switches/MCBs (for phase as well as neutral isolation).

Correct type of lighting equipment (fixtures and JB's) with regard to hazardous protection as specified in the drawing shall be installed for the areas classified as Zone 1, Zone 2etc.

The terminations in the junction boxes and the lighting fittings shall be done avoiding possibility of loose connections due to vibrations. After the terminations are made the cover of the junction boxes and the lighting fittings shall be closed properly with all bolts and hard wares in correct position, retaining its explosion and weather protections. In fixtures having double cable entries, both the entries shall be used for looping in and looping out connection, thus minimising the use of a separate junction box. Wherever separate control gear boxes (C.G. box) are provided looping in and looping out connections shall be through CG box, thus avoiding the use of a additional junction box. All unused cable entries shall be sealed with suitable plugs.

Circuit cables shall be firmly cleated in a group along columns/ beam/ladders/side channels/platform using 1.6mm thick GI saddles on 25x3 mm GI saddle bar at intervals of 400mm to 500mm for straight run and on either side close to bending and at both termination ends as per the directions of Purchaser. Where required, 3 or more of cables may be taken in slotted channel tray after obtaining approval of the Purchaser. Cables shall not be routed along hand rails.

Where fire proofing column/structures are encountered, all cabling shall be taken in GI pipes of required size and both ends shall be sealed, well before fire proofing is done. Similarly, equipment such as lighting fixture, control gear box, lighting/ power panels, field call stations, junction boxes etc. shall be installed on suitable steel mounting frame/distance bracket, thereby avoiding direct contact with the concrete used for fire proofing.

Cable glands for terminating cable on flameproof equipment shall be of double compression FLP type. Any material/equipment specified to be supplied by Contractor for installation in hazardous areas, shall be tested by CMRI and duly approved by PESO Nagpur or DGMS Dhanbad or any other applicable statutory authority. All indigenous FLP equipment shall also have valid BIS license as required by statutory authorities.

High Mast Lighting

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 23 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

The high masts shall be installed on concrete foundations with the base plate bolted on to the anchor bolts. The high mast shall be painted with a coat of primer and two coats of aluminium paint, the second coat to be given just before handing over to the Purchaser. The high masts shall be numbered as per drawings. The high masts shall be connected to the plant earth grid at two points.

Exact orientation of flood lighting fixtures shall be decided at site to achieve optimum utility of these fixtures.

A separate earth pit (lightening) shall be provided near each high mast & shall be connected to lightning Arrestor of High Mast through insulated cable running directly from LA. This pit shall be connected to lightning earth grid.

3.7 EARTHING INSTALLATION

Entire system shall be earthed in accordance with the provisions of the relevant IEC recommendations/ IS code of practice IS 3043-1987 and Indian Electricity Rules, so that the values of the step and contact potentials in case of faults are kept within safe permissible limits.

This consist of main earth conductor (grid conductor) forming a closed ring network with required number of earth electrodes connected to it to provide a common earth for electrical device and metallic structures. From each earth electrode two distinct connections shall be made of the main earth conductor. The earth plates shall be used for taking multiple earth connections to two or more equipment.

The earth conductors shall be laid in ground, along cable trays / cable trench / pipe rack etc as indicated on the earthing layout drawings. The location shown on the earthing layout drawings are indicative. The exact location of earth conductors in the filed shall be determined by Contractor in consultation with the Purchaser. Earth conductors shall be located avoiding interferences with other services such as piping, instrumentation, civil, structural, mechanical etc.

The ring earthing system around each building shall be laid at a distance of approximately 1.5 m from the building and at a depth of approximately 0.8m. The ring shall be bonded at intervals to the building steel structures, reinforcement of building columns and also to pipes, wherever they are crossing. The earth ring shall further be connected at intervals to deep earthing electrodes to achieve a combined earth resistance of less than **one ohm**.

All exposed metal part such as HT/LT switchgear, DP/FP structure, distribution board, metal clad switchgear enclosure, lamp brackets, lamp holder, plug sockets, lighting poles, junction boxes, high mast etc shall be properly earthed by connecting these to the earth electrode by means of GI wire/Flat or PVC insulated Cu conductor of approved size to pass the fault current safely to earth in case of any fault.

Where lined cable trenches are available, the earth conductor shall be laid in the trenches and shall be firmly cleated to the sidewall of concrete trenches using GI clamps at interval of 400 mm to 500 mm and near to the termination end. The earthing conductor shall run along one of the cable trays along a cable

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 24 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

route. The earthing conductor shall be suitably cleated and electrically bonded to all the other cable trays on the same cable route at regular interval of 25 to 30 metre. The earthing for equipment shall be tapped from the main earth conductor and not from cable tray support structure. Earth conductor when laid underground shall be at a depth of 600mm below finished grade level.

Joints and tapping in the main earth loop shall be made in such a way that reliable and good electrical connections are permanently ensured. All joints below grade shall be welded and shall be suitably protected by giving two coats of bitumen and covering with Hessian tape. Earth strip laid above ground shall be welded across straight through joints and joints shall be suitably protected by giving two coats of bitumen to avoid oxidation and insulation film formation of the strip surface. When two earth strips are to be joined by means of welding, lap welding with an overlapping of strip equivalent to double the width of the strip and all four sides shall be continuously welded. All joints at tappings above ground shall be means of connector/ lugs. A minimum of two bolts of adequate size shall be used for this purpose. Earthing strip joints at earth plate and equipment shall be through GI bolts, nut etc.

The earthing installation shall be done in accordance with the earthing drawings and the standard drawings of reference attached with this document. The entire earthing system shall fully comply with the Indian Electricity Act and Rules. The contractor shall carry out any changes desired by the Electrical Inspector or the owner, in order to make the installation conform to the Indian Electricity Rules at no extra cost. The exact location on the equipment shall be determined in field, in consultation with the Engineer-in-Charge or his authorized representative. Any changes in the methods, routing, size of conductors etc shall be subject to approval of the Owner/ Engineer-in-Charge before execution.

In process unit areas, the earthing cable shall be run along cable trays wherever specified in the layout drawings. The earthing cable shall be suitably cleated and electrically bonded to the cable tray at regular intervals

Installation of Earth Electrodes

Earth electrodes shall be installed as shown on earthing layout drawings and installation details. The location shown on the earthing layout drawings are indicative. The exact location of earth electrodes in the field shall be determined by Contractor in consultation with the Purchaser, depending on the soil strata and resistivity. Earth electrodes shall be located avoiding interferences with other services such as road, building foundation, column, pipelines etc. The civil area drawings shall be referred for this. The distance between two earth electrodes shall not be less than twice the depth of electrode.

Earth electrodes shall preferably be located in a moist soil which has a fine texture, grain size and distribution. Wherever practicable the soil be dug up, all lumps broken and stones removed from the immediate vicinity of the electrodes and soil packed by watering and ramming as tight as possible.

The electrodes shall have a clean surface, not covered by paint, enamel, grease or other materials of poor conductivity.

All earth electrodes shall be tested for earth resistance by means of standard earth test meter. The tests
@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 25 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

shall take place in dry months, preferably after a protracted dry spell.

The disconnect facility shall be provided for the individual earth electrode to check its earth resistance periodically.

Location of earth electrodes shall be marked by permanent markers for easy identification. All earth Electrodes shall be serial numbered and also marked on 'As Built' drawing for future reference.

Individual earth electrodes shall be provided for each lighting arrestor and flood light mast.

Earthing system provided for concrete paved area by other agency where applicable; shall be connected to the plant earthing system below ground by minimum two earth connections.

Connection

The earth system connections shall generally cover the following:

- Equipment earthing for personnel safety
- System neutral earthing
- Static and lighting protection

The following shall be earthed.

- System neutral
- Current and potential transformer secondary neutral
- Metallic non-current carrying parts of all electrical apparatus such as transformers, switchboards, bus duct, motors, neutral earthing resistors, capacitors, UPS, battery charger panels, welding receptacles, power sockets, lighting / power panels, control stations, lighting fixtures etc.
- Steel structures/ columns, rail loadings platforms etc.
- Cable trays and racks, lighting mast and poles.
- Storage tanks, spheres, vessels, columns and all other process equipment.
- Fence and gate for electrical equipment (e.g. transformer, yard etc.)
- Cable shields and armour
- Flexible earth provision for Wagon, Truck
- Shield wire

Conductor size for branch connection to various equipment shall be as per Installation details unless otherwise stated on earthing layout drawings.

All process pipelines shall be bonded and earthed at the entry and exist points of battery limit of hazardous area. Earth continuity conductors across pipe flanges shall not be provided as per OISD 110.

Steel pipe racks in the process units and offsite area shall be earthed at every 24metres.

Equipment / street light pole etc. located remote from main network may be earthed by means of individual earth electrode and earth conductor unless otherwise stated in specifications.

The main earthing network shall be used for earthing of equipment to protect against static electricity.

All medium and high voltage equipment (above 250V) shall be earthed by two separate and distinct

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 26 of 29
			REVISION: 0
			EDITION: 3

connections with earth.

Plant instrument system clean earthing, UPS system clean / safety earth shall be separate from the electrical earthing system.

All paint, scale and enamel shall be removed from the contact surface before the earthing connections are made.

All earthing connections for equipment earthing shall be preferably from the earth plate mounted above ground wherever provided. Equipment foundation bolts shall not be used for earthing connection.

Earth connections shall be made through compression type cable welded lugs.

All hardware used for earthing installation shall be hot dip galvanized or zinc passivated. Spring washers shall be used for all earthing connections and all connections adequately locked against loosening.

Lighting fixtures and receptacles shall be earthed through the extra core provided in the lighting circuit/ cable for this purpose.

The reinforcement of sub-station building and the sub-station floor shall be connected to main earth grid.

TESTING OF EARTHING SYSTEM

Earthing systems/connections shall be tested as follows:

Resistance of individual electrodes shall be measured after disconnecting it from the grid.

Earthing resistance of the grid shall be measured after connecting all the electrodes to the grid.

The resistance between any point on the metallic earth grid and the general mass of earth shall not exceed 1 ohm.

The resistance to earth shall be measured at the following:

- 1) At each electrical system earth or system neutral earth.
- 2) At each earth provided for structure lightning protections.
- 3) At one point on each earthing system used to earth electrical equipment enclosure.
- 4) At one point on each earthing system used to earth wiring system enclosures such as metal conduits and cable sheaths or armour.
- 5) At one point on each fence enclosing electrical equipment.

Measurement shall be made before connection is made between the ground and the object to be grounded.

3.8 LIGHTNING PROTECTION INSTALLATION:

Lightning protection shall be provided for the equipment, structure and buildings as shown on lightning

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 27 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

protection layout drawings. Self-conducting structures shall not require separate aerial rod and down conductors. These shall however be connected to the earthing system at two or more points as shown on earthing layout drawing. An independent earthing network shall be provided for lightning protection and this shall be bonded at least at two points with the main earthing network below ground. Lightning down conductor shall be brought to earth electrode in shortest straight path as feasible to minimize surge impedance. Aerial and down conductors shall be located avoiding interferences with other services such as ducts, pipes, equipment, supports etc.

3.9 BATTERIES:

Battery (Lead acid, Nickel Cadmium or VRLA type as specified) shall be erected on stands and insulators supplied by the manufacturer of the batteries. The installation shall be done as per the layout drawings and manufacturer's instructions. Electrolyte if required / as applicable shall be filled as per manufacturer's instructions. Inter row connections shall be made with the leads supplied by the manufacturer.

3.10 NEUTRAL EARTHING RESISTOR

The neutral earthing resistor shall be inspected for any damage to the resistor grid and other components. The resistor shall be levelled and installed. All covers etc. shall be checked for tightness to ensure that the enclosure of the resistor is dust, vermin and weatherproof. Earthing conductors shall be taken from the out-end terminal of the resistor, for connection to earth electrodes and to the main grid.

3.11 WELDING RECEPTACLES:

The welding receptacles shall be erected on steel/concrete structures as per the drawings. In isolated places a separate support shall be fabricated and installed.

3.12 PUSH BUTTON/CONTROL STATIONS

The push buttons / control stations shall be installed near to the motors to be controlled. Individual channel supports shall be installed as per standard. If control stations for hazardous areas are to be supplied by contractor, these shall be of Ex (d) type, tested by CMRI and approved by CCE or other applicable certifying authorities. All outdoor push buttons / control stations shall preferably have integral canopies for additional weather protection. The canopy shall be made of 2 mm thick galvanized sheet steel or FRP where these are not integral with the equipment.

3.13 Miscellaneous Items

Contractor shall provide the following items in substation, as per Indian Electricity Rules.

Fire buckets filled with clean dry sand and ready for immediate use for extinguishing fires and fire extinguisher (carbon dioxide, dry chemical extinguisher etc.) suitable for dealing with electric fires shall be conspicuously marked and kept.

First aid boxes containing ointments and medicines for immediate treatment of injuries (As prescribed by @MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO.	Page 28 of 29
		MEC/05/E9/TS/14	REVISION: 0
			EDITION: 3

Indian Red Cross Society or equivalent).

Instructions of restoration of persons suffering from electric shock in English, Hindi and local language of the district shall be affixed in a conspicuous place.

Danger boards (H.V., M.V.) shall be provided on transformer gate, switchboards, entrance to switchgear room and at other places as required by Purchaser.

Generators

Contractor shall install main, emergency or standby generators with their gas turbine or diesel engine drivers, and equipment associated with these 'packages', in locations as shown on the AFC contract drawings and in accordance with manufacturer's instructions. Contractor shall install and terminate interconnecting cables in accordance with equipment vendor's drawings and contract drawings.

Contractor shall check the installation and correctness of the various protection devices fitted to medium voltage machines. Anti-condensation heaters where fitted shall be connected up to a temporary supply and left energized as soon as equipment is delivered.

3.14 LIST OF CONSTRUCTION EQUIPMENT

The contractor shall have all necessary construction equipment, tools and tackles and testing instruments to carry out the erection works and to commission the system as specified. These shall include but not be limited to the following, and these shall be brought to site by contractor before the start of work.

Equipment

1. Portable grinder.
2. Portable welding machine.
3. Portable gas cutting / welding set.
4. Pipe threading machine.
5. Pipe bending machine(hydraulic).
6. Portable drill machine suitable to take up drilling for different sizes as per requirement.
7. Dewatering pump sets (diesel driven).
8. Power Hacksaw.
9. Conduit Dyset.
10. Hydraulic crimping Machine
11. Hand crimping tool.
12. Portable electric blowers, vacuum cleaners.
13. Miscellaneous items such as slings, pulleys, tarpaulins, wooden sleepers, ladders, etc. as required.
14. Safety belts, safety goggles, and gloves.
15. Separate tool kit for each Electrician.

Test Instruments

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	INSTALLATION OF ELECTRICAL EQUIPMENT	DOCUMENT NO. MEC/05/E9/TS/14	Page 29 of 29
			REVISION: 0
			EDITION: 3

1. Insulation tester 1000V hand driven.
2. Insulation tester 2500V motor/hand driven.
3. Insulation tester 5000V motor/hand driven
4. Phase sequence indicator.
5. Earth Resistance tester.
6. Single phase variac
7. 3 phases variac of adequate capacity.
8. Secondary injection testing kit (By Vendor).
9. Multimeter both analogue and digital
10. Portable Ammeters, Wattmeters, P.F. meters.
11. Portable Voltmeters.
12. Clip on meters of different ranges.
13. Tacho-meter.
14. Kelvins double bridge for measurement of very low resistance.
15. D.C. high -pot test kit.
16. Oil filtration machine of adequate capacity.
17. LUX METER to measure illumination levels.

TECHNICAL SPECIFICATION
FOR
FIELD INSPECTION, TESTING and COMMISSIONING

DOCUMENT No. : MEC/05/E9/TS/15

Prepared & Issued by



ELECTRICAL SECTION
(Oil & Gas SBU)
MECON LIMITED

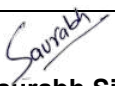
(A Govt. of India Undertaking)
13th & 15th Floor, North Tower, SCOPE MINAR,
Laxmi Nagar District Centre,
Delhi-110092 (India)

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 2 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

INDEX

S.No.	DESCRIPTION	PAGES
01.00	CODES AND STANDARDS	5
02.00	FIELD INTALLATION TESTING and COMMISSIONING	6
02.01	SWITCHBOARD	8
02.02	DG SET	10
02.03	BUSDUCT	11
02.04	TRANSFORMER	12
02.05	HV and MV MOTORS	13
02.06	POWER AND CONTROL CABLES	15
02.07	CABLE TRAY	18
02.08	LIGHTING INSTALLATION	18
02.09	CONDUIT AND WIRING	19
02.10	EARTHING INSTALLATION	22
02.11	LIGHTNING PROTECTION INSTALLATION	23
02.12	BATTERY, BATTERY CHARGER AND UPS	24
02.13	HIGH VOLTAGE TESTING	26
03.00	LIST OF CONSTRUCTION EQUIPMENTS	27
04.00	FIELD INSPECTION REPORT AND TEST PLAN FORMATS	
04.01	ELECTRICAL PANELS	28
04.02	DG SET	29
04.03	BUSDUCT	32
04.04	TRANSFORMER	34
04.05	MOTORS	35
04.06	CABLES	37
04.07	CABLE TRAY	36
04.08	INTERNAL LIGHTING	41
04.09	OUTDOOR LIGHTING	42
04.10	HIGH MAST	43
04.11	ELECTRICAL SWICTHES	44
04.12	CONDUIT WIRING	45
04.13	EARTHING	46
04.14	LIGHTNING PROTECTION	48
04.15	BATTERIES	50
04.16	UPS	51
05.00	INCOMING MATERIAL INSPECTION REPORT	52

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 3 of 52
			REVISION: 0
			EDITION: 3

Rev	Date	Prepared by	Checked by	Approved by
0	11.07.2025	 Chirosmita Banerjee	 Saurabh Singh	Pankaj Shrivastava

© Copyright MECON Limited – All rights reserved.
THIS DOCUMENT IS THE SOLE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED
HEREIN. THIS IS NOT TO BE COPIED OR USED FOR ANY OTHER PROJECTS UNLESS EXPLICITLY PERMITTED BY
MECON.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 4 of 52
			REVISION: 0
			EDITION: 3

AMENDMENT STATUS

(OLD NUMBER OF STANDARD: MEC/TS/05/E9/15)

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Document Number replaced with New number as MEC/05/E9/TS/15	All	Rev 0/ Ed 3	11.07.2025		
2	Section re-name as Electrical Section (Oil & Gas SBU) Delhi	All	Rev 0/ Ed 3	11.07.2025		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 5 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

1.0 INTENT

The intent of this standard specification is to define the general requirements for design, manufacture, assembly and testing at manufacturer's works, packing, transportation and receipt at site with all materials and accessories of Field Inspection, Testing and Commissioning.

1.0 CODES AND STANDARDS

- 1.1 The equipment shall comply with the requirements of latest revision of following standards issued by BIS (Bureau of Indian Standards), unless otherwise specified:

SP 30 (BIS)	National Electrical Code 2011
IS 1255	Code of practice for installation and maintenance of power cables up to and including 33kV rating
IS 7816	Guide for testing Insulation resistance of rotating machines
IS 10810: Part 43	Method of test for cables: Part 43 - Insulation resistances IS
10810: Part 45	Method of test for cables: Part 45 - High Voltage test
OISD-STD-137	Inspection of Electrical Equipment
OISD-RP-147	Inspection and safe practices during electrical installations

- 1.2 In addition to the above it shall be ensured that the field inspection, testing and commissioning conforms to the requirements of the following as applicable:

- Indian Electricity Act and Rules.
- Regulations laid down by CEA/Electrical Inspectorate.
- Regulations laid down by PESO / DGMS (as applicable).
- The petroleum rules (ministry of Industry Government of India).
- Any other regulations laid down by central/state/local authorities and Insurance agencies.

In case of imported equipment standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian standards.

The equipment shall also confirm to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.

In case of any contradiction between various referred standards/ specifications/ data sheet and statutory regulations the following order of priority shall govern. However, the stringent of the below shall be followed.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 6 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

- Statutory regulations.
- Schedule of Rate
- Scope of Work/ Job specification.
- Design Basis.
- Data sheets.
- Standard Specification.
- Codes and standards.

2.0 FIELD INSPECTION, TESTING AND COMMISSIONING

Contractor shall carry out complete filed inspection, testing and commissioning of electrical equipment as per Inspection Test Plans.

Before the complete installation or an addition to the existing installation is put into service, inspection/ pre-commissioning checks and tests shall carried out by contractor, In the event of defects being found out, the same shall be rectified and the installation retested as applicable.

The pre-commissioning inspection among the requirements shall include visual inspection, checking the workmanship of the installation, the rating of equipment, safety clearances sizes of cables installed, conformance to the AFC document, soundness of switchgear bus connections, wiring properly dressed and labelled, sealing of unused cable entries, checking of all safety interlocks, control/ interface functions as per requirements etc.

Visual inspection for soundness of bus bar connections of bus ducts, terminal connections of equipment / motor shall be carried out. After the visual inspection, all the covers of equipment manufacturers instructions. It shall be ensure that no foreign materials are present inside bus duct and equipment terminal boxes.

Pre- commissioning tests shall include but not be limited to the following. The works/testing at site shall be done as per the scope matrix between the site installation contractor and respective equipment vendor attached in each tender.

- Continuity test for each winding, power and control circuits.
- Insulation test for each winding, power and control circuit.
- High Voltage test for cables.
- Dielectric strength test on transformer oil.
- Magnetic Current Test and Magnetic Core Balance Test.
- Vector Group
- Voltage Ratio Test
- Short Circuit Test
- Winding Resistance Test for CTs, PTs, Closing coils & trip coil of breakers, Transformers for each tap position.
- WTI, OTI, Buchholz, PRV, MOG, Emergency Stop Simulations

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 7 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

- Checking the correctness of wiring schemes, control circuit interlocks for intended functioning.
- Verification of phase sequence.
- Testing of all types of relays/ releases for required operation.
- Testing of measuring instruments for proper functioning
- Polarity test, ratio test and Knee point voltage test for CT's and PT's
- Polarity test and ratio test for PT's.
- Earth continuity test for all circuits.
- Checking of safety features of correctness of operation etc.
- Checking of all wired interface contacts (analog, digital input/ output contacts) for PLC and ESD interface, at panel and equipment terminal chambers as applicable. (Contractor shall co-ordinate with the other agencies involved for the above and provide support service for checking interfaces of electrical equipments and the intended functioning)
- Earth resistance measurement for each earth electrode and the earthing system as a whole.
- Lighting installation shall be tested for correct illumination levels, with the fittings installed. Fittings shall be operated only With specified type of a lamp or tube.
- Checking of battery float and boost charge voltage at correct levels.
- Battery duty cycle test to meet the load cycle requirement shall be performed at site after installation as part of commissioning.
- Load trials as agreed between Vendor/Contractor and Purchaser.

After the above test and inspection are completed, control circuits shall be tested for correct operation under all operating combinations and proved correct applying power to main circuits.

A close visual inspection of electrical equipment in hazardous area shall be made to ensure that equipment is suitable for the classified zone and gas group and correctly installed, with all covers, bolts, nuts and hardware's intact and there is no physical damage mark seen on the enclosure.

Site Acceptance test procedure for specific equipment shall be furnished by the respective equipment vendor. The contractor shall provide necessary assistance to the equipment vendor to perform site acceptance testing to enable the equipment vendor to perform the same.

All pre-commissioning checks and tests shall be carried out as per the directions of Purchaser. In addition to the equipment manufacturers instructions, pre-commissioning check requirements shall also be complied. All tests shall be carried out by vender/contractor in the presence of Purchaser.

The Vender/contractor shall bring to site required tools, tackles and testing instruments for carrying out filed testing, Vender/Contractor shall use only calibrated measuring and test instrument and shall maintain calibrated records.

The Insulation Resistance test values for various electrical equipment shall be as mentioned below:

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 8 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

2.1 HV, MV and Miscellaneous Switchboards

The insulation resistance test values for switchboards shall be as per following table:

Rated Voltage of the Switchboard	DC Test Voltage in Volts	Minimum Insulation resistance in Mega ohms
33,000V	5,000	200
11,000V	5,000	200
6,600V	1,000	200
3,300V	1,000	200
415V	1,000	100
240V	500	10
110V	500	10

SITE TEST

- IR test
- HV test with 2.5 kV megger for 1 min.
- Functional test for all feeders.
- Testing and calibration of all meters.
- Checking and calibration of overload relays and protective relays by primary injection method.
- Check operation of contactors from local and remote points.
- Checking of interlocking between incomers/ bus couplers and other feeders
- Testing of CTs & PTs installed in panel (Ratio, polarity, winding resistance & class as per datasheet)
- Test of prove inter changeability of similar parts.
- Test to prove correct operation of breakers at minimum and maximum specified control voltages.
- Checking operation of RC circuit (if there) for tripping of circuit breaker after disappearance of control voltage.
- Checking of earthing connection for neutral-earth bus, cable armour, location of E/F CT etc. as per the scheme.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 9 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

- Checking of tests, service and draw out position of all the breakers and operations of mechanical flag indicator and electrical indication lamps.
- Checking the functioning of various electrical schemes like auto change over, signalling etc.
- Contact resistance test for bus bar & breakers.
- Timing test for ACBs & VCBs.
- Hi Pot test for Breakers (above 1100V).

Pre-Commissioning Check List:

Before commissioning any switchboard, following points shall be checked and ensured for safe energizing of the switchboard:

The installation of equipment to be commissioned is complete in all respects with its auxiliaries and all other mounting including earthing. Openings in floor within and outside panels have been sealed off. All cover and door gaskets are intact to make the enclosure vermin proof.

- a) All the metering instruments have been checked and found in working order. Indicating lamps are healthy and are in correct position. All power and control fuses are of proper rating.
- b) That the polarity test and ratio test of all the P.T.s and C.T.s is complete and phase sequence of C.T.s conforms to the correct vector group connections. Wiring continuity and correctness are ensured in the protection and measurement circuits. Polarity of D.C. supply for all the circuits is correct.
- c) The high voltage tests of incoming and outgoing cables have been conducted and results are satisfactory.
- d) All the protective relays including both conventional and microprocessor based numerical relays and thermal overload relays have been tested for secondary injection tests. (Primary injection tests shall be carried out for overload relays, differential protection, Restricted Earth fault protection at full / reduced current to ensure correctness of complete wiring). Relay settings, status indications, fault annunciations, data logging, display of switchboard SLDs shall be verified from MMI in case the same is provided.
- e) The I.R. Value has been recorded for bus bars, circuit breaker, incoming and outgoing cables, control wiring and potential transformers. Where required joint resistance of bus bars have been recorded and found to be satisfactory. All the surroundings and panels have been cleaned and temporary earth leads have been removed.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 10 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

2.2 DG SET

The Tenderer shall perform the preliminary acceptance test (PAT) and Final acceptance test (FAT) to ensure that the plant and equipment supplied by them meet purchasers' system requirements.

Primary acceptance test for equipment and system covered in the specification shall be conducted unit wise or group wise within a reasonable period after the completion of erection work which will be mutually agreed upon.

The following test shall be performed at site: -

1. Visual and Dimensional check
2. Starting up and interlock checking as per approved scheme.
3. Governor response
4. Voltage regulator response
5. Load test
6. Functional tests on control panel, Sync cum AMF Panel/Only AMF Panel.
7. Power output at 100% Capacity- No Negative Tolerance.
8. Auxiliary power Consumption.
9. Guaranteed fuel oil consumption at 75% PPR of the engine and maximum load on the DG set.
10. Lubricating oil consumption at 50% PPR of the engine.
11. Prime power Rating (PPR) output of the diesel generator set at site at various points of load test.
12. Noise level over maximum load range.
13. Vibration level over maximum load range.
14. HSD shall be the fuel for performance test at the factory and functional test at site.

All tools & test equipment as required for the tests to be conducted at site to be arranged by vendor. CT, PT & relays if any supplied by vendor, same to be tested as per individual equipment test procedure as mentioned elsewhere in MR/ SOR.

Field test report to be prepared & submitted duly signed by vendor & EPMC to the purchaser.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 11 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

2.3 BUS DUCT

The insulation resistance test values for Transformers shall be as per following table:

Rated Voltage (Highest System Voltage) KV (rms)	Standard Impulse Withstand Voltage KV(Peak)	One Minute Power Frequency Withstand Voltage KV(rms)
3.6	40	10
7.2	60	20
12.0	75	28
17.5	95	38
24.0	125	50
36.0	170	70

TEST

A. Routine Tests

- One min. power freq. withstand voltage.
- Measurement of insulation resistance.
- Measurement of resistance and reactance of bus bars.

B. Type Tests

- Heat run test
- Short time rating test (thermal & dynamic)
- Impulse withstand test
- Tests for degree of protection for enclosures

C. Site Tests

- IR measurement before and after HV test.
- HV test.
- Checking tightness of bolts with torque wrench.
- Checking for phase sequence marking.
- Check for clearances between phase to phase and phase to earth.
- Check for minor damages and cracks in supporting insulators and bushings after cleaning.
- Checking of bus bar cracks and rectification of same.
- Checking for inspection openings and accessibility for replacement of insulator etc.
- Check tightness of earthing connections on enclosure.
- Checking of silica gel breather (if there).
- Checking of working of space heater.
- Contact Resistance Measurement Test

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 12 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

2.4 TRANSFORMERS

The insulation resistance test values for Transformers shall be as per following table:

Rated Voltage of the Transformers	DC Test Voltage in Volts	Minimum Insulation resistance in Mega ohms
Up to 600V	1,000	100
601 to 500V	2,500	1,000
5001 to 15,000V	5,000	5,000
15001 to 35,000V	5,000	10,000

It shall be ensured that during insulation tests, electronic devices and components that are liable to get damaged on applied test voltage shall be disconnected from circuit. The instructions of equipment / panel manufacturer shall be followed strictly in this regard.

For medium voltage (up to 1000V), 1000V Megger and for high voltage 5kV Megger shall be used.

Testing

A. Routine Tests

- i) Assembly inspection/ Painting check
- ii) Measurement of winding resistance
- iii) Measurement of voltage ratio and check of voltage vector relationship
- iv) Measurement of impedance voltage (Principal tapping), short circuit impedance and load loss.
- v) Measurement of no-load and current.
- vi) Measurement of insulation resistance/ polarization index.
- vi) Dielectric test:
 - a) Induced over voltage withstand test
 - b) Applied voltage withstand test
(H.V. power frequency test)
- vii) Certification for off-load tap changer
- viii) Final documentation check

B. Type Tests

- i) Temperature rise test
- ii) Measurement of acoustic sound level
- iii) Lightning impulse withstand test (if test certificates are not available)

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 13 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

- iv) Short circuit test
- v) Measurement of commutating reactance and determination of inductive voltage drops (for thyristor converter transformer only).

Site Tests

The tests to be carried out on the equipment at pre-commissioning stage will include following but not limited to the following:

- IR test on each winding to ground and between winding and check for polarization index.
- Turns ratio test on each tap
- Polarity and vector group test
- Measurement of winding resistance at each tap position for windings by Kelvin bridge.
- Heating and drying and checking with heating and cooling curve.
- Checking of earthing wrt transformer tank (flexible from top cover to tank) other parts, neutrals and tank to electrodes of LAs (for LAs located near transformer).
- Testing of Buchholz relay for alarm and trip conditions.
- For bushing (SEF & REF) CTs, tests applicable will be as for current transformers.
- Calibration and setting of oil/winding temperature indicators, level gauge. OTI & WTI transducers for 4-20mA output & its integration with DCS System
- Check insulators for cracks.
- Checking for oil leakage and arresting of leakages (if required)
- Checking of operation of all valves.
- Checking of open operation of all valves (except drain and filter set)
- Filtration of oil by using line filter and heater set
- BDV test on Oil samples from top & bottom
- Checking of Oil for acidity, water content and tan delta as per IS 335.
- Measurement of magnetizing current and no-load loss.
- Checking of silica gel breather.
- Checking of noise level at no load and at full load.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 14 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

- Checking of air circulation conditions for indoor transformers.
- Conducting magnetic balance test.
- Checking of other points given in manufacturer's commissioning manuals.
- IR, wiring and operational tests on all control devices in control cabinet, oil level indicator winding and oil temp. indicators, oil pump, cooling fan etc.

2.5 Generators and Motors

The insulation resistance test values for Generators and Motors shall be as per following table:

Rated Voltage of the Generators and Motors	DC Test Voltage in Volts	Minimum Insulation resistance in Mega ohms
11,000V	5,000	120
6,600V	1,000	80
3,300V	1,000	50
415V	1,000	15
240V	500	12

Testing

A. Routine Tests

The following are the routine tests carried out on each and every motor:

- 1 Measurement of resistance.
- 2 Insulation resistance test.
- 3 Motors are tested at 1/3 times the rated voltage for checking the ability of the motor to run upto full speed, when switched in either direction.
- 4 No load test.
- 5 High voltage test.

B. Type Tests

- 1 Measurement of rotor resistance.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 15 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

- 2 No load test
- 3 Locked rotor test.
- 4 Full load reading of voltage, current, power input and slip.
- 5 Temperature rise test.
- 6 Momentary overload test.
- 7 Insulation resistance test.
- 8 High voltage test.
- 9 Polarization index test (for HT motors)

2.6 CABLES

Before energizing, the insulation resistance of every circuit shall be measured from phase to neutral and from phase/neutral to earth.

Where splices or terminations are required in circuits rated above 650 volts, insulation resistance of each length of cable shall be measured before splicing and /or terminating. After completion of splices and /or terminations measurements shall be repeated.

The insulation resistance of directly buried cable shall be measured before cable trenches are back filled. Measurements shall be repeated after backfilling.

D.C. High Voltage test shall be conducted on cables given below after installation.

- a) All 1100 volts grade cables in which straight through joints have been made.
- b) All cables above 1100V grade.

Cables shall be installed in final positions with all the straight through joints complete.

During the high voltage test, all other electrical equipment related to the cable installation, such as switches, instrument transformers, bus bars, etc., must be earthed and adequate clearance shall be maintained from the other equipment and framework to prevent flash overs. In each test, the metallic sheath/screen/armour shall be connected to earth.

The insulation resistance test values for cables shall be as per following table:

Rated Voltage of the Cable	DC Test Voltage in Volts	Minimum Insulation resistance in Mega ohms
Lighting and power circuit wiring	250	1
650 /1100V grade cables	1,000	10
1,900/3,600V grade cables	1,000	200

MECON LIMITED REGD. OFF: RANCHI 834002		TECHNICAL SPECIFICATION		
		ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15		Page 16 of 52
				REVISION: 0
				EDITION: 3
	3,800/6,600V grade cables	1,000	200	
	6,350/11,000V grade cables	5,000	200	
	8,700/15,000V grade cables	5,000	200	
	12,700/22000V grade cables	5,000	200	
	19,000/33000V grade cables	5,000	200	

For cables up to 1.1KV grade 500V megger and for HV cables 2.5KV/5KV megger shall be used.

Insulation resistance value of the cable shall be taken before & after lying of cables and before energizing the cable. The IR values shall be recorded in the approved inspection test plan formats.

For cables of above 1100V grade, the DC high voltage test shall be performed before energizing the cable. During the DC high voltage test shall be conducted on all 1100 volts & above grade cables in which straight through joints have been made. All other electrical equipment related to the cable installation such as switches, instrument transformers, bus bars etc. must be earthed and adequate clearance shall be maintained from other equipment and framework to prevent flashover. In each test, the metallic sheath/screen/armor shall be also connected to earth.

For record purposes test data shall include the measure values of leakage current versus time.

The D.C. high voltage test data shall be performed as detailed below in the presence of the engineer-in-charge or his authorized representative only. Terminations shall be kept unfinished so that motors, switchgear, transformer etc are not subjected to test voltage.

The test voltage shall be under: -

- i) For cables 3.3 KV grade 5.4 KV DC
- ii) For cables 6.6 KV grade 10.8 KV DC
- iii) For cables 11 KV grade 18 KV DC

Testing Shop Tests

The cables shall be subject to shop tests in accordance with relevant standards to prove the design and general qualities of the cables as below: -
Routine test on each drum of cables

Acceptance tests

On drum chosen at random for acceptance of the lot

High Voltage withstand test for HT cable (Hi Pot test)

Type tests certificates on each type of cable, inclusive of measurement of armour D.C. resistance of power cables will be furnished by Contractor

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 17 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

PACKING

- Cables will suit barrel diameter and securely clamped/fixed. The barrels must be sufficiently strong to withstand mechanical shocks and shall effectively protect against transit.
- Both ends of cable will be metal capped to prevent moisture ingress. Ends shall be kept inside the cable drum in a manner so that these are accessible for testing.
- Cable drum identification/markings will be as follows:
 - Maker's name
 - Consignee's full address
 - Type size and length of cables
 - Net and gross weights
 Any other marking for shipping Drum Markings

Drum Lengths

- LT Cables will be delivered at site preferably on standard drums each containing 500 m or 1000 m cables, where total quantity of a particular cable is less than 500 m, the entire length will be supplied in one drum.
- For 90% cable drum of each item of cable permissible tolerance is in length + 5% For 10% balance cable drums, Contractor shall ensure that each 500 m capacity drum contains at least 250m and each 1000m capacity drum contains at least 500m cable lengths. Overall tolerance for each item of cable is + 1% of total length.

SITE TEST

- Visual check
- Checking of continuity and IR values for all the cables before and after HV test.
- HV test and measurement of leakage current after termination of cable kits.
- Checking of earth continuity for armour and fourth core (if applicable)
- Check for mechanical protection of cables.
- Check for identification (tag number system) distance placement of cable marker, cable joint etc. as per the cable layout drawing.
- Check earthing of cable structures.
- Check safe head room in tunnel and basement area.
- Check clearance from ventilation duct and light fittings for cable structures.
- Check proper fixing of cable structures.
- Check for proper drainage and removal of water (if any).
- Lightning Protection
- Check continuity of all the earth strips / shield wire.
- Check tightness of all connections.
- Measure earth resistance of each electrode and combined system.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 18 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

2.7 CABLE TRAY

1. All cable trays used are G.I tray type as per specification.
2. Cable trays shall be hot dip galvanized, either ladder type or perforated type
3. The cable trays shall be in standard length sections. Individual sections shall be securely bolted together on 50 X 50 X 5 mm painted iron angles.
4. The cable trays shall be supported on 65 x 65 x 5mm painted iron angle painted as per specification/approved drawing.
5. Vertical support shall be ISMC 100 and insertion plates shall be provided in cable trench to support cable trays.
6. All support work shall be completed prior to installation work
7. 10% future space shall be provided for future cables.
8. Supports shall be provided at an interval of 1.0 meters or as per the drawing.

2.8 LIGHTING INSTALLATION

Pre-commissioning checks and tests shall include but not be limited to the following:

- a) The insulation resistance of each circuit without the lamps (load) being in place shall be measured and it should not be less than 1000,000 ohms. (Between phases, phases to neutral, phase/neutral to Earth).
- b) Current and voltage of all the phases shall be measured at the lighting panel busbars with all the circuits switched on with lamps. If required load shall be balanced on the three phases.
- c) The earth continuity for all socket outlets shall be checked. A fixed relative position of the phase and neutral connections inside the socket shall be established for all sockets.
- d) After inserting all the lamps and switching on all the circuits, minimum and maximum illumination level shall be measured in the area and recorded.
- e) It shall be ensured that switch provided for ON/OFF control of point (light/fan/socket) is only on LIVE side.
- f) Operation of ELCB's shall be checked
- g) focusing angle of fixtures shall be changed/ adjusted where required.
- h) All the luminaires will be designed, manufactured and tested in accordance with the Indian Standards as far as they are applicable.
- i) All the luminaires will be industrial type. Specification for the various types of sodium vapour and fluorescent fittings mentioned in the schedule of quantities will be followed. All the lighting fixtures will be complete with all parts along with lamps/tubes, control gears and accessories for installation and efficient performance whether specifically mentioned in the specification or in the schedule of items or not.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 19 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

- j) Individual light fittings will be provided with suitable gland arrangements for 3x2.5 sq.mm armoured copper cable entry unless otherwise specified. Terminals of all fittings will be suitable for taking 3x2.5 sq.mm, copper conductor PVC insulated and PVC sheathed cable.
- k) All fittings will be supplied with all interconnections made and fully wired upto the terminal block.
- l) All live parts will be provided with suitable sleeves to prevent accidental contacts. The earthing terminal in the fitting will effectively earth the body of the entire luminaire.
- m) Dust and vapour tight fittings will have the enclosures suitably designed to withstand the heating effect.
- n) The fixing arrangement of various components and lamps will be in such a way that the maintenance and replacement jobs can be easily carried out.
- o) All flameproof equipment will be provided with flameproof plugs.
- p) Flame proof fittings and control gearboxes will be provided as per relevant IS in hazardous area.

Final Test of Materials of lightning system

1. Visual check
2. Dimensional check
3. Accessories fitting check
4. Mechanical and electrical test (where applicable)
5. Final documentation check.

2.9 CONDUIT AND WIRING

A) CONDUIT INSTALLATION

Embedded Conduit

I. Installation

- a. Conduit installation may be embedded in RCC structures or brick work as per the approved drawing.
- b. The installation in RCC structures shall be carried out before concrete after the completion of form work and reinforcement work.
- c. Conduit size shall be as per the requirement. However minimum size of the conduit shall be 25 sq. mm.
- d. Conduits laid in concrete shall have minimum 50mm cover up to the finished surface and shall preferably be laid behind the reinforcement.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 20 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

- e. Conduits shall be securely fixed to prevent their movement during concreting.
- f. Proper care shall be taken while installing the conduit near the beam and conduit openings shall be left for the light points as per the direction of the site engineer.
- g. Installation in brickwork will require chases to be made in brick work, sufficiently deep to provide adequate cover for the conduits.
- h. All embedded accessories such as junction boxes, switchboxes, etc. shall be mounted in such a way that they shall be flushed with the finished surface including plaster.
- i. All joints in the installation shall be tight and properly covered to prevent ingress of concrete slurry, water or dust.
- j. Conduits for bracket mounted lights shall be provided up to parapet of the wall for their electrical connection.
- k. Each fixture shall be connected to Earth Wire.

II. Surface Conduit Installation

- a. When conduits are exposed on surface, the complete routing shall be marked on the surface as per approved drawing. Conduit installation shall be carried out neatly with conduits runs truly vertical or horizontal.
- b. All screwed connections shall ensure that at least five threads are engaged and electrical continuity shall be maintained.
- c. Conduits & flexible PVC conduits shall be used for wiring in false ceiling.
- d. Conduits & flexible PVC conduits shall be used for wiring above the surface wherever required.
- e. Conduits shall be supported with saddles at a spacing of 1200mm maximum for conduits up to 25mm size and 1800mm for larger sizes. Saddles shall also be provided at both the fittings, Equipment, devices, junction boxes, bends and offset within 200mm maximum. However, this method shall be implemented only for open conduiting and not for concealed one.
- f. Minimum clearance between conduits and surface shall be 6mm. Saddles shall be cast /malleable iron, cast aluminium or any other approved materials and galvanized painted.
- g. Each electrical point, provisions to be provided to connect it by two ways/paths. Conduits shall be provided accordingly

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 21 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

h. All the conduits from SSB/Power points/Fixture terminated below LDB shall be identical & have good aesthetic appearance.

i. Conduit terminated below LDB shall be identical & the aesthetic appearance shall be good.

Conduit wiring (Supply & Point

III. wiring) :-

- a. Conduit wiring shall generally be carried out with single core PVC insulated cables / wires.
- b. The conduit installation shall be complete in all respects before the cables drawn in conduits.
- c. The cables shall be neatly bunched together to prevent kinks or twisting.
- d. Each point wiring shall comprise the following:

- * Insulated copper single core wires of 600/1100v grade (HR PVC) and including one number for earthing. For suspending of fluorescent light fitting dome cover junction box shall be used. All wiring shall be done by using 2 Nos. of 1.5 Sq mm wires (one each for Phase & Neutral) plus 1 No. 1.5 sq.mm. wire for Earthing). Wiring for industrial socket for AC and power points shall be done by using 2 Nos. of 4 sq mm wire plus 1 No. of 2.5 sq mm wire as earthing.
- * Color Code:-Phase- Red, Yellow, Blue. Neutral- Black. Earthing- Green.
- * Wiring for exhaust fans shall be terminated in ceiling roses/receptacles and the connection from ceiling roses/receptacles to the exhaust fan shall be by means of a flexible cord equivalent in size to the main run of wires. For exhaust fan of battery room no plug shall be provided near to exhaust fan.
- * Fabrication and fixing of hardware such as clamp, saddles, bolts, nuts, frame work etc as required. PVC insulated 1 Sq mm wire for copper earthing shall be run within conduits for earthing of fittings, junction boxes, switch/single phase socket outlet / enclosures.
- * Each wire shall be traced for continuity, insulation testing and connection to be made at both ends
- * Earthing shall be done at single point only.
- * After erection, the entire conduit system shall be tested through-out, for mechanical & electrical continuity & shall be permanently connected to earth by means of earthing clamps, in accordance with Indian Electricity Rules.
- * All conduits shall be IS certified & tested.
- * For guard room, 3 Nos. of cable shall be used and junction boxes shall be provided for termination of these cables for normal power, emergency power and bore well starter.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 22 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

* Battery room SSB shall be located outside the room and exhaust fan of the battery room shall be directly connected to wiring (no plug socket required)

* Each Fixture shall be connected to earth wire.

2.10 EARTHING INSTALLATION

Earthing systems/ connections shall be tested as follows:

- a) Resistance of individual earth electrodes shall be measured after disconnecting it from the grid by using standard earth test megger.
- b) Earthing resistance of the grid shall be measured after connecting all the earth electrodes to the grid. The resistance value of an earth grid to the general mass of earth shall be as follows:
 - For the electrical system and equipment, a value that ensures the operation of the protection device in the electrical circuit but not in excess of 1ohm.
 - For lighting protection, the value of 5 ohms as earth resistance shall be desirable, but in no case it shall be more than 10ohms.
- c) The resistance to earth shall be measured typically at the following points:
 - At each electrical system earth or system neutral earth.
 - At each earth provided for structure lighting protections.
 - At one point on earthing system used to earth electrical equipment enclosures.
 - At one point on earthing system used to earth wiring system, enclosures, such as metal conduits and cable sheaths or armour.
 - At one point on fence enclosing electrical equipment.

SITE TEST

- Check tightness of all earth connections.
- Check earthing of all metallic equipment, cable trays, busbar supporting structures, building column (if steel) all electrical equipment, pipe lines etc. as per the drawing / specification
- Measurement of earth resistance for each electrode.
- Measurement of total earth resistance.
- Measurement of earth loop resistance for E/F path of biggest LT drive.

Final Test of Materials of earthing system

- i) Visual check
- ii) Dimensional check

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 23 of 52
			REVISION: 0
			EDITION: 3

- iii) Accessories fitting check
- iv) Mechanical and electrical test (where applicable)
- v) Final documentation check

2.11 LIGHTNING PROTECTION INSTALLATION

All buildings and plant structures vulnerable to lightning strokes owing to their height or exposed situation shall be protected against atmospheric flash over and lightning strokes in such a manner as to eliminate any danger to the personnel employed therein. Stipulations of IS : 2309 - 1969 shall be followed.

A 'Faraday Cage' made of hot galvanised strip steel connected to all buried pipes and steel structures crossing this cage ring shall be laid around each main building or plant unit as earthing device. This shall be separate from the electrical equipment earthing ring main.

All lightning arrestor earth leads of the buildings and plant units shall be connected to this cage ring.

Air termination network should cover all salient points of the structure. All metallic chimneys, ducts and the like above the roof of the structure shall be bonded to and form part of the air termination network. Vertical air termination points shall project at least 30 cm above the object on which it is fixed.

Down conductors shall follow the most direct path possible between air termination and earth termination avoiding sharp bends. Down conductor shall have a testing point adjacent to the earth electrode. Each conductor shall have an independent earth termination. All earth terminations shall be interconnected.

Earthing electrodes and grid for lightning protection will be distinct separate from the earthing system for earthing of electrical equipment and at no place will be connected to other earthing system.

Earthing connection to equipment subject to movement, vibration and shocks, shall be through flexible stranded conductors.

The termination of strips to the equipment shall be done by bolting and the wires shall be terminated by compression lugs. Jointing of strips shall be done by welding for proper continuity. All contact surfaces shall be thoroughly cleaned of dust and oil and after jointing, the joints shall be given bitumen paint.

Guidelines for installation of Earthing Conductor

- Earthing conductors laid directly in ground for **Lightning protection**, shall be coated with one coat of bituminised paints, be wrapped with one layer of bitumastic tape laid on half lapped and shall have a final coat of bituminised paint to prevent corrosion.
- Earthing conductors run on walls/floors/cable and equipment structures etc. shall be supported at suitable intervals and painted with black oxide paint.
- All joints in all kind of Earthing conductors except at earthing electrode shall be welded and painted

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 24 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

black with bitumen paint.

- At road /rail crossings earthing strips shall be laid through conduits /concrete ducts.
- Special earthing shall be provided for all electronic equipment as per manufacturer's recommendations / practice.

2.12 BATTERY, BATTERY CHARGER & UPS SYSTEM

Pre-Commissioning Checks

- All Pre-Commissioning checks to be carried out shall be in full compliance with the Inspection Test Plan.
- All the test instruments used shall be calibrated before use and shall have a valid calibration certificate.
- All the tests on live circuits shall be carried out under permit control applying lock out tag procedures.
- The testing engineer shall carry out the pre-commissioning checks after obtaining the permit to work.
- All the incoming & outgoing control & power cables to be connected.
- Tightness of all the connections shall be checked and panel to panel inter panel wiring to be completed.
- The IR value of main bus bars, distribution bus bars and neutral bus bars is to be checked as per vendors manual and recorded.
- Mechanical operation of breakers shall be checked.
- Schemes shall be checked as per the schematic diagram.
- Electrical operation of breakers, Simulation and interlocks shall be checked before the energization of panels / boards.
- Battery to be filled with electrolyte and cleaned & hold to settle.
- The batteries shall be charged as per the vendors Manual.
- Specific gravity, temperature & Voltage of individual cells shall be checked and recorded as per the Inspection test Plan.
- All the safety requirements of testing are covered under the risk assessment for Electrical work. All testing shall be carried out on dead circuits prior to Energization.
- All the tests on live circuits shall be carried out under permit control applying lock out tag out procedures.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 25 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

- Measure the earth path resistance at the main earthing terminal.
- Measure the voltage and specific gravity of each cell and compare with the recommended values.
- When all the inspection and tests have been carried out, the batteries may be given their initial charge. This may be carried out under the supervision of vendor's representative on site. The boost and float charge voltage settings should be noted and confirm the current limit settings.
- Check the operation of the battery earth fault alarm and measure the earth current flowing for a zero-impedance earth fault.
- Check the operation of all alarms and trips including the main supply and charge failure alarms.
- Check the operation of the DC over and under voltage alarms and trips.
- After reaching required voltage and specific gravity levels stop the battery bank charging and put under standby as per vendor's manual recommendation.
- Functional check shall be carried out on each charger and UPS.
- If number of battery bank is two then parallel operation for charging to be checked with battery charger and UPS.
- Carry out a battery discharge test using the vendor procedure and record the results including decay graphs.
- Recharge the battery at completion of discharge test, record the specific gravity of the electrolyte and cell volts.

Commissioning

- The UPS/Battery Charger shall be commissioned only after successful completion of pre-commissioning tests/checks. The commissioning program shall be communicated to all concerned persons in advance.
- All the tests on live circuits shall be carried out under permit control applying lock out tag out procedures.
- The setting of all the relays shall be done as per relay coordination charts.
- All the commissioning activities shall be carried out under the direct supervision of the vendor / Company representative.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 26 of 52
			REVISION: 0
			EDITION: 3

2.13 HIGH VOLTAGE TESTING

D.C. high voltage test shall be conducted as per following table on all H. V. feeder cables and also on 1100V grade cables where straight through joints have been made.

Rated Voltage of Cable (kV)	TEST VOLTAGE (kV) BETWEEN		Duration (Minutes)
U _o / U *	Any Conductor and Metallic Sheath / Screen / Armour	Conductor to Conductor (For Unscreened Cables)	
0.65/1.1	3	3	5
1.9/3.3	5	9	5
3.3/3.3	9	9	5
3.8/6.6	10.5	18	5
6.6/6.6	18	18	5
6.35/11	18	30	5
11/11	30	30	5
12.7/22	37.5	-	5
19/33	60	-	5

* U_o : Phase Voltage

U : Line Voltage

The cable cores must be discharged on completion of DC high voltage test and cable shall be kept earthed until it is put into service.

DC test voltage for old cables shall be 1.5 times rated voltage or less depending on the age of cables, repair work or nature of joining work carried out, etc. In any case, the test voltage shall not be less than the rated voltage.

All protective relays including thermal overload relays shall be tested by secondary injection current. Primary injection tests shall be carried out for differential protection, restricted earth fault protection at full/ reduced current to ensure correctness of complete wiring.

Before energizing any equipment, 'COMMISSIONING CLEARANCE FORM' as per standard format shall be duly filled in by contractor and submitted to MECON/ Owner. It shall be ensured that the electrical inspectorate approval is available before energizing the equipment.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 27 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

3.0 LIST OF CONSTRUCTION EQUIPMENT

The contractor shall have all necessary construction equipment, tools and tackles and testing instruments to carry out the erection works and to commission the system as specified. These shall include but not be limited to the following, and these shall be brought to site by contractor before the start of work.

EQUIPMENT

1. Portable grinder.
2. Portable welding machine.
3. Portable gas cutting / welding set.
4. Pipe threading machine.
5. Pipe bending machine(hydraulic).
6. Portable drill machine suitable to take up drilling for different sizes as per requirement.
7. Dewatering pump sets (diesel driven).
8. Power Hacksaw.
9. Conduit Dyset.
10. Hydraulic crimping Machine
11. Hand crimping tool.
12. Portable electric blowers, vacuum cleaners.
13. Miscellaneous items such as slings, pulleys, tarpaulins, wooden sleepers, ladders, etc. as required.
14. Safety belts, safety goggles, and gloves.
15. Separate tool kit for each Electrician.

TEST INSTRUMENTS

1. Insulation tester 1000V hand driven.
2. Insulation tester 2500V motor/hand driven.
3. Insulation tester 5000V motor/hand driven
4. Phase sequence indicator.
5. Earth Resistance tester.
6. Single phase variac
7. 3 phases variac of adequate capacity.
8. Secondary injection testing kit (By Vendor).
9. Multimeter both analogue and digital
10. Portable Ammeters, Wattmeters, P.F. meters.
11. Portable Voltmeters.
12. Clip on meters of different ranges.
13. Tacho-meter.
14. Kelvins double bridge for measurement of very low resistance.
15. D.C. high-pot test kit.
16. Oil filtration machine of adequate capacity.
17. LUX METER to measure illumination levels.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 28 of 52
			REVISION: 0
			EDITION: 3
Client and EPMC LOGO	INSPECTION REPORT FOR PANELS / DISTRIBUTION BORAD		
Contractor LOGO	PROJECT:	JOB ID	
	CLIENT:	DOC ID	
	EPMC:	REV	
	CONTRACTOR:	REPORT NO	
LOCATION/ AREA:		DATE	
PRELIMINARY CHECKOUT			
SL NO	ACTIVITY	INSPECTION STATUS	REMARKS
1	Permanent Installation/ alignment, Checking of base channel, correct provision of grouting.		
2	Input supply available and termination complete.		
3	Panel interconnection correct		
4	Check the cleanliness inside the panel.		
5	All bolted connection inspected for tightness		
6	Proper termination of cable and wiring continuity		
7	Check all connection are tightened & ferruled		
8	Proper earthing of panel (doubly earthed)		
9	IR check of incoming and outgoing cables		
10	All cable check for proper cable tag		
11	Check function and operation		
12	Proper glanding termination		
13	Check name plate of panel		
14	Sealing of dummy hole in gland plate		
Remarks			
For(contractor Name)		For (EPMC/Client)	
Name		Name	
Sign		Sign	
Date		Date	

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 29 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR DIESEL GENERATOR						
Contractor LOGO	PROJECT:				JOB ID		
	CLIENT:				DOC ID		
	EPMC:				REV		
	CONTRACTOR:				REPORT NO		
LOCATION/ AREA:					DATE		
Test Equipment type /Brand					Calibration date		
SL NO	Activity	Inspection Status	Remarks		Activity	Inspection Status	Remarks
1	EXTERIOR OF EQUIPMENT			14	EQUIPMENT IDENTIFICATION		
2	COMPLETENESS OF ASSEMBLY			15	BRACING		
3	EQUIPMENT ROTATION			16	PROPER PHASE CONNECTIONS		
4	CHECK OIL LEVEL			17	REFERENCE DRAWINGS		
5	CHECK FUEL LEVEL			18	WORKING CLEARANCE		
6	PROPER EQUIPMENT GROUNDING			19	ANCHORAGE		
7	CHECK METERS/GAUGES			20	ALL FILTERS AND VENTS CLEAR		
8	CHECK TIGHTNESS OF BOLTED CONNECTIONS			21	CHECK EQUIPMENT ENVIRONMENTAL CLASSIFICATION		
9	VERIFY GOVERNOR AND REGULATOR			22	CHECK FOR PROVISIONS OF SPILL CONTAINER		
10	CHECK VIBRATION			23	CONTROL SYSTEM		

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002		TECHNICAL SPECIFICATION						
		ELECTRICAL SECTION (OIL & GAS SBU) DELHI						
TITLE		FIELD INSPECTION, TESTING and COMMISSIONING		DOCUMENT NO. MEC/05/E9/TS/15		Page 30 of 52		
						REVISION: 0		
						EDITION: 3		
11	CHECK BATTERIES			24	CHECK FUEL FILTER			
12	CHECK RADIATOR FLUID			25	CHECK ALARM INDICATORS: PROPER COLOR FOR EACH FUNCTION			
13	PROPER SYSTEM GROUND			26				
VOLTAGE		R-N	Y-N	B-N	R-B	Y-B	R-Y	
CURRENT		R	Y	B	N	G		
INSULATION RESISTANCE @V		R-GRID	Y-GRID	B-GRID	R-B	Y-B	R-Y	
POLARIZATION INDEX RATIO = 10 MINUTE/1 MINUTE								
DC OVER POTENTIAL TEST @V								
LOAD TESTS AS A PERCENTAGE OF GENERATOR RATING								
		NO LOAD	25%	50%	75%	100%	110% (Prime Engine Only)	
	R-N							
	Y-N							
	B-N							
	R-B							
	Y-B							
	R-Y							
	R							

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 31 of 52
			REVISION: 0
			EDITION: 3

Y						
B						
N						
G						

Remarks	
For(contractor Name)	For (EPMC/Client)
Name	Name
Sign	Sign
Date	Date

- NOTES:**
- PERFORM 5 MEASUREMENTS AT ONE MINUTE INTERVALS.
 - DC HIPOT MEASUREMENTS SHOULD BEGIN AT 20% OF MAXIMUM TEST VOLTAGE AND INCREASE IN EQUAL INTERVALS.
 MAX DC TEST VOLTAGE = R (2 x NAME PLATE RATING) x 1.6
 WHERE R = .8 FOR DC TEST ON INSTALLATION
 R = .6 FOR DC TEST AFTER SERVICE
 (TEST MEASUREMENTS SHOULD NOT EXCEED MANUFACTURER'S RECOMMENDATION)
 - VOLTAGE MEASUREMENT TO BE MADE AFTER GENERATOR IS STARTED AND CONNECTED TO LOAD (CAN USE LOAD BANK).
 - DURING COMMISSIONING OF GENERATOR SETS OR ANY EQUIPMENT, A REPRESENTATIVE OF THE MANUFACTURING COMPANY OR SUPPLIER MUST BE PRESENT TO WITNESS AND/OR PERFORM THE TESTS.
 - ENGINE GENERATOR TESTING IS A VERY INTENSIVE PROCESS AND REQUIRES A 10 TO 14 HOUR DAY DEPENDING ON THE EQUIPMENT BEING COMMISSIONED. SUPPLIER/MANUFACTURER NORMALLY SUPPLY GENERATOR TESTING LOAD REQUIREMENTS.
 - VERIFY ALL SYSTEM CHECK POINTS DURING LOAD CHANGES AND RECORD PER SPECIFIED REQUIREMENTS AND/OR EQUIPMENT MANUFACTURER.
 - PERFORM AND RECORD ENGINE MANUFACTURER'S RECOMMENDED CHECKS AND INSPECTIONS.

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 32 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR BUSDUCT		
Contractor LOGO	PROJECT:	JOB ID	
	CLIENT:	DOC ID	
	EPMC:	REV	
	CONTRACTOR:	REPORT NO	
LOCATION/ AREA:		DATE	
SL NO	ACTIVITY	INSPECTION STATUS	REMARKS
1	Ensure that the switch board terminal box & the transformer terminal boxes are inspected & cleared before proceeding to the busduct installation.		
2	Check the equipment no. And rating as per drawings, no physical damage etc.		
3	Check availability of all accessories		
4	Inspect the bus duct insulators for any physical damage occurred during the transit.		
5	Check bushing cracks, chips or presence of dirt. Bushing cleaned as per vendor's instruction		
6	Ensure various section of bus duct enclosures are coupled together by using proper gaskets & bellow as specified.		
7	Ensure the busbar are properly fixed & coupled on the Insulator and correct phase are connected at both ends.		
8	Ensure bus bar joints are insulated using manufacturers recommended materials, wherever required.		
9	Prior to closing of the bus duct cover, ensure that the bus duct enclosure are cleared of tool/ loose materials and debris.		
10	Ensure enclosure of bus duct & support structures earthed (to the earthing grid) as per drawing.		
Remarks			
For(contractor Name)		For (EPMC/Client)	
Name		Name	
Sign		Sign	
Date		Date	

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 33 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSULATION RESISTANCE & TEST OF BUSDUCT												
Contractor LOGO	PROJECT:					JOB ID							
	CLIENT:					DOC ID							
	EPMC:												
	CONTRACTOR:					REV							
LOCATION/ AREA:						REPORT NO							
						DATE							
Megger detail	Make	serial no.			Model			Calibration due date					
Bus Bar	Insulation Resistance in M.OHMS										Applied Voltage	Continuity	Remark
	R-E	Y-E	B-E	R-Y	Y-B	B-R	R-N	Y-N	B-N	N-E			
Section													

2. TORQUE TEST

Joints has been tightened and Torqued at Nm

Ensure the bus bar are properly fixed and coupled on the insulators and correct phases are connected at both ends.

3. SPACE HEATER

Temperature setting of Thermostat

Load current of SH

.....

Functional Check

Ok/ Not Ok

Remarks

For(contractor Name)	For (EPMC/Client)
Name	Name
Sign	Sign
Date	Date

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 34 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR DISTRIBUTION TRANSFORMER		
Contractor LOGO	PROJECT:	JOB ID	
	CLIENT:	DOC ID	
	EPMC:	REV	
	CONTRACTOR:	REPORT NO	
LOCATION/ AREA:		DATE	
PRELIMINARY CHECKOUT			
SL NO	ACTIVITY	INSPECTION STATUS	REMARKS
1	Proper installation and alignment of 2 Pole structure		
2	Proper installation and alignment of Transformer and its accessories		
3	Checking the proper connection and wiring.		
4	Proper cleanliness of the transformer		
5	Check the proper earthing of the structure (doubly Earthed)		
6	IR check of incoming and outgoing cables.		
7	Check the proper tightness		
8	BVD Test		
9	Check the operation and function		
10	check for the proper cable Tags		
Remarks			
For(contractor Name)		For (EPMC/Client)	
Name		Name	
Sign		Sign	
Date		Date	

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 35 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR MOTORS									
Contractor LOGO	PROJECT:					JOB ID				
	CLIENT:					DOC ID				
	EPMC:									
	CONTRACTOR:					REV				
LOCATIO N/ AREA:						REPORT NO				
						DATE				
Megger Used for HT	Make		serial no.		Model		Calibration date	due		
Megger Used for LT	Make		serial no.		Model		Calibration date	due		
SI No.	Terminal Under Test	IR Value(M.OHMS)	In	Remarks						
1	R-E,YB Earthed									
2	Y-E,RB Earthed									
3	B-E,YR Earthed									
4	R-Y									
5	Y-B									
6	B-R									
SI No.	P.I FOR HT MOTORS	IR Value after 1 Minutes(in OHMS)	M	IR Value after 10 Minutes(in M OHMS)		PI Value (for HT Motors)				
Winding resistance for Motor										
SI No.	Motor Tag No.	Terminal of Equipment				Motor winding resistance				
		U1-V1								
		V1-Y1								

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002		TECHNICAL SPECIFICATION											
		ELECTRICAL SECTION (OIL & GAS SBU) DELHI											
TITLE		FIELD INSPECTION, TESTING and COMMISSIONING		DOCUMENT NO. MEC/05/E9/TS/15		Page 36 of 52							
						REVISION: 0							
						EDITION: 3							
		Y1-U1											
Pre Commissioning & Operation check:													
a) Direction of rotation (If incorrect reverse the lead and correct terminal coding)													
b) Starting Current (Kick)													
c) Operation of control & signalling circuit													
AT NO LOAD RUN													
Time	Motor Volatge			Motor Current			RPM	Bearing Temp.	Body/Winding temp.	Any abnormal Noise	Vibrations		
	R-Y	Y - B	B-R	R	Y	B					Horizontal	Vertical	Axial
AT ON LOAD RUN													
Time	Motor Volatge			Motor Current			RPM	Bearing Temp.	Body/Winding temp.	Any abnormal Noise	Vibrations		
	R-Y	Y - B	B-R	R	Y	B					Horizontal	Vertical	Axial
Remarks													
For(contractor Name)								For (EPMC/Client)					
Name								Name					
Sign								Sign					
Date								Date					

TECHNICAL SPECIFICATION

ELECTRICAL SECTION (OIL & GAS SBU) DELHI



Page 36 of 52

REVISION: 0

EDITION: 3

TITLE

FIELD INSPECTION, TESTING and COMMISSIONING

DOCUMENT NO.
MEC/05/E9/TS/15

Y1-U1

Pre Commissioning & Operation check:

a) Direction of rotation (If incorrect reverse the lead and correct terminal coding)

b) Starting Current (Kick)

c) Operation of control & signalling circuit

AT NO LOAD RUN

[illegible]

Motor Voltage

**Motor
Current**

RF
M

**Bearin
g
Temp.**

Body/Winding temp.

Any abnormal Noise

Vibrations

Horizontal

Vertical	

Axia	
I	

AT ON LOAD RUN

[illegible]

Motor Voltage

**Motor
Current**

RF
M

**Bearin
g
Temp.**

**Body/Windin
g temp.**

**Any
abnorm
al Noise**

Vibrations

Horizontal

Vertical	

Axia	
I	

Remarks

For(contractor Name)

For (EPMC/Client)

Name _____

Name _____

Sign

Sign

Date _____

Date _____

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 37 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR BURRIED CABLE TRENCH									
Contractor LOGO	PROJECT:						JOB ID			
	CLIENT:						DOC ID			
	EPMC:						REV			
	CONTRACTOR:						REPORT NO			
LOCATION/ AREA:							DATE			
SL NO	CABLE ROUTE		CABLE Tag No.	Buried Trench Dimension in mm			Dressing / Sand bedding	Route mark/ Cable tag	Brick Covering	Remark
	FROM	TO		Length	Width	Depth				
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Remarks										
For(contractor Name)						For (EPMC/Client)				
Name						Name				
Sign						Sign				
Date						Date				

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 38 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSULATION RESISTANCE & CONTINUITY TEST (PRE LAYING / POST LAYING OF CABLE)													
Contractor LOGO	PROJECT:										JOB ID			
	CLIENT:										DOC ID			
	EPMC:										REV			
	CONTRACTOR:													
LOCATION / AREA:											REPORT NO			
											DATE			
Megger detail	Make		serial no.				Model				Calibration due date			
SL NO	CABLE Tag	Type	Size	Voltage Grade	Insulation Resistance in M.OHMS								Continuity	Remark
					R-E	Y-E	B-E	R-Y	Y-B	B-R	RYB-N	N-E		
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
Remarks														
For(contractor Name)										For (EPMC/Client)				
Name										Name				
Sign										Sign				
Date										Date				

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 39 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR CABLE LAYING					
Contractor LOGO	PROJECT:			JOB ID		
	CLIENT:			DOC ID		
	EPMC:			REV		
	CONTRACTOR:			REPORT NO		
LOCATION/ AREA:				DATE		
SL NO	CABLE TAG	SIZE OF CABLE	FROM	TO	LAI D LENGTH Mtr's	REMARKS
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
Remarks						
For(contractor Name)			For (EPMC/Client)			
Name			Name			
Sign			Sign			
Date			Date			

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 40 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR INSTALLATION CABLE TRAY SUPPORT			
Contractor LOGO	PROJECT:	JOB ID		
	CLIENT:	DOC ID		
	EPMC:	REV		
	CONTRACTOR:	REPORT NO		
LOCATION/ AREA:		DATE		
SL NO	ACTIVITY	INSPECTION STATUS	REMARKS	
1	Check proper installation of Cable tray			
2	Check proper painting of cable tray support before and after installation.			
3	Check proper installation of cable tray.			
4	Check routing of tray as per layout.			
5	IR check			
6	Check function and operation			
SLNO	Size of tray/ Structural Steel	Lengths (Mtrs)	Area	Remarks
Remarks				
For(contractor Name)		For (EPMC/Client)		
Name		Name		
Sign		Sign		
Date		Date		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 41 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR INSTALLATION OF INTERNAL LIGHTING			
Contractor LOGO	PROJECT:	JOB ID		
	CLIENT:	DOC ID		
	EPMC:	REV		
	CONTRACTOR:	REPORT NO		
LOCATION/ AREA:	DATE			
S. No	Inspection Item	Inspection status	Remarks	
1	Check proper installation of light fixtures, type, model & mounting.			
2	Check proper installation of Switches/Sockets.			
3	Check proper installation & Cable Dressing of fixture & LDB etc.			
4	Check proper earthing with light fixtures & DBs.			
5	Check the operation of light fixture with lighting DB.			
6	Check proper installation of exhaust fan & ceiling fans.			
7	Check emergency light and its operation as per drawing			
8	Check Lux level			
9	No. of Fixtures and switchgears			
S. No.	Area/Location	Type of Fixture	Qty.	Remarks
Remarks				
For(contractor Name)		For (EPMC/Client)		
Name		Name		
Sign		Sign		
Date		Date		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 42 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR INSTALLATION OF EXTERNAL LIGHTING			
Contract or LOGO	PROJECT:	JOB ID		
	CLIENT:	DOC ID		
	EPMC:	REV		
	CONTRACTOR:	REPORT NO		
LOCATI ON/ AREA:		DATE		
S. No	Inspection Item	Inspection status	Remarks	
1	Check type, model, and area classification of fixture.			
2	Check proper installation of light pole.			
3	Check proper installation of light fixtures & JB			
4	Check proper installation of FLP Junction Box.			
5	Check proper earthing with pole, light fixture & JB			
6	Check glanding of cables, tightness, size, type, etc.			
7	Measurement of circuit current at OLDB			
8	Check cable IR drop at LDB before charging			
9	Check proper installation of cable gland			
10	Check proper termination of cable in junction box			
S. No.	Area/Location	Type of Fixture	Qty.	Remarks
Remarks				
For(contractor Name)		For (EPMC/Client)		
Name		Name		
Sign		Sign		
Date		Date		

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 43 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR INSTALLATION OF HIGH MAST			
Contractor LOGO	PROJECT:	JOB ID		
	CLIENT:	DOC ID		
	EPMC:	REV		
	CONTRACTOR:	REPORT NO		
LOCATION/ AREA:		DATE		
S. No	Inspection Item	Inspection status	Remarks	
1	Check proper installation of High Mast			
2	Check proper installation of light fixtures			
3	Check proper installation of Feeder Panel.			
4	Check proper earthing of High Mast, Feeder Panel			
5	Check operation of High Mast in Auto/ manual mode Including the operation of carriage			
6	Check lightning protection system of High Mast			
S. No.	Area/Location	Type of Fixture	Qty.	Remarks
Remarks				
For(contractor Name)		For (EPMC/Client)		
Name		Name		
Sign		Sign		
Date		Date		

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 44 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR INSTALLATION OF SWITCH/SOCKET/FAN			
Contractor LOGO	PROJECT:	JOB ID		
	CLIENT:	DOC ID		
	EPMC:	REV		
	CONTRACTOR:	REPORT NO		
LOCATION/ AREA:		DATE		
S. No	Inspection Item	Inspection status	Remarks	
1	Check proper installation of exhaust fan & ceiling fans.			
2	Check proper installation of Switches / Sockets, modular boxes, Switch boards.			
3	Check proper installation & Cable Dressing of LDB, wiring etc.			
4	Check proper earthing with light fixtures & DBs, sockets & Fans			
5	Check operation of Switch, Sockets& Fans			
6	Check proper operation of emergency lights			
S. No.	Area/Location	Type of Fixture	Qty.	Remarks
Remarks				
For(contractor Name)		For (EPMC/Client)		
Name		Name		
Sign		Sign		
Date		Date		

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO.	Page 45 of 52
		MEC/05/E9/TS/15	REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR CONDUITING IN SLAB/ WALL & WIRING		
Contractor LOGO	PROJECT:	JOB ID	
	CLIENT:	DOC ID	
	EPMC:	REV	
	CONTRACTOR:	REPORT NO	
LOCATION/ AREA:		DATE	
PRELIMINARY CHECKOUT			
SL NO	ACTIVITY	INSPECTION STATUS	REMARKS
1	CONDUITING		
1.1	Virtual check of material (IS-Certified)		
1.2	Routing of conduit and location of junction box		
1.3	Proper binding of conduit with steel bar and burr removed from conduit and putting small pieces of bag inside junction box.		
2	WIRING		
2.1	Identification of circuit check		
2.2	Check the size of wire and colour code		
2.3	Check earthing Continuity		
2.4	Insulation Test		
2.5	Check continuity of wire		
2.6	Earthing of switch box		
Remarks			
For(contractor Name)		For (EPMC/Client)	
Name		Name	
Sign		Sign	
Date		Date	

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 46 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR EARTHING		
Contractor LOGO	PROJECT:	JOB ID	
	CLIENT:	DOC ID	
	EPMC:	REV	
	CONTRACTOR:	REPORT NO	
LOCATION/ AREA:		DATE	
PRELIMINARY CHECKOUT			
SL NO	ACTIVITY	INSPECTION STATUS	REMARKS
1a	Earth electrode , Pit & their connection are to be checked for proper installation		
1b	Earth electrode resistance test		
2	Check all connection for proper tightness.		
3	Check the test facility shall be provided with test links for earthing system		
4	Check the dimension of earth strip & bitumen application.		
5	Check the welding and cleanliness of earth strip		
6	Earth resistance of earth electrode and grid		
7	Continuity test for earthing conductor		
8	Paint of epoxy on earthing joints.		
9	check no earth pit, marking of measured value		
Remarks			
For(contractor Name)		For (EPMC/Client)	
Name		Name	
Sign		Sign	
Date		Date	

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 47 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR EARTH RESISTANCE TEST				
Contractor LOGO	PROJECT:		JOB ID		
	CLIENT:		DOC ID		
	EPMC:		REV		
	CONTRACTOR:		REPORT NO		
LOCATION/ AREA:			DATE		
SL NO	AREA/LOCATION	EARTH PIT NO.	EARTH RESISTANCE		REMARKS
			WITH GRID	WITHOUT GRID	
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Remarks					
For(contractor Name)			For (EPMC/Client)		
Name			Name		
Sign			Sign		
Date			Date		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 48 of 52
			REVISION: 0
			EDITION: 3
Client and EPMC LOGO	INSPECTION REPORT FOR LIGHTNING PROTECTION		
Contractor LOGO	PROJECT:	JOB ID	
	CLIENT:	DOC ID	
	EPMC:		
	CONTRACTOR:	REV	
LOCATION/ AREA:		REPORT NO	
		DATE	
PRELIMINARY CHECKOUT			
SL NO	ACTIVITY	INSPECTION STATUS	REMARKS
1	Check all materials are as per approved IC or IWC report/ Specified Tender standards.		
2	Check the routing of down conductor should be straight as possible, Following the shortest path,avoiding the sharp bends or upward sections.		
3	Check bending radii should not less than 20 cm or 90 degree.		
4	Check Lighting rod at least connected with two down Conductors.		
5	Check all the receiving antennas (TV , Radio, Telephone) should be connected with Lighting protection system with proper conductors.		
6a	Earth electrode , Pit & their connection are to be checked for proper installation		
6b	Earth electrode resistance test		
7	Check all connection for proper tightness.		
8	Check the test facility shall be provided with test links for earthing system and for periodic inspection.		
9	Check the dimension of earth strip & bitumen application.		
10	Check the welding and cleanliness of earth strip		
11	Earth resistance of earth electrode and grid		
12	Paint of epoxy on earthing joints.		
13	check no earth pit, marking of measured value		
Remarks			
For(contractor Name)		For (EPMC/Client)	
Name		Name	
Sign		Sign	
Date		Date	

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 49 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR LIGHTING RESISTANCE TEST				
Contractor LOGO	PROJECT:		JOB ID		
	CLIENT:		DOC ID		
	EPMC:		REV		
	CONTRACTOR:		REPORT NO		
LOCATION/ AREA:			DATE		
SL NO	AREA/LOCATION	EARTH PIT NO.	EARTH RESISTANCE		REMARKS
			WITH GRID	WITHOUT GRID	
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Remarks					
For(contractor Name)			For (EPMC/Client)		
Name			Name		
Sign			Sign		
Date			Date		

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 50 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR BATTERY AND BATTERY CHARGER		
Contractor LOGO	PROJECT:	JOB ID	
	CLIENT:	DOC ID	
	EPMC:		
	CONTRACTOR:	REV	
LOCATION/ AREA:		REPORT NO	
		DATE	
PRELIMINARY CHECKOUT			
SL NO	ACTIVITY	INSPECTION STATUS	REMARKS
1	Proper alignment of Battery Charger		
2	Checking the proper connection/wiring		
3	Check the cleanliness inside the Battery Charger.		
4	Check for proper earthing		
5	IR check		
6	Check function and operation		
Remarks			
For(contractor Name)		For (EPMC/Client)	
Name		Name	
Sign		Sign	
Date		Date	

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 51 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INSPECTION REPORT FOR UPS		
Contractor LOGO	PROJECT:	JOB ID	
	CLIENT:	DOC ID	
	EPMC:	REV	
	CONTRACTOR:	REPORT NO	
LOCATION/ AREA:		DATE	
PRELIMINARY CHECKOUT			
SL NO	ACTIVITY	INSPECTION STATUS	REMARKS
1	Proper alignment of UPS		
2	Checking the proper connection/wiring		
3	Check the cleanliness inside the panel.		
4	Proper earthing of panel (doubly earthed)		
5	IR check and HV		
6	Check function and operation		
7	Voltage Measurement Between P-N/P-E/N-E		
Remarks			
For(contractor Name)		For (EPMC/Client)	
Name		Name	
Sign		Sign	
Date		Date	

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	FIELD INSPECTION, TESTING and COMMISSIONING	DOCUMENT NO. MEC/05/E9/TS/15	Page 52 of 52
			REVISION: 0
			EDITION: 3

Client and EPMC LOGO	INCOMING MATERIAL INSPECTION REPORT			
Contractor LOGO	PROJECT:	JOB ID		
	CLIENT:	DOC ID		
	EPMC:	REV		
	CONTRACTOR:	REPORT NO		
LOCATION/ AREA :		DATE		

Sr. No.	SOR No.	Description of Material	Size	Batch No.	Quantity	Manufacturer Name	Date of Receipt	IRN/TC	Remarks
1									
2									
3									
4									
5									

The above material inspected and found satisfactory for execution.

For(contractor Name)		For (EPMC/Client)	
Name		Name	
Sign		Sign	
Date		Date	

REV: 0

EDITION: 3

TECHNICAL SPECIFICATION
FOR
Ni Cd BATTERY
DOCUMENT No. : MEC/05/E9/TS/17

Prepared & Issued by



ELECTRICAL SECTION
(Oil & Gas SBU)
MECON LIMITED
(A Govt. of India Undertaking)
13th & 15th Floor, North Tower, SCOPE MINAR,
Laxmi Nagar District Centre,
Delhi-110092 (India)

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	Ni Cd BATTERY	DOCUMENT NO. MEC/05/E9/TS/17	Page 2 of 7
			REVISION: 0
			EDITION: 3

INDEX

Sl. No.	Description	Page No
01.00	Intent	04
02.00	Codes & Standards	04
03.00	General Requirements	04
04.00	Technical Requirements	05
05.00	Drawings and Documents	05
06.00	Technical Specifications	05
07.00	Inspection and Testing	16
8.00	Packing and Despatch	16

Rev	Date	Prepared by	Checked by	Approved by
0	11.07.2025	 Aashish Moyal	 Saurabh Singh	Pankaj Shrivastava

© Copyright MECON Limited – All rights reserved.
 THIS DOCUMENT IS THE SOLE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED
 HEREIN. THIS IS NOT TO BE COPIED OR USED FOR ANY OTHER PROJECTS UNLESS EXPLICITLY PERMITTED BY
 MECON.

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	Ni Cd BATTERY	DOCUMENT NO. MEC/05/E9/TS/17	Page 3 of 7
			REVISION: 0
			EDITION: 3

AMENDMENT STATUS

(OLD NUMBER OF STANDARD: MEC/TS/05/E9/17)

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Document Number replaced with New number as MEC/05/E9/TS/17	All	Rev 0/ Ed 3	11.07.2025		
2	Section re-name as Electrical Section (Oil & Gas SBU) Delhi	All	Rev 0/ Ed 3	11.07.2025		

1.0 INTENT

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	Ni Cd BATTERY	DOCUMENT NO.	Page 4 of 7
		MEC/05/E9/TS/17	REVISION: 0
			EDITION: 3

The intent of this specification is to define the requirement of Nickel – Cadmium batteries and its accessories for the UPS/solar power system. The scope of work includes design, manufacture and testing of Nickel – Cadmium batteries as per specification and datasheet.

2.0 CODES AND STANDARDS

The equipment shall comply with the requirements of latest revision of following standards of

- Bureau of Indian Standards (BIS) IS-10918
- British Standard Institution
- American Standard Institution
- International Electro Technical Commission
- IEEE
- NEMA

2.1 The equipment shall also conform to the provisions of Indian Electricity Rules and other statutory regulations currently in force in the country.

2.2 Wherever the requirements in this specification are in conflict with any of the above Standards, the requirements under this specification shall be binding.

3.0 GENERAL REQUIREMENTS

3.1 Ni-Cd Batteries

The offered Battery shall be brand new with state of art technology and proven field track record.

3.1.1 Basic Particulars for Design

a) SITE CONDITIONS

Nickel Cadmium battery shall be suitable for operating satisfactorily in humid corrosive atmosphere found in gas processing plants. Atmospheric conditions/Site conditions are specified in the scope of work/Datasheet.

4.0 TECHNICAL REQUIREMENTS

4.1 The Nickel Cadmium cell / battery shall be suitable for float duty operation at constant voltage permanently applied to its terminals which is sufficient to maintain it in a state close to full charge and shall be designed to supply load in the event of normal power supply failure. Battery shall be Fiber Plate or Pocket Plate Type.

4.2 Supplier shall carry out battery sizing calculations based on load as specified and in line with IEEE-1115, The same shall be submitted to owner/consultant for approval. For long duration discharge, like SPV

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	Ni Cd BATTERY	DOCUMENT NO.	Page 5 of 7
		MEC/05/E9/TS/17	REVISION: 0
			EDITION: 3

system, the selection of batteries shall be as per relevant IEC/IEEE.

4.3 Ampere-hour capacity of the battery shall be selected on the following basis:

- a) The nominal voltage of single cell be 1.2V
- b) Load power factor of 0.8
- c) Aging factor of 0.8
- d) Battery state of charge factor of 0.88
- e) Minimum ambient temperature as specified in data sheet
- f) **Backup time as specified in data sheet**
- g) Minimum end cell voltage shall be 1.1V per cell for Ni-Cd battery
- h) Depth of discharge (DOD) as specified in data sheet

4.4 The number of cells shall be determined as per load and system voltage level as specified in data sheet.

4.5 Battery shall be supplied in single bank of 100% capacity or two parallel banks of 50% capacity each as specified in data sheet/block-diagram. The battery shall be suitable for being boost charged to fully charged condition from fully discharged condition within 10 hours unless other wise specified.

4.6 Battery assembly shall be supplied in dry and uncharged condition. Electrolyte with 10% extra quantity shall be delivered with the battery in a suitable, non-returnable, sealed containers.

4.7 Each cell shall have a separate container. The cell shall be housed in high strength impact resistant & alkali resistant container and should be transparent/translucent material and designed to withstand mechanical stresses, shocks and vibrations.

4.8 The components such as containers, lids/ covers and seals used in the manufacture shall be the fire, flame and smoke resistant.

4.9 The terminal post shall be nickel-plated. The terminals shall be suitable for short circuit current and specified discharge current without damage to cell as a result of terminal heating.

4.10 Nickel cadmium cells shall be designed to withstand the mechanical stresses encountered during normal transportation and handling. The battery shall be suitable for satisfactory operation at remote unattended sites. The batteries shall need minimum maintenance. The battery shall be installed in battery room having restricted ventilation.

4.11 A Flame arrestor shall be mounted on the cell so that all vented gasses diffuse through the arrestor to the outside environment. The construction of the arrestor shall be such that hydrogen burning on the external surface of the arrestor shall not propagate back in to the cell to cause explosion.

4.12 The following information shall be permanently marked on the cell:

@MECON Limited; all rights reserves

MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	Ni Cd BATTERY	DOCUMENT NO.	Page 6 of 7
		MEC/05/E9/TS/17	REVISION: 0
			EDITION: 3

- Name of manufacturer/model reference
- Nominal voltage
- Rated capacity in ampere hours (Ah) with End Cell voltage
- Voltage for float operation of 27 deg C with tolerance of 1%
- Month and year of manufacture
- Polarity Marking

4.13 Each set of battery shall be supplied with all accessories including but not limited to the following:

- Battery stands in Step and tier formation as per data sheet
- Inter cell, inter row and inter bank connectors and end take offs. These shall be of Nickel-plated copper, Connector covers.
- Cell number plates and fixing pins, connecting cables, Lugs for cable termination as required and Bolt & washers, Top up bottle, Thermometer-1 no.
- Manufacturer shall supply the copy of instruction manual for commissioning, initial treatment of battery & maintenance
- One number Cell testing voltmeter (3V-0-3-V) complete with leads
- Four pairs of Rubber gloves, Cell lifting puller-1 no.
- One number Spanner.
- Any other accessories.

5.0 DRAWINGS AND DOCUMENTS

The following documents shall be submitted along with the offer

- Battery sizing calculation
- Dimension of battery bank and each cell offered.
- Dimension /GA of battery stand
- Catalogue

6.0 INSPECTION AND TESTING

Batteries shall be subject to inspection by Consultant / Owner or by a third agency authorized by the owner for acceptance. Nickel Cadmium batteries shall be type tested to meet the performance requirements for each design and AH rating of cells as per IS 10918. Type test reports/certificates shall be submitted for review.

Battery shall be tested for 'Acceptance test' as per IS 10918 at manufacturer works for the acceptance of batteries.

Load test shall be carried out on the Battery at site after installation as part of commissioning.

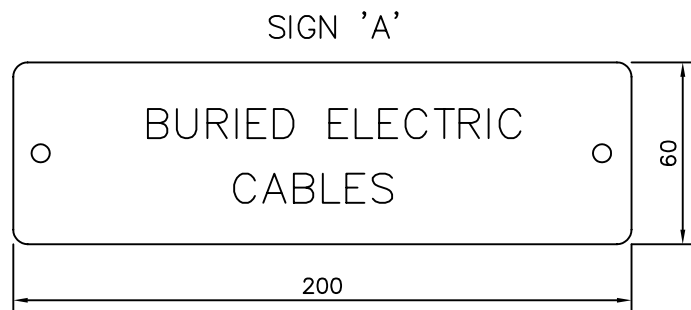
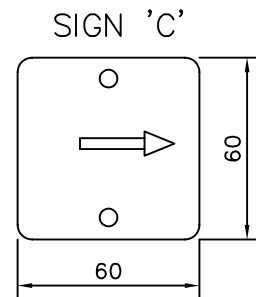
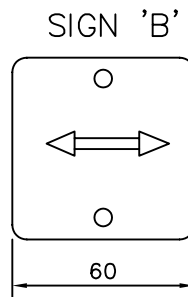
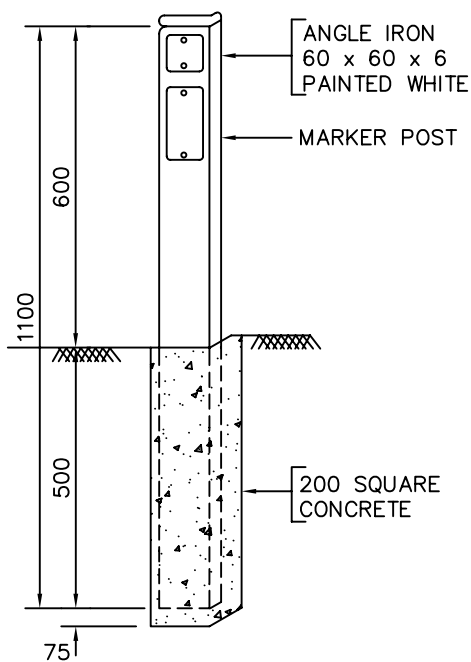
7.0 PACKING AND DESPATCH

@MECON Limited; all rights reserves

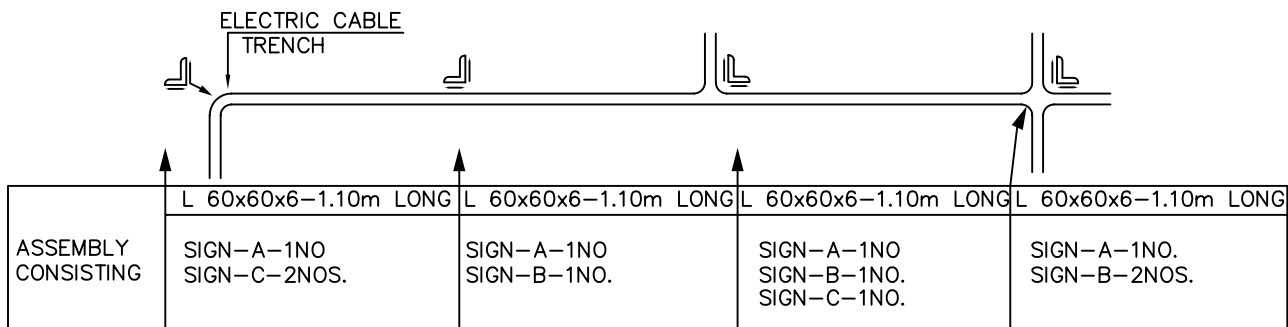
MECON LIMITED REGD. OFF: RANCHI 834002	TECHNICAL SPECIFICATION		
	ELECTRICAL SECTION (OIL & GAS SBU) DELHI		
TITLE	Ni Cd BATTERY	DOCUMENT NO. MEC/05/E9/TS/17	Page 7 of 7
			REVISION: 0
			EDITION: 3

The equipment shall be properly packed for transportation by ship / rail or trailer. The equipment shall be wrapped in polythene sheets before being placed in crates / cases to prevent damage. Crates / cases shall have skid bottoms for handling. Special notations such as "Fragile", "This side up" "Centre of gravity", "Weight", "Owner's particulars", "PO nos." etc, shall be clearly marked on the package together with other details as per purchase order. Contractor shall supply above packed material at required place as specified elsewhere.

STANDARD DRAWING (ELECTRICAL SYSTEM)



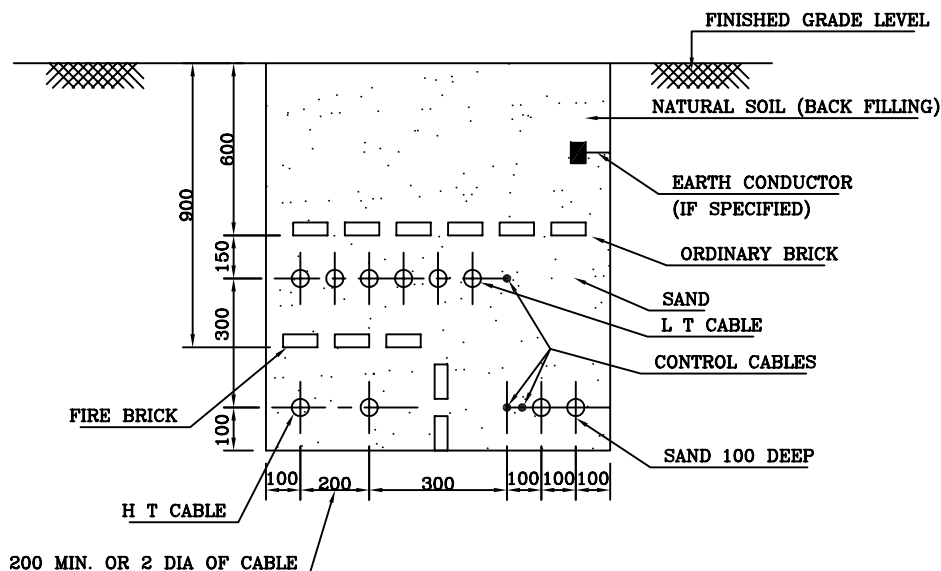
TYPICAL ARRANGEMENT OF MARKER



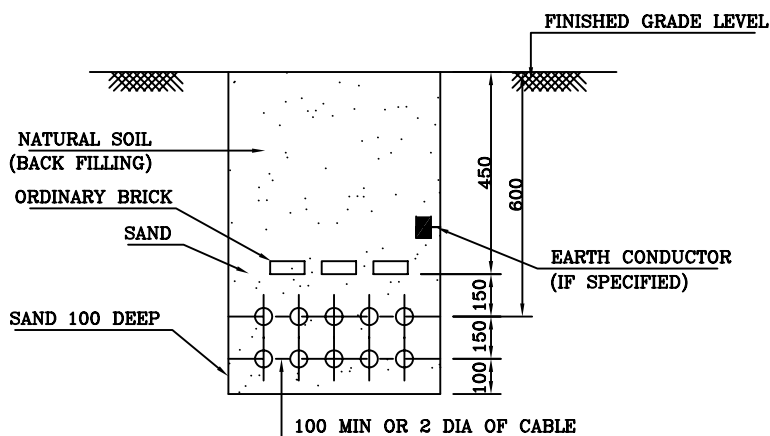
- NOET: —**
1. TRENCHES SHALL BE MARKED AT ALL DIRECTION CHANGES, INTERSECTIONS AND STRAIGHT RUNS.
 2. SIGN MADE OF 14 ENAMELLED SHEET PLATE WHITE LETTRING MADE ON GREEN BACKGROUND.

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.												
SECTION: ELECTRICAL <table border="1"> <thead> <tr> <th>NAME</th> <th>DATE</th> <th>CHKD</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>DSGN</td> <td></td> <td></td> <td></td> </tr> <tr> <td>DRWN</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> MARKING OF TRENCHES FOR ELECTRIC CABLES  मेकॉन लिमिटेड MECON LIMITED SCALE : N.T.S. DRG.NO MEC/SD/05/E9/01/01								NAME	DATE	CHKD	DATE	DSGN				DRWN			
NAME	DATE	CHKD	DATE																
DSGN																			
DRWN																			
APPROVED						REV 0													

TYPICAL SECTION WITH H. T. CABLES AND L T CABLES



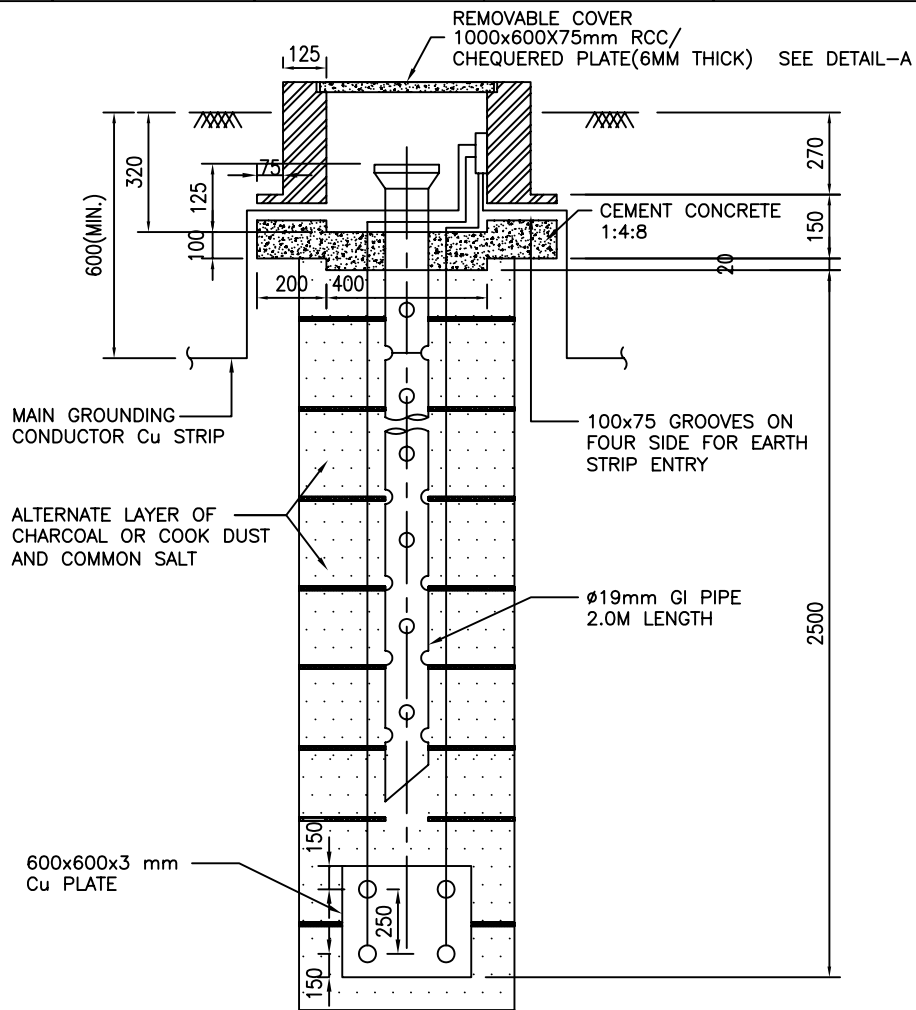
TYPICAL SECTION WITH L T CABLES ONLY



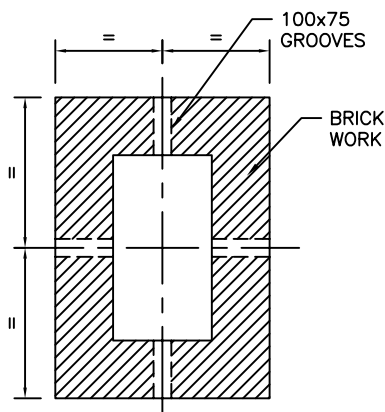
NOTES:—

1. LEAVE SPACE FOR LATER ADDITION OF AT LEAST 2 CABLES OR 15% AVERAGE SPARE SPACE REGARDLESS OF FUTURE EXPANSION.
2. IF TELEPHONE CABLES ARE LAID IN THE SAME TRENCH A CLEARANCE OF 300mm SHALL BE PROVIDED BETWEEN POWER AND TELEPHONE CABLES .

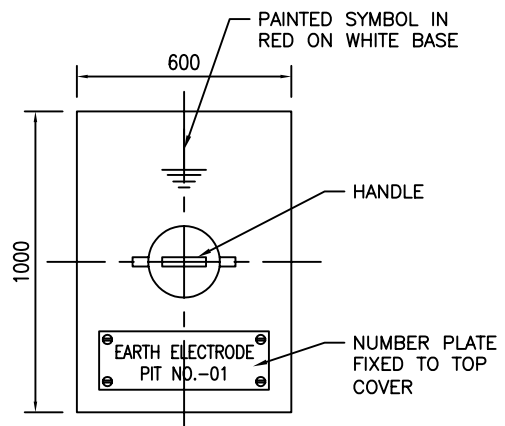
REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.	
REVISIONS								
REFERENCES								
DRG. NO.								
SECTION: ELECTRICAL			TYPICAL SECTION OF CABLE TRENCH IN UNPAVED AREAS					
NAME	DATE	CHKD						DATE
DSGN								
DRWN								
APPROVED								
			SCALE : N.T.S. DRG.NO MEC/SD/05/E9/01/02					
			REV 0					



COPPER PLATE ELECTRODE WITH TREATED EARTH PIT



DETAIL-B



DETAIL-A

																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					</

STREET LIGHT POLE

50 mm WIDEx60x6 mm THK. MS FLAT WELDED
TO POLE FOR EARTH TERMINATION
(SEE DETAIL-1)

10 mm DIA. GALVANISED MS
BOLT, NUT & SPRING WASHER

TERMINAL CONNECTION

225

25x4mm GI STRIP

G.L.

450
MIN.

45

20

20

WELD

10 mm DIA GALVANISED
MS BOLTS, NUTS AND
SPRING WASHER

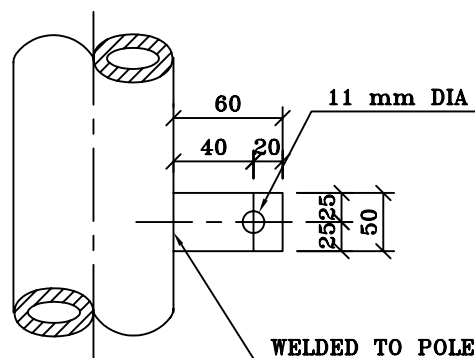
25x4mm GI STRIP
FROM NEAREST
MAIN EARTH GRID OR
FROM LOCAL EARTHING
STATION. SEE DETAIL -2

50x6x65 LONG
G.I. FLAT

38 mm DIA. & 2500 mm
LONG. G.I. PIPE (MEDIUM)

DETAIL-2

LOCAL EARTHING STATION

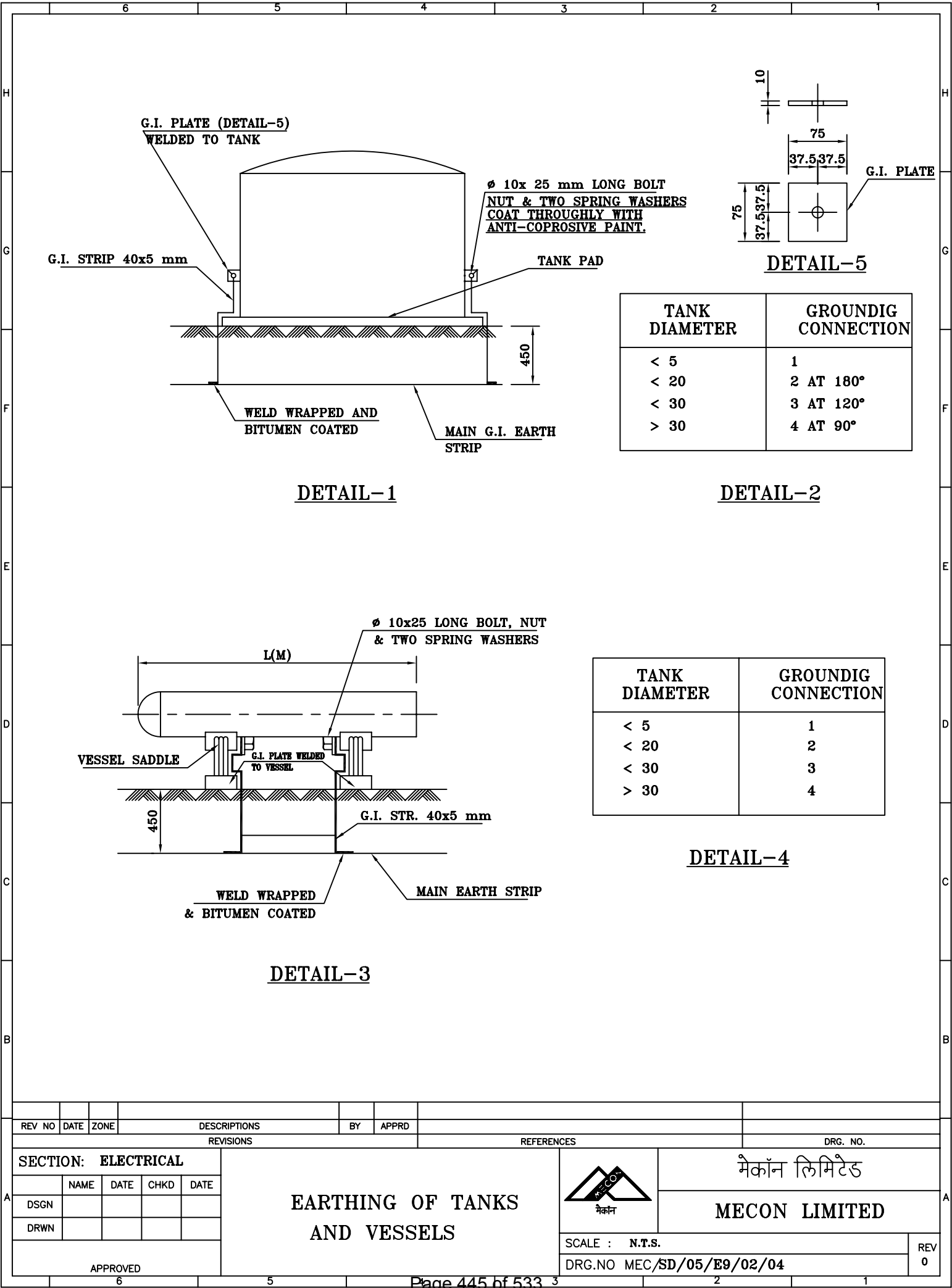


DETAIL-1

NOTES:-

1. USE TWO EARTHING IF VOLTAGE IN POLE
JUCTION BOX IS 415 V

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.												
SECTION: ELECTRICAL <table border="1"> <tr> <th>NAME</th> <th>DATE</th> <th>CHKD</th> <th>DATE</th> </tr> <tr> <td>DSGN</td> <td>QUASIM</td> <td></td> <td></td> </tr> <tr> <td>DRWN</td> <td>IRFAN</td> <td>29.07.04</td> <td></td> </tr> </table> TYPICAL EARTH CONNECTION FOR STREET LIGHT POLE  मेकॉन लिमिटेड MECON LIMITED APPROVED SCALE : N.T.S. DRG.NO MEC/SD/05/E9/02/03 REV 2								NAME	DATE	CHKD	DATE	DSGN	QUASIM			DRWN	IRFAN	29.07.04	
NAME	DATE	CHKD	DATE																
DSGN	QUASIM																		
DRWN	IRFAN	29.07.04																	

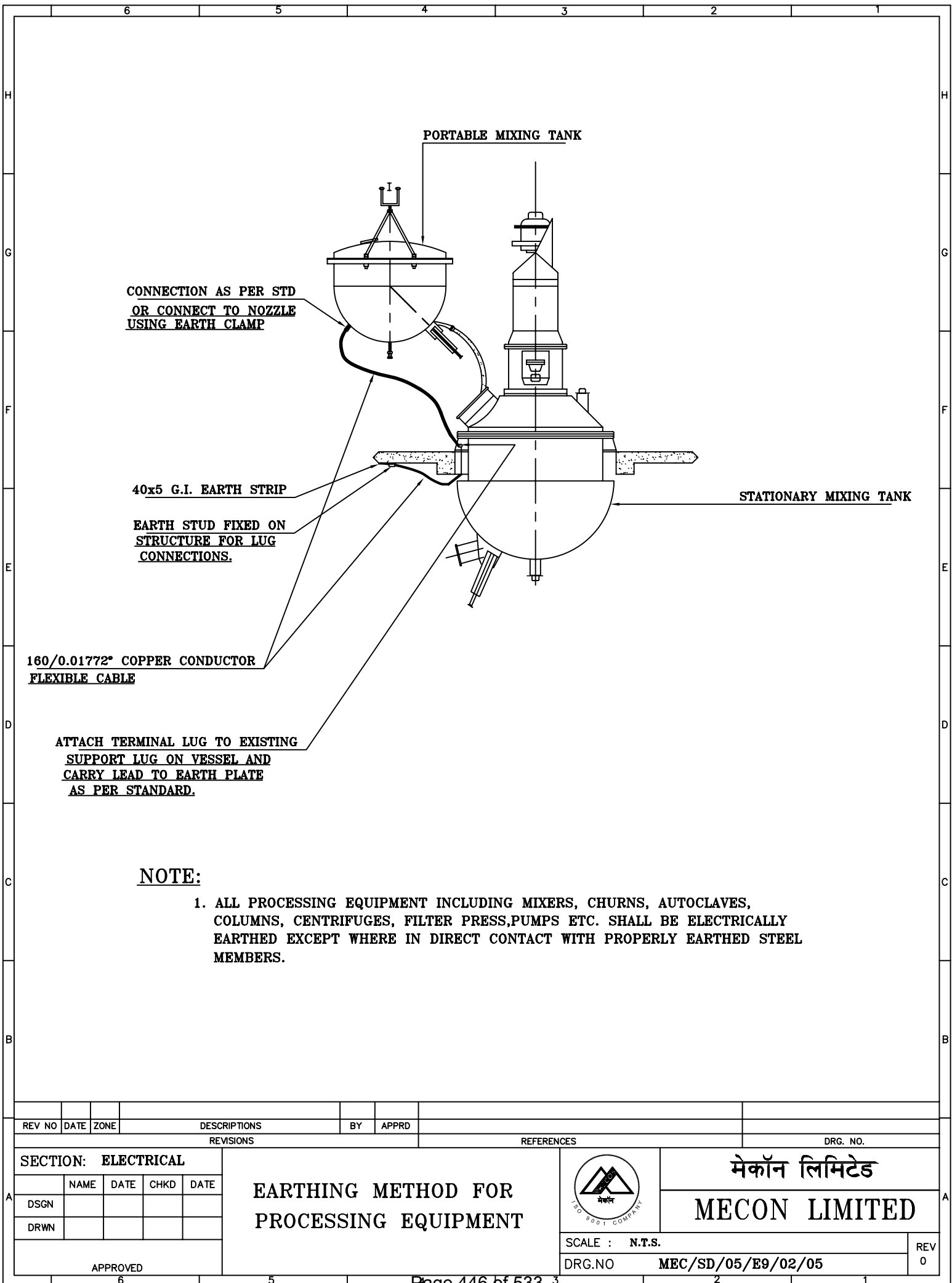


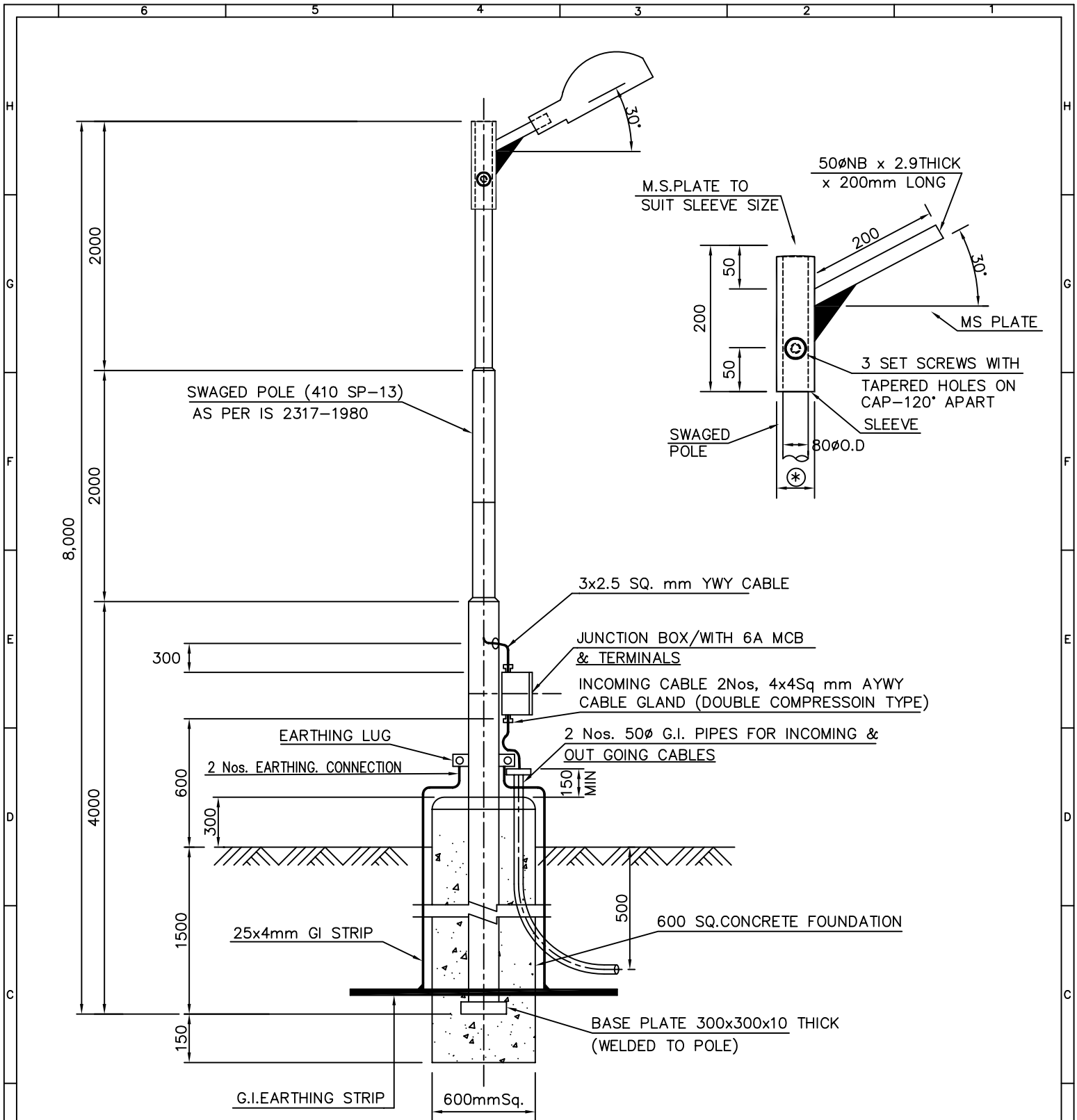
REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
SECTION: ELECTRICAL							
DSGN							
DRWN							
APPROVED				SCALE : N.T.S.			
				DRG.NO MEC/SD/05/E9/02/04			
				REV 0			

EARTHING OF TANKS
AND VESSELS



मेकॉन लिमिटेड
MECON LIMITED





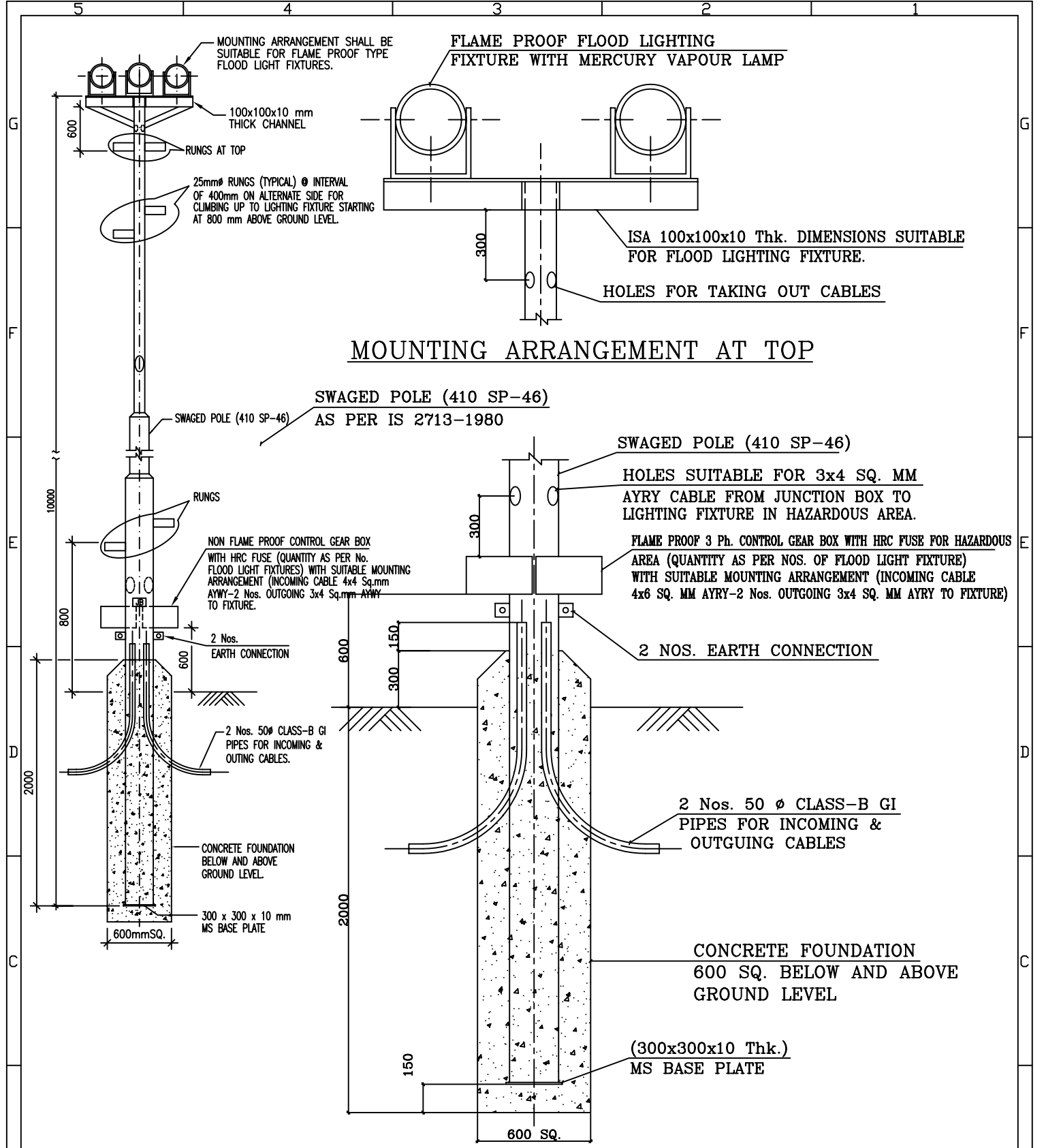
NOTES:-

- 1.) * TO SUIT 80mm Ø DD (TOP SECTION).
- 2.) MARSHALLING BOX, JUNCTION BOX & G.I. PIPES FOR CABLES SHALL BE PROVIDED ON THE CABLE TRENCH SIDE.

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
REVISIONS							
SECTION: ELECTRICAL							
DSGN	NAME	DATE	CHKD	DATE	TYPICAL INSTALLATION OF STREET LIGHTING FIXTURE (BRACKET MOUNTED) ON POLE FOR SAFE AREA		
DRWN	IRFAN	30.07.04					
APPROVED					SCALE : N.T.S.		REV 0
					DRG.NO MEC/SD/05/E9/03/01		



मेकॉन लिमिटेड
MECON LIMITED

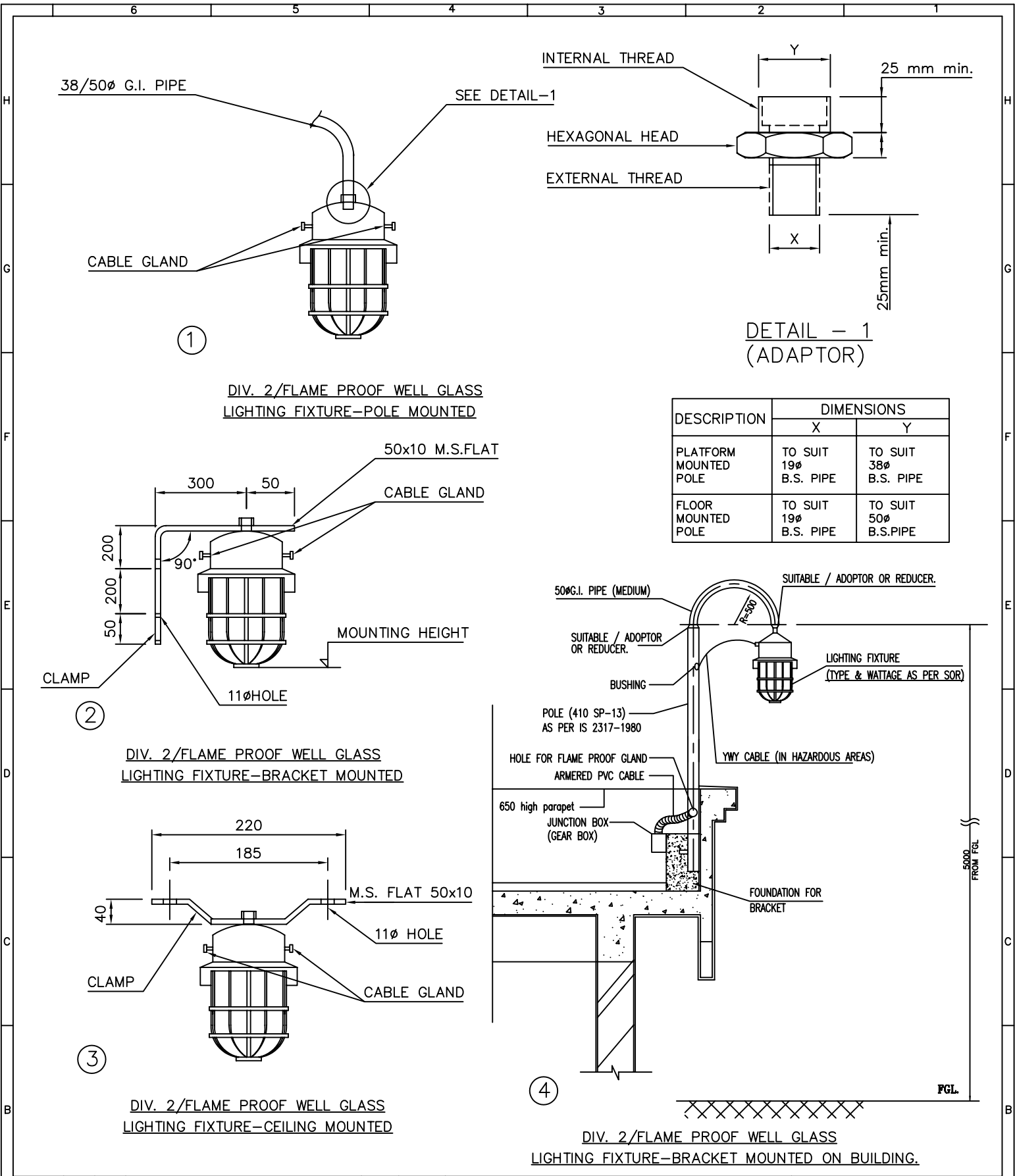


BOTTOM DETAIL

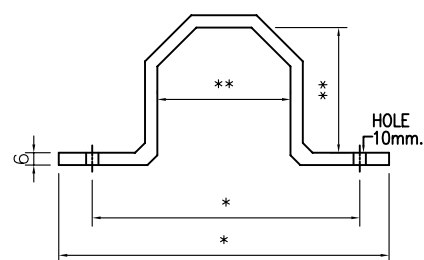
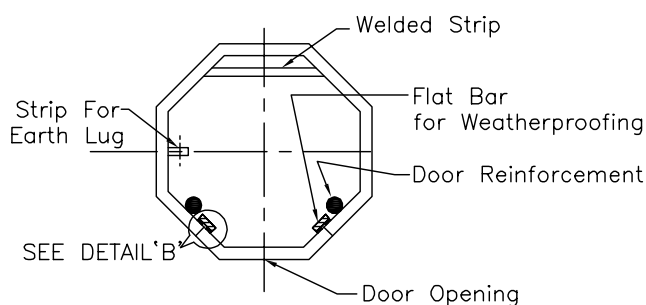
NOTE :-

- MARSHALLING BOX / JUNCTION BOX & G.I. PIPES FOR CABLES SHALL BE PROVIDED ON THE CABLE TRENCH SIDE.

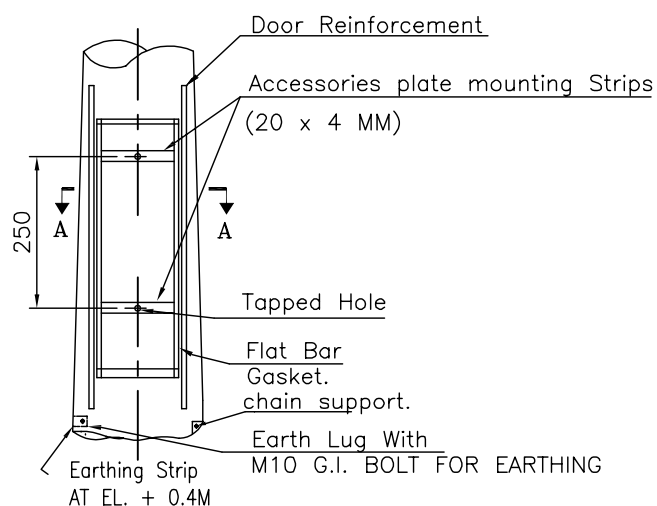
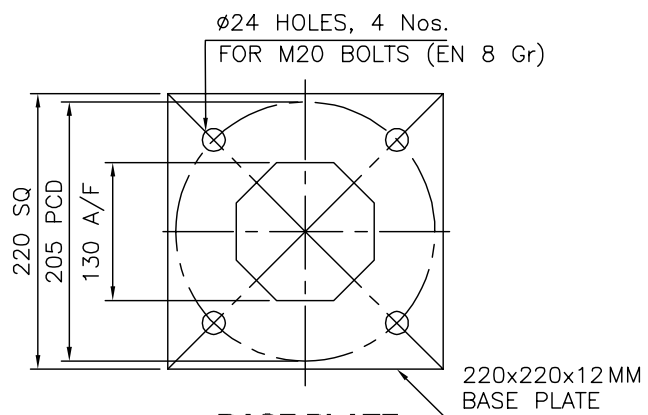
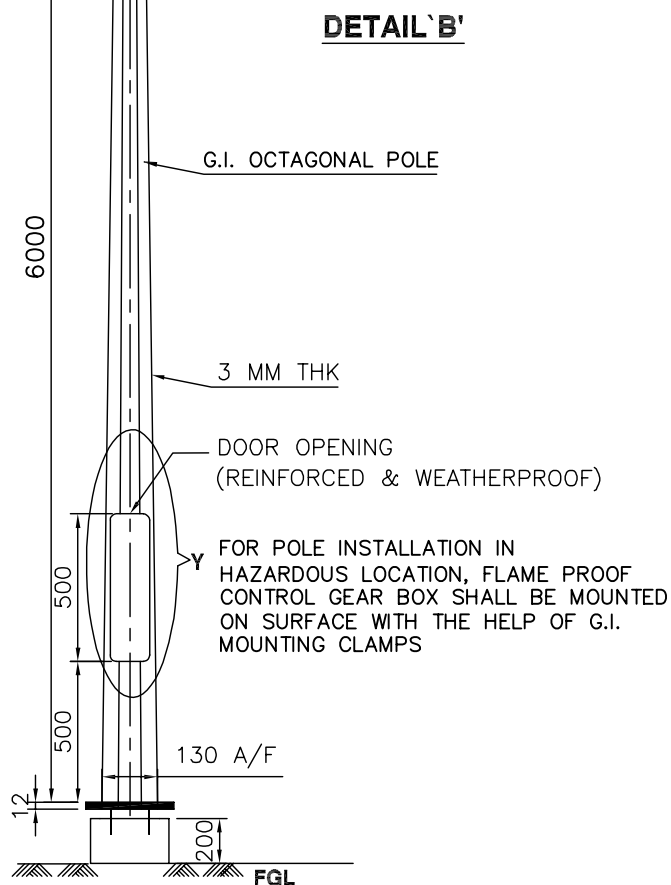
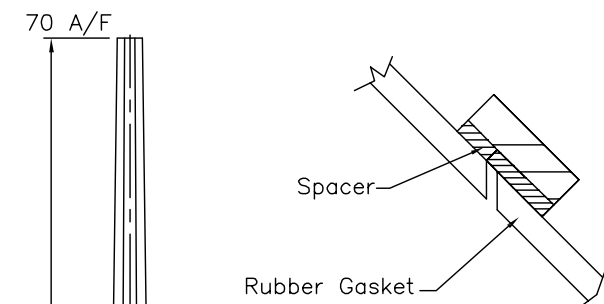
REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
THIS DRAWING IS PROPERTY OF MECON AND IS ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.							
SECTION ELECTRICAL				TYPICAL INSTALLATION OF FLOOD LIGHTING POLE (WITH RUNGS)			
NAME	DATE	CHKD	DATE				
DSGN							
DRWN	DAYA	12.04.2001		SCALE : 1:50 DRG.NO. MEC/SD/05/E9/77/02			
APPROVED				REV 0			



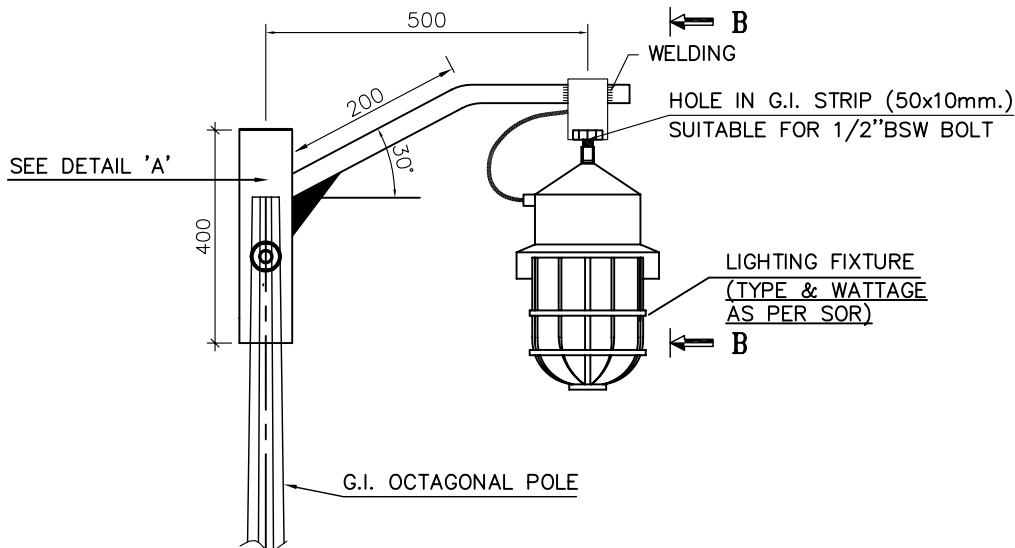
REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
REVISIONS							
SECTION: ELECTRICAL							
DSGN	NAME	DATE	CHKD	DATE	FLAME PROOF LIGHTING FIXTURE MOUNTING DETAILS (TYPICAL)		
DRWN							
APPROVED					 मेकॉन लिमिटेड MECON LIMITED		
SCALE : N.T.S.						REV 0	
DRG.NO MEC/SD/05/E9/77/03							



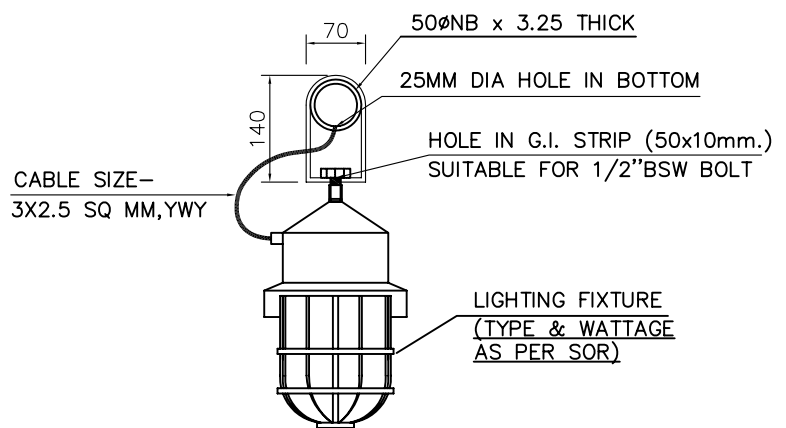
NOTE:-



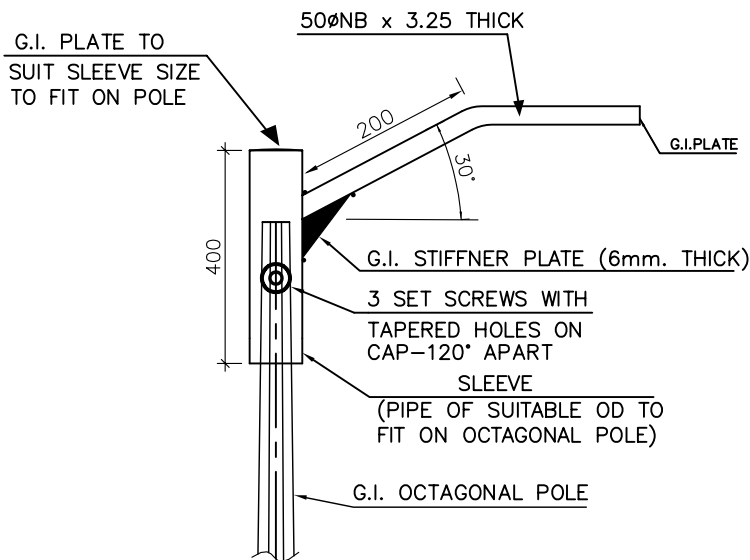
REV NO	DATE	ZONE	DESCRIPTIONS				BY	APPRD																	
REVISIONS									REFERENCES					DRG. NO.											
SECTION: ELECTRICAL					TYPICAL INSTALLATION OF LIGHTING FIXTURE ON OCTAGONAL POLE										मेकॉन लिमिटेड										
															MECON LIMITED										
DSGN	NAME	DATE	CHKD	DATE										SCALE : N.T.S.									SHEET 1 OF 3		REV 0
DRWN	SUNIL	13.01.10												DRG.NO MEC/SD/05/E9/77/04											
APPROVED																									



DETAIL OF BRACKET/ARM

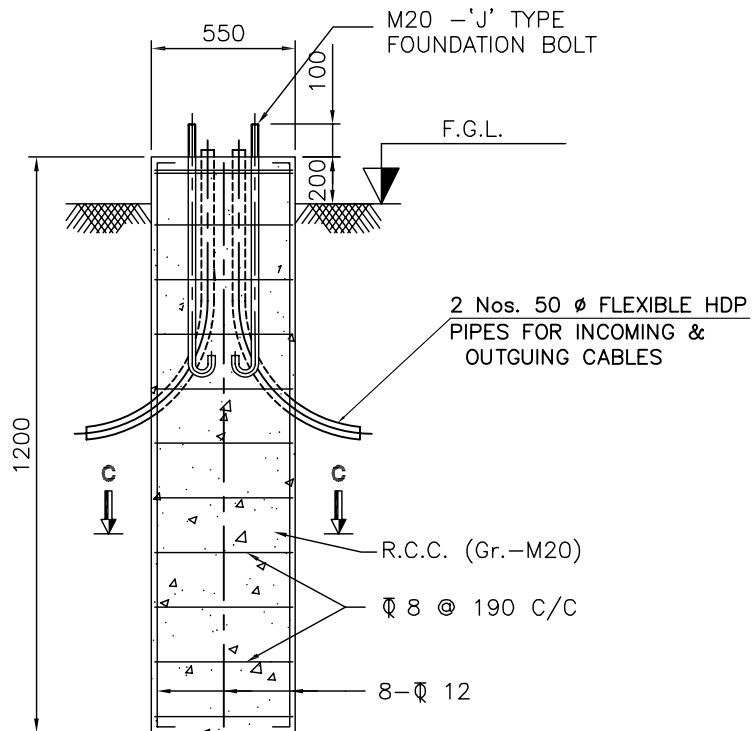


VIEW B-B

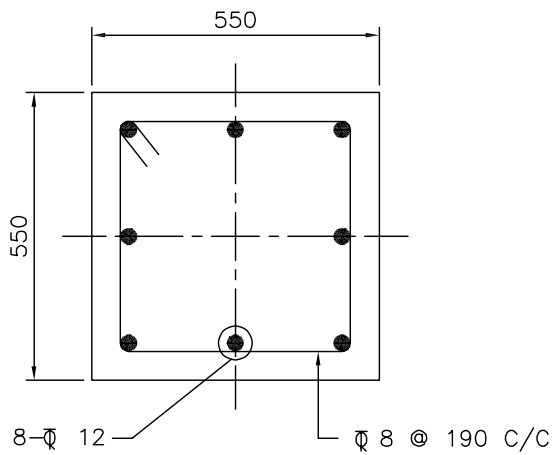


DETAIL-A

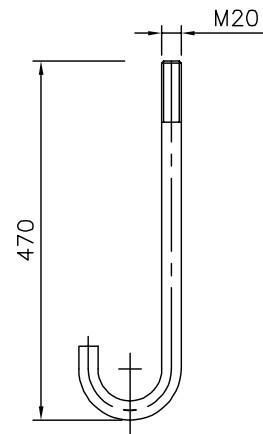
REV NO		DATE	ZONE	DESCRIPTIONS		BY	APPRD	REFERENCES		DRG. NO.		
SECTION: ELECTRICAL				TYPICAL INSTALLATION OF LIGHTING FIXTURE ON OCTAGONAL POLE					मेकॉन लिमिटेड			
									MECON LIMITED			
APPROVED								SCALE : N.T.S.		SHEET 2 OF 3		REV 0
								DRG.NO MEC/SD/05/E9/77/04				



DETAIL OF CIVIL FOUNDATION



SECTION C-C



ANCHOR BOLT DETAIL
(TOTAL LENGTH-600 mm)

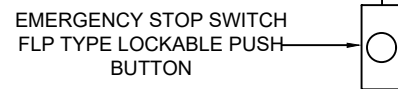
NOTES:

1. Grade of steel reinforcement (for R.C.C.)
- Fe 415
2. Clear cover to reinforcement - 50 mm
3. Assumed S.B.C. - 10 T/Sq.mtr. (minimum)

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
SECTION: ELECTRICAL			TYPICAL INSTALLATION OF LIGHTING FIXTURE ON OCTAGONAL POLE				DRG. NO.
DSGN	NAME	DATE	CHKD	DATE	 मेकॉन लिमिटेड MECON LIMITED		
DRWN	SUNIL	13.01.10					
APPROVED			SCALE : N.T.S. DRG.NO MEC/SD/05/E9/77/04				SHEET 3 OF 3 REV 0

Page 453 of 533

TENDER DRAWING (ELECTRICAL SYSTEM)



	AMMETER		CURRENT TRANSFORMER
	AMMETER SELECTOR SWITCH		TRI VECTOR METER
	VOLTMETER		FREQUENCY METER
	VOLTMETER SELECTOR SWITCH		DRAW OUT
	KILOWATT HOUR METER		EARTHING
	TRANSFORMER (POTENTIAL CONTROL)		CABLE GLAND
	INDICATION LAMP		HRC FUSE
	MCCB+ELR		SELECTOR SWITCH
	CONTACTOR		AIR CKT BREAKER
	O/L RELAY		SWITCH FUSE UNIT
	MCB		VACCUUM CIRCUIT BREAKER
	ON OFF TRIP INDICATION		MCCB
	MOTOR PROTECTION CIRCUIT BREAKER		CBCT WITH ELR

FOR TENDER PURPOSE ONLY



REFERENCES	DRG.NO.
© Copyright MECON LIMITED - All rights reserved THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.	

Page 455 of 533



	AMMETER		CURRENT TRANSFORMER
	AMMETER SELECTOR SWITCH		TRI VECTOR METER
	VOLTMETER		FREQUENCY METER
	VOLTMETER SELECTOR SWITCH		DRAW OUT
	KILOWATT HOUR METER		EARTHING
	TRANSFORMER (POTENTIAL CONTROL)		CABLE GLAND
	INDICATION LAMP		HRC FUSE
	MCCB+ELR		SELECTOR SWITCH
	CONTACTOR		AIR CKT BREAKER
	O/L RELAY		SWITCH FUSE UNIT
	MCB		VACCUUM CIRCUIT BREAKER
	ON OFF TRIP INDICATION		MCCB
	MOTOR PROTECTION CIRCUIT BREAKER		VOLTAGE MONITORING RELAY
	SINGLE PHASE PREVENTER		

FOR TENDER PURPOSE ONLY

SECTION	ELECTRICAL	SINGLE LINE DIAGRAM OF APFC PANEL OF 10 KVAR		
LOCATION	NEW DELHI			
DESIGNED	SHIFA			
DRAWN	SANYUKTA			
CHECKED AND VERIFIED	QUASIM AHMAD			
APPROVED		SCALE : NTS	SHEET	REV
	DATE 07.07.2026	DRG. NO :- MEC/E0086/05/E/1E/1081B	2 OF 2	0

Page 456 of 533

**SPECIFICATION
FOR
HEALTH, SAFETY
AND
ENVIRONMENT (HSE)
MANAGEMENT**

SPECIFICATION NO. MEC/S/05/21/65



**(OIL GAS SBU)
MECON LIMITED
DELHI 110 092**

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 1 of 1
			REVISION : 0
			EDITION : 1

C O N T E N T S

<u>SL. NO.</u>	<u>DESCRIPTION</u>
1.0	SCOPE
2.0	REFERENCES
3.0	REQUIREMENT OF HEALTH, SAFETY & ENVIRONMENT (HSE) MANAGEMENT SYSTEM TO BE COMPLETED BY BIDDERS.
4.0	DETAILS OF HSE MANAGEMENT SYSTEM BY CONTRACTOR
5.0	RECORDS
	ANNEXURE-A
	ANNEXURE-B
	ANNEXURE-C
	ANNEXURE-D
	ANNEXURE-E

PREPARED BY	CHECKED BY	APPROVED BY	ISSUE DATE
(Shalini Singh)	(Sunil Kumar)	(A.K. ohri)	Feb. 2009

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 1 of 59
			REVISION : 0
			EDITION : 1

1.0

SCOPE

This specification establishes the Healthy, Safety and Environment (HSE) management requirement to be compiled with by the Contractors during construction.

This specification is not intended to replace the necessary professional judgement needed to design & implement an effective HSE system for construction activities and the contractor is expected to exceed requirements given in this specification.

Requirement stipulated in this specification shall supplement the requirement of HSE management given in relevant Act (S)/ legislations. General Condition of Contract (GCC) Special Condition of Contract (SCC) and Job Specifications. Where different documents stipulate different requirements, the most stringent shall be adopted.

2.0

REFERENCES

This document should be read in conjunction with following:

- General Conditions of Contract (GCC)
- Special Conditions of Contract (SCC)
- Building and other construction workers (regulation of employment and condition of service) Act, 1996
- Job Specifications
- Relevant IS Codes (refer Annexure-A)
- Reporting Formats (refer Annexure-B)
- Statutory requirements

3.0

REQUIREMENT OF HEALTH, SAFETY ENVIRONMENT (HSE) MANAGEMENT SYSTEM TO BE COMPLETED BY BIDDERS.

3.1

Management Responsibility

3.1.1

The Contract should have a document HSE policy to cover commitment of the organization to ensure health, safety and environment aspects in their line of operations

3.1.2

The HSE management system of the Contractor shall cover HSE requirement including but not limited to what specified under clause 1.0 & 2.0 mentioned above

3.1.3

Contractor shall be fully responsible for planning and implementing HSE requirement to the satisfaction of the company. Contractor as a minimum requirement shall designate/deploy the following to co-ordinate the above:

No. Of workers deployed

Up to 250

- Designate one safety supervisor who will guide the workers from time to time, as well as impart training basic guidelines at least weekly once.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 2 of 59
			REVISION : 0
			EDITION : 1

Above 250 & upto 500 - Deploy one qualified and experienced safety Engineer/ Officer who will guide the workers from time to time as well as impart basic guideline & training at least weekly once. He / She shall possess a recognized Degree in any branch of engineering or technology or architecture and had a post qualification construction experience of minimum two years or possess a recognized Diploma in any branch of engineering or technology or Graduate in Science stream and had a post qualification construction experience of minimum five years.

Above 500
(for every 500 or less) - One additional safety engineer/Officer whose function will be as mentioned above

Contractor shall indemnify and hold harmless OWNER/ MECON & their representative's from any and all liabilities arising out of non fulfillment of HSE requirements.

Above is the minimum requirement and the Contractor shall ensure physical presence of a safety personnel at each place where Hot work permit is required. No work shall be started at site until above safety personnel are physically present at site. The contractor shall submit a safety organogram clearly indicating the lines of responsibility and reporting system. He shall furnish Bio-Data/Resume/Curriculum Vitae of the safety personnel he intends to mobilize, at least 1 month before the intended mobilization, for MECON/Owner's approval.

- 3.1.4 The Contractor shall ensure that the Health, Safety and Environment (HSE) requirements are clearly understood & faithfully implemented at all levels, at each and every site/ work place.
- 3.1.5 The Contractor shall promote and develop consciousness for Health, Safety and Environment among all personnel working for the Contractor. Regular awareness programs and fabrication shop/work site meeting shall be arranged on HSE activities to cover hazards involved in various operations during construction.
- 3.1.6 Arrange suitable first aid measures such as First Aid Box, trained personnel to give First Aid, Stand by Ambulance or Vehicle and install fire protection measures such as: adequate number of steel buckets with sand and water and adequate fire extinguishers to the satisfaction of OWNER/ MECON. In case the number of workers exceeds 500, the Contractor shall position an ambulance /vehicle on full time basis very close to the worksite.
- 3.1.7 The Contractor shall evolve a comprehensive planned and documented system for implementation and monitoring of the HSE requirements. This shall submitted to

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 2 of 59
			REVISION : 0
			EDITION : 1

Above 250 & upto 500 - Deploy one qualified and experienced safety Engineer/ Officer who will guide the workers from time to time as well as impart basic guideline & training at least weekly once. He / She shall possess a recognized Degree in any branch of engineering or technology or architecture and had a post qualification construction experience of minimum two years or possess a recognized Diploma in any branch of engineering or technology or Graduate in Science stream and had a post qualification construction experience of minimum five years.

Above 500
(for every 500 or less) - One additional safety engineer/Officer whose function will be as mentioned above

Contractor shall indemnify and hold harmless OWNER/ MECON & their representative's from any and all liabilities arising out of non fulfillment of HSE requirements.

Above is the minimum requirement and the Contractor shall ensure physical presence of a safety personnel at each place where Hot work permit is required. No work shall be started at site until above safety personnel are physically present at site. The contractor shall submit a safety organogram clearly indicating the lines of responsibility and reporting system. He shall furnish Bio-Data/Resume/Curriculum Vitae of the safety personnel he intends to mobilize, at least 1 month before the intended mobilization, for MECON/Owner's approval.

- 3.1.4 The Contractor shall ensure that the Health, Safety and Environment (HSE) requirements are clearly understood & faithfully implemented at all levels, at each and every site/ work place.
- 3.1.5 The Contractor shall promote and develop consciousness for Health, Safety and Environment among all personnel working for the Contractor. Regular awareness programs and fabrication shop/work site meeting shall be arranged on HSE activities to cover hazards involved in various operations during construction.
- 3.1.6 Arrange suitable first aid measures such as First Aid Box, trained personnel to give First Aid, Stand by Ambulance or Vehicle and install fire protection measures such as: adequate number of steel buckets with sand and water and adequate fire extinguishers to the satisfaction of OWNER/ MECON. In case the number of workers exceeds 500, the Contractor shall position an ambulance /vehicle on full time basis very close to the worksite.
- 3.1.7 The Contractor shall evolve a comprehensive planned and documented system for implementation and monitoring of the HSE requirements. This shall submitted to

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 3 of 59
			REVISION : 0
			EDITION : 1

OWNER & MECON for approval well in advance, prior to start of work. The monitoring for implementation shall be done by regular inspection and compliance to the observations thereof. The Contractor shall get similar HSE requirements implemented at his sub-contractor (s) work site/ Office. However, compliance of HSE requirement shall be the sole responsibility of the Contractor. Any review/ approval by OWNER/ MECON shall not absolve the Contractor of his responsibility/ liability in relation to all HSE requirements.

3.1.8 Non-Conformance on HSE by the Contractor (including his Sub-contractors) as brought out during review/ audit by MECON/ OWNER representative shall be resolved forthwith by Contractor. Compliance report shall be possibility submitted to MECON/ OWNER at the earliest.

3.1.9 The Contractor shall ensure participation of his Resident Engineer/Site-in-Charge in the Safety Committee/HSE Committee meetings arranged by OWNER/ MECON. The compliance of any observation shall be arranged urgently. Contractor shall assist OWNER/MECON to achieve the targets set by them on HSE during the project implementation.

The contractor shall ensure that his staff members & workers (permanent as well casual) shall not be in a state of intoxication during working hours and shall abide by any law relating to consumption & possession of intoxicating drinks or drugs in force. Awareness about local laws on this issue shall form part of the Induction Training.

The contractor shall ensure that all personnel working for him comply with No-smoking requirements of the owner as notified from time to time. Cigarettes, lighters, auto ignition tools or appliances shall not be allowed inside the plant complex. Smoking shall be permitted only inside smoking booths expressly designated & authorized by the Owner/MECON.

3.1.10 The Contractor shall adhere consistently to all provisions of HSE requirements. In case of non-compliance or continuous failure in implementation of any of HSE provisions; OWNER/ MECON may impose stoppage of work without any Cost & Time implication to Owner and/or impose a suitable penalty for non-compliance with a notice of suitable period, upto a cumulative limit of 1.0% (one percent) of Contract value with a ceiling of Rs. 10 lakhs.

0.2% (Zero decimal two percent) of the contract value for LSTK, EPC, EPCC or Package contracts with an overall ceiling of Rs. 1,00,00,000/- (Rupees one crore).

S. No.	Violation or HSE norms	Penalty Amount
1.	For not using personal protective equipment (Helmet, Shoes, Goggles, Gloves, Full body harness, Face shield, Boiler suit, etc.)	Rs. 250/- per day / item / person
2.	Working without Work Permit / Clearance	Rs.5,000/- per occasion

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 4 of 59
			REVISION : 0
			EDITION : 1

S. No.	Violation or HSE norms	Penalty Amount
3.	Unsafe electrical practices (not installing ELCB, using poor joints of cables, using naked wire without top plug into socket, laying wire / cables on the roads, electrical jobs by incompetent person, etc.)	Rs.3,000/- per item per day.
4.	Working at height without full body harness, using non-standard / rejected scaffolding and not arranging fall protection arrangement as required like Safety Nets.	Rs.1,000/ per case per day.
5.	Unsafe handling of compressed gas cylinders (No trolley, jubilee clips double gauge regulator, improper storage / handling).	Rs. 100/- per item per day
6.	Use of domestic LPG for cutting purpose.	Rs.1,000/- per occasion
7.	No fencing / barricading of excavated areas.	Rs.1,000/- per occasion
8.	Not providing shoring / strutting / proper slope and not keeping the excavated earth at least 1.5 M away from excavated area.	Rs.5,000/- per occasion
9.	Non display of caution boards, list of hospitals, emergency services available at work locations.	Rs.500/- per occasion
10.	Traffic rules violations like over speeding of vehicles, rash driving, wrong parking, not using seat belts, vehicles not fitted with reverse warning alarms.	Rs.1,000/- per occasion
11.	Absence of Contractor's top most executive at site in the safety meetings whenever called by MECON / Owner	Rs.1,000/- per occasion
12.	Failure to maintain safety records by Contractor Safety personnel.	Rs.1,000/- per month.
13.	Failure to conduct daily safety site inspection, HSE meeting and HSE audit at predefined frequencies.	Rs.1,000/- per occasion
14.	Failure to submit the monthly HSE report by 5 th of subsequent month to Engineer-in-Charge.	Rs. 1,000/- per occasion and Rs. 100/- per day for further delay.
15.	Poor House Keeping	Rs.1,000/- per occasion
16.	Failure to report & follow up accident (including Near Miss) reporting system.	Rs. 10,000/- per occasion

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 5 of 59
			REVISION : 0
			EDITION : 1

S. No.	Violation or HSE norms	Penalty Amount
17.	Degradation of environment (not confining toxic spills oil / lubricants onto ground)	Rs.1,000/- per occasion
18.	Not medically examining the workers before allowing them to work at height, not providing ear muffs while allowing them to work in noise polluted areas, made them to work in air polluted areas without respiratory protective devices, etc.	Rs.1,000/- per occasion
19.	Violation of any other safety condition as per job HSE plan, work permit and HSE conditions of contract (using crowbar on cable trenches, improper welding booth, not keeping fire extinguisher ready at hot work site, unsafe rigging practices, non-availability of First-Aid box, etc.)	Rs.1,000/- per occasion
20.	Any violation not covered above.	To be decided by MECON / Owner

This penalty shall be in addition to all other penalties specified else where in the contract. The decision of imposing stoppage of work, its extent & monetary penalty shall rest with MECON/OWNER & binding on the Contractor.

3.1.11 All fatal accidents and other personnel accidents shall be investigated by a team of Contractor's senior personnel for root cause and recommend corrective and preventive actions. Findings shall be documented and suitable actions taken to avoid recurrences shall be communicated to OWNER / MECON. OWNER / MECON shall have the liberty to independently investigate such occurrences and Contractor shall extend all necessary help and co-operation in this regard. MECON / Owner shall have the right to share the content of this report with the outside world.

3.2 House Keeping

3.2.1 Contractor shall ensure that a high degree of house keeping is maintained and shall ensure the followings:

- All surplus earth and debris are removed/disposed off from the working site to identified location (s).
- Unused/Surplus Cables Steel items and steel scrap lying scattered at different places within the working areas are removed to identified location (s).
- All wooden scrap, empty wooden cable drums and other combustible packing materials shall be removed from work place to identified location(s).

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 6 of 59
			REVISION : 0
			EDITION : 1

- d. Roads shall be kept clear and materials like pipes, steel, sand, boulders, concrete chips and bricks, etc. shall not be allowed in the roads to obstruct free movement of men & machineries.
- e. Fabricated steel structurals, pipes & piping materials shall be stacked properly for erection.
- f. Water logging on rods shall not be allowed.
- g. No parking of trucks/ trolleys, cranes and trailers etc. shall be allowed on of roads, which may obstruct the traffic movements.
- h. Utmost care shall be taken to ensure over all cleanliness and proper up keep of the working areas.
- i. Trucks carrying sand, earth and pulverized materials etc. shall be covered while moving within the plant areas.
- j. The contractor shall ensure that the atmosphere in plant area and on roads is free from particulate matter like dust, sand, etc. by keeping the top surface wet for ease in breathing.
- k. At least two exits for any unit area shall be assured at all times.

3.3

Healthy, Safety and Environment

- a) The Contractor shall provide safe means of access to any working place including provision of suitable and sufficient scaffolding at various stages during all operations of the work for the safety of his workmen, and OWNER/ MECON. Contractor shall ensure deployment of appropriate equipment and appliances for adequate safety and healthy of the workmen and protection of surrounding areas.

Contractor shall ensure identification of all Occupational Health, Safety & Environmental hazards in the type of work he is going to undertake and enlist mitigation measures. Contractor shall carry out Job Safety Analysis (JSA) specifically for high risk jobs like working at height & in confined space, deep excavations, radiography jobs, electrical installations, blasting operations, demolishing / dismantling activities, welding / gas cutting jobs and submit the findings to MECON / Owner. The necessary HSE measures devised shall be in place prior to start of an activity by the contractor.

- b) The Contractor shall ensure that all their staff workers including their sub-Contractor (s) shall wear Safety Helmet and Safety shoes. Contractor shall also ensure use of safety belt, protective goggles, gloves etc. by the personnel as per jobs requirements. All these gadgets shall conform to relevant IS specification equivalent.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 7 of 59
			REVISION : 0
			EDITION : 1

The Contractor shall ensure that all their staff, workers and visitors including their sub-contractor(s) have been issued (records to be kept) & wear appropriate PPEs like nape strap type safety helmets preferably with head & sweat band with ¾" cotton chin strap (made of industrial HDPE), safety shoes with steel toe cap and antiskid sole, full body harness (CE marked and conforming to EN361), protective goggles, gloves, ear muffs, respiratory protective devices, etc. All these gadgets shall conform to applicable IS Specifications / CE or other applicable international standards.

Owner may issue a comprehensive color scheme for helmets to be used by various agencies. The Contractor shall follow the scheme issued by the owner. All Safety / Fire personnel shall preferably wear red colour helmet so that workmen can approach them for guidance during emergencies.

For shot blasting, the usage of protective face shield and helmets, gauntlet and protective clothing is mandatory.

For offshore jobs/contracts, contractor shall provide PPEs (new) to MECON & Owner's personnel, at his (contractor's) cost. All personnel shall wear life jacket at all time.

An indicative list of HSE standards/codes is given under Appendix-A.

The contractor shall issue height permit for working at height after verifying and certifying the checkpoints as specified in the attached permit (Format No. HSE-6). He shall also undertake to ensure compliance to the conditions of the permit during the currency of the permit including adherence to personal protective equipments.

The permit shall be issued initially for one week or expected duration of an activity and extended further for the balance duration. This permit shall be applicable in areas where specific clearance from Owner's operation Deptt. / Safety Deptt. is not required. MECON field Engineers / Safety Officers / Area Coordinators may verify and counter sign this permit (as an evidence of verification) during the execution of the job.

In case work is undertaken without taking sufficient precautions as given in the permit, MECON Engineers may cancel the permit and stop the work till satisfactory compliance is arranged. Contractors are expected to maintain a register for issuance of permit and extensions thereof including preserving the used permits for verification during audits etc.

Contractor shall arrange (at his cost) and ensure use of Fall Arrester Systems by his workers. Fall arresters are to be used while climbing / descending tall structures. These arresters should lock automatically against the anchorage line, restricting free fall of the user. The device is to be provided with a double security opening system to ensure safe attachment or release of the user at

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 8 of 59
			REVISION : 0
			EDITION : 1

any point of rope. In order to avoid shock, the system should be capable of keeping the person in vertical position in case of a fall.

Contractor shall ensure that Full body harnesses conforming EN361 and having authorized CC marking is used by all personnel while working at height. The lanyards and life lines should have enough tensile strength to take the load of the worker in case of a fall. One end of the lanyard shall be firmly tied with the harnesses and the other end with life line. The harness should be capable of keeping the workman vertical in case of a fall, enabling him to rescue himself.

Contractor shall provide Roof Top Walk Ladders for carrying out activities on sloping roofs in order to reduce the chances of slippages and falls.

- c) Contractor shall ensure that a proper Safety Net System shall be used at appropriate locations. The safety net shall be located not more than 30 feet (9.0 metres) below the working surface at site to arrest or to reduce the consequences of possible fall of persons working at different heights.
- d) Contractor shall ensure that flash back arrestors conforming to BS:6158 or equivalent are installed on all gas cylinders as well as at the torch end of the gas hose, while in use. All cylinders shall be mounted on trolleys and provided with a closing key. The burner and the hose placed downstream of pressure reducer shall be equipped with Flash Back Arrestor / Non Return Valve device. The hoses for acetylene and oxygen cylinders must be of different colours. Their connections to cylinders and burners shall be made with a safety collar. At end of work, the cylinders in use shall be closed and hoses depressurized. All welding machines shall have effective earthing. In order to help maintain good housekeeping, and to reduce fire hazard, live electrode bits shall be contained safely and shall not be thrown directly on the ground.
- e) The Contractor shall assign to his workmen, tasks commensurate with their qualification, experience and state of health for driving of vehicles, handling and erections of materials and equipment's. All lifting equipments shall be tested certified for its capacity before use. Adequate and suitable lighting at every work place and approach there to shall be provided by the contractor before starting the actual work/ operation at night.

Contractor shall ensure installation of Safe Load Indicator (SLI) on all cranes (while in use) to minimize overloading risk. SLI shall have capability to continuously monitor and display the load on the hook, and automatically compare it with the rated crane capacity at the operating condition of the crane. The system shall also provide visual and audible warnings at set capacity levels to alert the operator in case of violations.

The contractor shall be responsible for safe operations of different equipments mobilized and used by him at the workplace like transport

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO.	Page 9 of 59
		MEC/S/05/21/65	REVISION : 0
			EDITION : 1

vehicles, engines, cranes, mobile ladders, scaffoldings, work tools, etc.

- f) Hazardous and/or toxic material such as solvent coating or thinners shall be stored in appropriate containers.
- g) All hazardous materials shall be labeled with the name of the materials, the hazards associated with its use and necessary precautions to be taken.

The work place shall be checked prior to start of activities to identify the location, type and condition of any asbestos materials which could be disturbed during the work. In case asbestos material is detected, usage of appropriate PPEs by all personnel shall be ensured and the matter shall be reported immediately to MECON / Owner.

- h) Contractor shall ensure that during the performance of the work all hazards to the health of personnel have been identified assessed and eliminated.
- i) Chemical spills shall be contained & cleaned up immediately to prevent further contamination.
- j) All personnel exposed to physical agents such as ionizing or non-ionizing radiation ultraviolet rays or similar other physical agents shall be provided with adequate shielding or protection commensurate with type of exposure involved. For ionizing radiation, requirements of Bhabha Atomic Research Centre (BARC)/ Atomic Energy Regulatory Board (AERB) shall be followed.
- k) Where contract or exposure of hazardous materials could exceed limits or could otherwise have harmful affects, appropriate personal protective equipment's such as gloves, goggles, aprons, chemical resistant clothing and respirator shall be used.

- l) Contractor shall ensure the following facilities at work sites:

- I) A Crèche where 10 or more female workers are having children below the age of 6 years.

- II) Reasonable Canteen facilities are made available at appropriate location depending upon site conditions.

- m) Suitable facilities for toilet, drinking water, proper lighting shall be provided at site and labor camps, commensurate with applicable Laws/Legislation.
- n) Contractor shall ensure storage and utilization methodology of material that are not detrimental to the environment. Wherever required Contractor shall ensure that only the environment friendly material are selected.

Emphasize on recycling of waste materials such as metals, plastics, glass, paper, oil & solvents. The waste that can not be minimized, reused or

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 10 of 59
			REVISION : 0
			EDITION : 1

recovered shall be stored and disposed of safely. In no way, toxic spills shall be allowed to percolate into the ground. The contractor shall not use the empty areas for dumping the wastes.

- o) All person deployed at site shall be knowledgeable of and comply with the environmental laws, rules & regulation relating to the hazardous materials substance and wastes. Contractor shall not dump, release or otherwise discharge or dispose off any such materials without the authorization of OWNER/ MECON.

Suitable scaffoldings shall be provided to workmen for all works that cannot be safely done from the ground or from solid construction except such short period work that can be safely done using ladders. When a ladder is used, an extra workman shall be engaged for holding the ladder.

The contractor shall ensure that the scaffolds used during construction activities shall be strong enough to take the designed load. Owner / MECON reserves the right to ask the contractor to submit certification and or design calculations from his Engineering regarding load carrying capacity of the scaffoldings.

All scaffolds shall be inspected by a Scaffolding Inspector of the contractor. He shall paste a GREEN tag on each scaffold found safe and a RED tag on each scaffold found unsafe. Scaffoldings with GREEN tag only shall be permitted to be used and RED ones shall immediately be removed from the site.

All electrical installations / connections shall be carried out as per the provisions of latest revision of following codes/standards, in addition to the requirements of Statutory Authorities and IE / applicable international rules & regulations:

- OISO SID 173 : Fire prevention & protection system for electrical installations
- SP 30 (BIS) : National Electric Code

All electrical installations shall be approved by the concerned statutory authorities.

- The contractor shall meet the following requirements:
 - i) Ensure that electrical systems and equipment including tools & tackles used during construction phase are properly selected, installed, used and maintained as per provisions of the latest revision of the Indian Electrical / applicable international regulations.
 - ii) Shall deploy qualified & licensed electricians for proper & safe installation and for regular inspection of construction power

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO.	Page 11 of 59
		MEC/S/05/21/65	REVISION : 0
			EDITION : 1

distribution system / points including their earthing. A copy of the license shall be submitted to MECON / Owner for records. Availability of at least one competent licensed electrician shall be ensured at site round the clock to attend to the normal / emergency jobs.

- iii) All switchboards / welding machines shall be kept in well-ventilated & covered shed. The shed shall be elevated to avoid water logging. No flammable materials shall be used for constructing the shed. Also flammable materials shall not be stored in and around electrical equipment / switchboard. Adequate clearances and operational space shall be provided around the equipment.
- iv) Fire extinguishers and insulating mats shall be provided in all power distribution centers.
- v) Temporary electrical equipment shall not be employed in hazardous area without obtaining safety permit.
- vi) Proper house keeping shall be done around the electrical installations.
- vii) All temporary installations shall be tested before energising, to ensure proper earthing, bonding, suitability of protection system, adequacy of feeders/cables etc.
- viii) All welders shall use hand gloves irrespective of holder voltage.
- ix) Multilingual (Hindi, English and local language) caution boards, shock treatment charts and instruction plate containing location of isolation point for incoming supply, name & telephone No. of contact person in emergency shall be provided in substations and near all distribution boards / local panels.
- x) Operation of earth leakage device shall be checked regularly by temporarily connecting series test lamp (2 bulbs of equal rating connected in series) between phase and earth.
- xi) Regular inspection of all installations (at least once in a month)
- The following features shall also be ensured for all electrical installations during construction phase by the contractor:
 - i) Each installation shall have a main switch with a protective device, installed in an enclosure adjacent to the metering point. The operating height of the main switch shall not exceed 1.5 M. The main switch shall be connected to the point of supply by means of armoured cable.
 - ii) The outgoing feeders shall be double or triple pole switches with fuses / MCBs. Loads in a three phase circuit shall be balanced as far as

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 12 of 59
			REVISION : 0
			EDITION : 1

possible and load on neutral should not exceed 20% of load in the phase.

- iii) The installation shall be adequately protected against overload, short circuit and earth leakage by the use of suitable protective devices. Fuses wherever used shall be HRC type. Use of rewirable fuses shall be strictly prohibited. The earth leakage device shall have an operating current not exceeding 30 mA.
- iv) All connections to the hand tools / welding receptacles shall be taken through proper switches, sockets and plugs.
- v) All single phase sockets shall be minimum 3 pin type only. All unused sockets shall be provided with socket caps.
- vi) Only 3 core (P+N+E) overall sheathed flexible cables with minimum conductor size of 1.5 mm² copper shall be used for all single phase hand tools.
- vii) Only metallic distribution boxes with double earthing shall be used at site. No wooden boxes shall be used.
- viii) All power cables shall be terminated with compression type cable glands. Tinned copper lugs shall be used for multistrand wires / cables.
- ix) Cables shall be free from any insulation damage.
- x) Minimum depth of cable trench shall be 750 mm for MV & control cables and 900 mm for HV cables. These cables shall be laid over a sand layer and covered with sand, brick & soil for ensuring mechanical protection. Cables shall not be laid in waterlogged area as far as practicable. Cable route markers shall be provided at every 25 M of buried trench route. When laid above ground, cables shall be properly cleated or supported on rigid poles of atleast 2 M high. Minimum head clearance of 6 meters shall be provided at road crossings.
- xi) Under ground road crossings for cables shall be avoided to the extent feasible. In any case no under ground power cable shall be allowed to cross the roads without pipe sleeve.
- xii) All cable joints shall be done with proper jointing kit. No taped / temporary joints shall be used.
- xiii) An independent earthing facility should preferably be established within the temporary installation premises. All appliances and

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 13 of 59
			REVISION : 0
			EDITION : 1

equipment shall be adequately earthed. In case of armoured cables, the armour shall be bonded to the earthing system.

- xiv) All cables and wire rope used for earth connections shall be terminated through tinned copper lugs.
- xv) In case of local earthing, earth electrodes shall be buried near the supply point and earth continuity wire shall be connected to local earth plate for further distribution to various appliances. All insulated wires for earth connection shall have insulation of green colour.
- xvi) Separate core shall be provided for neutral. Earth / Structures shall not be used as a neutral in any case.
- xvii) ON/OFF position of all switches shall be clearly designated / painted for easy isolation in emergency.

The contractor shall identify all operations that can adversely affect the health of its workers and issue & implement mitigation measures.

For surface cleaning operations, sand blasting shall not be permitted even if not explicitly stated elsewhere in the contract.

To eliminate radiation hazard, Tungsten electrodes used for Gas Tungsten Arc Welding shall not contain Thorium.

Appropriate respiratory protective devices shall be used to protect workmen from inhalation of air borne contaminants like silica, asbestos, gases, fumes, etc.

Workmen shall be made aware of correct methods for lifting, carrying, pushing & pulling of heavy loads. Wherever possible, manual handling shall be replaced by mechanical lifting equipments.

For jobs like drilling / demolishing / dismantling where noise pollution exceeds the specified limit of 85 decibels, ear muffs shall be provided to the workers.

To avoid upper limb disorders and backaches, Display Screen Equipments' workplace stations shall be carefully designed & used with proper sitting postures. Power driven hand-held tools shall be maintained in good working condition to minimize their vibrating effects and personnel using these tools shall be taught how to operate them safely & how to maintain good circulation in hands.

The contractor shall arrange health check up for all the workers at the time of induction. Health check may have to be repeated if the nature of duty assigned to him is changed necessitating health check or doubt arises about his wellness. MECON / Owner reserve the right to ask the contractor to submit test reports.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO.	Page 14 of 59
		MEC/S/05/21/65	REVISION : 0
			EDITION : 1

Weather Protection

Contractor shall take appropriate measures to protect workers from severe storms, solar radiations, poisonous gases, dust, etc. by ensuring proper usage of PPEs like Sun glasses, Sun screen lotions, respirators, dust masks, etc. and rearranging / planning the construction activities to suit the weather conditions.

Communication

All persons deployed at the work site shall have access to effective means of communication so that any untoward incident can be reported immediately and assistance sought by them.

All health & safety information shall be communicated in a simple & clear language easily understood by the local workforce.

Unsuitable Land Conditions

Contractor shall take appropriate measures and necessary work permits / clearances if work is to be done in or around marshy areas, river crossings, mountains, monuments, etc.

Under Water Inspection

Contractor shall ensure that boats and other means used for transportation, surveying & investigation works shall be certified seaworthy by a recognized classification society. It shall be equipped with all life saving devices like life jackets, adequate fire protection arrangements and shall possess communication facilities like cellular phones, wireless, walkie-talkie. All divers used for seabed surveys, underwater inspections shall have required authorized license, suitable life saving kit. Number of hours of work by divers shall be limited as per regulations. MECON / Owner shall have the right to inspect the boat and scrutinize documents in this regard.

TOOL BOX MEETING (TBM)

Contractor shall conduct daily TBM with workers prior to start of work and shall maintain proper record of the meeting. A suggested format is given below. The TBM is to be conducted by the immediate supervisor of the workers.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO.	Page 15 of 59
		MEC/S/05/21/65	REVISION : 0
			EDITION : 1

TOOLBOX MEETING RECORDING SHEET

Date & Time		
Subject		
Presenter		
Hazards involved		
Precautions to be taken		
Worker's Name	Signature	Section
Remarks, if any		

The topics during TBM shall include

- Hazards related to work assigned on that day and precautions to be taken.
- Any forthcoming HSE hazards / events / instruction / orders, etc.

The above record can be kept in local language, which workers can read. These records shall be made available to MECON / Owner whenever demanded.

TRAINING

Contractor shall ensure that all his personnel possess appropriate training to carry out the assigned job safely. The training should be imparted in a language understood by them and should specifically be trained about

- Potential hazards to which they may be exposed at their workplace
- Measures available for prevention and elimination of these hazards

The topics during training shall cover, at the minimum;

- Education about hazards and precautions required
- Emergency and evacuation plan
- HSE requirements
- Fire fighting and First-Aid
- Use of PPEs
- Local laws on intoxicating drinks, drugs, smoking in force

Records of the training shall be kept and submitted to MECON / Owner whenever demanded.

For offshore and jetty jobs, contractor shall ensure that all personnel deployed have undergone a structured sea survival training including use of lifeboats, basket landing, use of radio communication etc. from an agency acceptable to Owner / MECON.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 16 of 59
			REVISION : 0
			EDITION : 1

INSPECTION

The contractor shall carryout daily HSE inspection and record observations at a central location. These inspection records shall be freely accessible to Owner / MECON representatives. The contractor shall also assist Owner / MECON representatives during the HSE inspections conducted by them.

ADDITIONAL SAFETY REQUIREMENTS FOR WORKING INSIDE A RUNNING PLANT

As a minimum, the contractor shall ensure adherence to following safety requirements while working in or in the close vicinity of an operating plant :

- a) Contractor shall obtain permits for Hot work, Cold work, Excavation and Confined Space from Owner in the prescribed format.
- b) The contractor shall monitor, record and compile list of his workers entering the operational plant/unit each day and ensure & record their return after completing the job.
- c) Contractor's workers and staff members shall use designated entrances and proceed by designated routes to work areas only assigned to them. The workers shall not be allowed to enter units' area, tanks area, pump rooms, etc. without work authorization permit.
- d) Work activities shall be planned in such a way so as to minimize the disruption of other activities being carried out in an operational plant / unit and activities of other contractors.
- e) The contractor shall submit a list of all chemicals / toxic substances that are intended to be used at site and shall take prior approval of the Owner.
- f) Specific training on working in a hydrocarbon plant shall be imparted to the work force and mock drills shall be carried out for Rescue operations / First-Aid measures.
- g) Proper barricading / cordoning of the operational units / plants shall be done before starting the construction activities. No unauthorized person shall be allowed to trespass. The height and overall design of the barricading structure shall be finalized in consultation with the Owner and shall be got approved from the Owner.
- h) Care shall be taken to prevent hitting underground facilities such as electrical cables, hydrocarbon piping during execution of work.
- i) Barricading with water curtain shall be arranged in specific/critical areas where hydrocarbon vapors are likely to be present such as near horton spheres or tanks. Positioning of fire tenders (from owner) shall also be ensured during execution of critical activities.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 17 of 59
			REVISION : 0
			EDITION : 1

- j) Emergency evacuation plan shall be worked out and all workmen shall be apprised about evacuation routes. Mock drill operations may also be conducted.
- k) Flammable gas test shall be conducted prior to any hot work using appropriate measuring instruments. Sewers, drains, vents or any other gas escaping points shall be covered with flame retardant tarpaulin.
- l) Respiratory devices shall be kept handy while working in confined zones where there is a danger of inhalation of poisonous gases. Constant monitoring of presence of Gas / Hydrocarbon shall be done.
- m) Clearance shall be obtained from all parties before starting hot tapping, patchwork on live lines and work on corroded tank roof.
- n) Positive isolation of line/equipment by blinding for welding/cutting/grinding shall be done. Closing of valve will not be considered sufficient for isolation.
- o) Welding spatters shall be contained properly and in no case shall be allowed to fall on the ground containing oil. Similar care shall be taken during cutting operations.
- p) The vehicles, cranes, engines, etc. shall be fitted with spark arresters on the exhaust pipe and got it approved from Safety Department of the Owner.
- q) Plant air should not be used to clean any part of the body or clothing or use to blow off dirt on the floor.
- r) Gas detectors should be installed in gas leakage prone areas as per requirement of Owner's plant operation personnel.
- s) An experienced full time safety personnel shall be exclusively deployed to monitor safety aspects in running plants.

HSE PROMOTION

The contractor shall encourage his workforce to promote HSE efforts at workplace by way of organizing workshops / seminars / training programmes, celebrating HSE awareness weeks & National Safety Day, conducting quizzes & essay competitions, distributing pamphlets, posters & material on HSE, providing incentives for maintaining good HSE practices and granting bonus for completing the job without any lost time accident.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 18 of 59
			REVISION : 0
			EDITION : 1

4.0 **DETAILS OF HSE MANAGEMENT SYSTEM BY CONTRACTOR**

4.1 **On Award of Contract**

The Contractor shall prior to start of work submit his Health, Safety and Environment Manual of procedure and HSE Plans for approval by OWNER/MECON. The Contractor shall participate in the pre-start meeting with OWNER/MECON to finalize HSE plans including the following.

- Job procedure to be followed by Contractor for activities covering Handling of equipment's, Scaffolding, Electric Installation, describing the risks involved, actions to be taken and methodology for monitoring each.
- Organizations structure alongwith responsibility and authority records/ reports etc. on HSE activities.

4.2 **During ob execution**

4.2.1 Implement approved Health, Safety and Environment management procedure including but not limited to as brought our under para 3.0. Contractor shall also ensure to:

- Arrange workmen compensation insurance, registration under ESI Act, third party liability insurance etc. as applicable.
- Arrange all HSE permits before start of activities (as applicable) like her work, confined space, work at heights, storage of Chemicals/explosives materials and its use and implement all precautions mentioned therein
- Submit timely the completed check list on HSE activities, Monthly HSE report, accident report, investigation report, etc. as per OWNER/MECON requirements. Compliance of instructions on HSE shall be done by Contractor and informed urgently to OWNER/MECON.
- Ensure that resident Engineers/Site-In-Charge of the Contractor shall amend all the Safety Committee/HSE meeting arranged by OWNER/ MECON only in case of his absence from site, a seconds senior most person shall be nominated by him in advance and communicated to OWNER/MECON.
- Display at site office and work locations caution boards, list of hospitals for emergency services available.
- Provided posters, banners, for safe working to promote safety consciousness
- Carryout audits/inspection at sub Contractor work as per approved HSE documents & submit the reports for OWNER/MECON review.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 19 of 59
			REVISION : 0
			EDITION : 1

- Assist in HSE audits by OWNER/ MECON and submit compliance report.
- Generate & submit HSE records/ reports as per HSE Plan.
- Appraise OWNER/MECON on HSE activities at site.

5.0 RECORDS

At the minimum, the contractor shall maintain/ submit HSE records in the following reporting formats:

1.	Monthly HSE Checklist cum compliance report	HSE-1
2.	Accident / Incident Report	HSE-2
3.	Supplementary Accident / Incident Investigation report	HSE-3
4.	Near Miss Incident Report	HSE-4
5.	Monthly HSE Report	HSE-5
6.	Permit for working at height	HSE-6
7.	Permit for working in confined space	HSE-7
8.	Permit for radiation work	HSE-8
9.	Permit for demolishing / dismantling	HSE-9

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO.	Page 20 of 59
		MEC/S/05/21/65	REVISION : 0
			EDITION : 1

ANNEXURE-A

A. I.S. CODES ON HSE

SP:53	Safety code for the use, Care and protection of hand operated tools.
IS: 818	Code of practice for safety and health requirements in electric and gas welding and cutting operations
IS: 1179	Eye and Face precautions during welding, equipment etc.
IS: 1860	Safety requirements for use, care and protection of abrasive grinding wheels.
IS: 1989(Part-I & II)	Leather safety boots and shoes
IS: 2925	Industrial Safety Helmets
IS: 3016	Code of practice for fire safety precautions in welding and cutting operations.
IS: 3043	Code of practice for earthing.
IS: 3764	Code of safety for excavation work
IS: 3786	Methods for computation of frequency and severity rates for industrial injuries and classification of industrial accidents.
IS: 3996	Safety Code of scaffolds and ladders.
IS: 4082	Recommendation on stacking and storage of construction materials and components at site.
IS: 4770	Rubber gloves for electrical purposes
IS: 5121	Safety code for piling and other deep foundations
IS: 5216 (Part-I)	Recommendations on Safety procedures and practices in electrical works
IS: 5557	Industrial and Safety rubber lined boots.
IS: 5983	Eye protectors
IS:6519	Selection, care and repair of Safety footwear
IS: 6994 (Part-I)	Industrial Safety Gloves (Leather & Cotton Gloves)
IS: 7293	Safety Code for working with construction Machinery

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 21 of 59
			REVISION : 0
			EDITION : 1

IS: 8519	Guide for selection of industrial safety equipment for body protection
IS: 9167	Ear protectors
IS: 11006	Flash back arrestor (Flame arrestor)
IS:11016	General and safety requirements for machine tools and their operation
IS: 11057	Specification for Industrial safety nets
IS: 11226	Leather safety footwear having direct moulded rubber sole
IS: 11972	Code of practice for safety precaution to be taken when entering a sewerage system
IS: 13367	Code of practice-safe use of cranes
IS: 13416	Recommendations for preventive measures against hazards at working place

B. INTERNATIONAL STANDARDS ON HSE

Safety Glasses	:	ANSI Z 87.1, ANSI ZZ 87.1, AS 1337, BS 2092, BS 1542, BS 679, DIN 4646 / 58211
Safety Shoes	:	ANSI Z 41.1, AS 2210, EN 345
Hand Gloves	:	BS 1651
Ear Muffs	:	BS 6344, ANSI S 31.9
Hard Hat	:	ANSI Z 89.1 / 89.2, AS 1808, BS 5240, DIN 4840
Goggles	:	ANSI Z 87.1
Face Shield	:	ANSI Z 89.1
Breathing Apparatus	:	BS 4667, NIOSH
Welding & Cutting	:	ANSI Z 49.1
Safe handling of compressed Gases in cylinders	:	P-1 (Compressed Gas Association 1235 Jefferson Davis Highway, Arlington VA 22202 – USA)

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 22 of 59
			REVISION : 0
			EDITION : 1

ANNEXURE-B

DETAILS OF FIRST AID BOX

SL. NO	DESCRIPTION	QUANTITY
1.	Small size Roller Bandages, 1 inch wide (Finger Dressing small)	6 Pcs.
2.	Medium size Roller Bandages, 2 inch wide (Hand and Foot Dressing)	6 Pcs.
3.	Large size Roller Bandages, 4 inch wide (Body Dressing Large)	6 Pcs.
4.	Large size Burn Dressing (Burn Dressing Large)	4 Pkts.
5.	Cotton wool (20 gms packing)	4 Pkts.
6.	Antiseptic Solution Dettol (100 ml.) or Savlon	1 Bottle
7.	Mercurochrome Solution (100 ml.) 2% in water	1 Bottle
8.	Ammonia Solution (20 ml.)	1 Bottle
9.	A Pair of Scissors	1 Piece
10.	Adhesive Plaster (1.25 cm x 5 m)	1 Spool
11.	Eye pads in Separate Sealed Packet	4 Pcs.
12.	Tourniquet	1 No.
13.	Safety Pins	1 Dozen
14.	Tinc. Iodine / Betadin (100 ml.)	1 Bottles
15.	Ointment for burns (Burnol 20 gms.)	1 Bottole
16.	Polythene Wash cup for washing eyes	1 No.
17.	Potassium Permanganate (20 gms.)	1 Pkt.
18.	Tinc. Benzoine (100 ml.)	1 Bottole
19.	Triangular Bandages	2 Nos.
20.	Band Aid Dressing	5 Pcs.
21.	Iodex / Moov (25 gms.)	1 Bottole
22.	Tongue Depressor	1 No.
23.	Boric Acid Powder (20 gms.)	2 Pkt.
24.	Sodium Bicarbonate (20 gms.)	1 Pkt.
25.	Dressing Powder (Nebasulf) (10 gms.)	1 Bottole
26.	Medicinal Glass	1 No.
27.	Duster	1 No.
28.	Booklet (English & Local Language)	1 No. each
29.	Soap	1 No.
30.	Toothache Solution	1 No.
31.	Eye Ointment	1 Bottle
32.	Vicks (22 gms.)	1 Bottle
33.	Forceps	1 No.
34.	Cotton Buds (5 nos.)	1 Pkt.
35.	Note Book	1 No.
36.	Splints	4 Nos.
37.	Lock	1 Piece
38.	Life Saving/Emergency/Over-the Counter Drugs	As decided at site
	Box size : 14" x 12" x 4"	

Note : The medicines prescribed above are only indicative. Equivalent medicines can also be used. A prescription, in this regard, shall be required from a qualified Physician.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 23 of 59
			REVISION : 0
			EDITION : 1

ANNEXURE C

TYPE OF FIRES VIS- -VIS FIRE EXTINGUISHERS

Fire	Fire Extinguishers				
	Water	Foam	CO ₂	Dry Powder	Multi Purpose (ABC)
Originated from paper, clothes, wood	√	√	Can control minor surface fires	Can control minor surface fires	√
Inflammable liquids like alcohol, diesel, petrol, edible oils, bitumen	x	√	√	√	√
Originated from gases like LPG, CNG, H ₂	x	x	√	√	√
Electrical Fires	x	x	√	√	√

Legend : √ Can be used
 x Not to be used

Note : Fire extinguishing equipment must be checked atleast once a year and after every use by an authorized person. The equipment must have an inspection label on which the next inspection date is given. Type of extinguisher shall clearly be marked on it.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 24 of 59
			REVISION : 0
			EDITION : 1

ANNEXURE D

Indicative List of Statutory Acts Rules Relating to HSE

- The Indian Explosives Act and Rules
- The Motor Vehicle Act and Central Motor Vehicle Rules
- The Factories Act and concerned Factory Rules
- The Petroleum Act and Petroleum Rules
- The Workmen Compensation Act
- The Gas Cylinder Rules and the Static & Mobile Pressure Vessels Rules.
- The Indian Electricity Act and Rules
- The Indian Boiler Act and Regulations
- The Water (Prevention & Control & Pollution) Act
- The Water (Prevention & Control of Pollution) Cess Act
- The Mines & Minerals (Regulation & Development) Act
- The Air (Prevention & Control of Pollution) Act
- The Atomic Energy Act
- The Radiation Protection Rules
- The Indian Fisheries Act
- The Indian Forest Act
- The Wild Life (Protection) Act
- The Environment (Protection) Act and Rules
- The Hazardous Wastes (Management & Handling) Rules
- The Manufacturing, Storage & import of Hazardous Chemicals Rules
- The Public Liability Act
- The Building and Other Construction Workers (Regulation of Employment and Condition of service) Act
- Other statutory acts Like EPF, ESIS, Minimum Wage Act.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 25 of 59
			REVISION : 0
			EDITION : 1

ANNEXURE E

CONSTRUCTION HAZARDS, THEIR EFFECTS PREVENTIVE MEASURES

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
(A) EXCAVATION Pit Excavation up to 3.0m	➤ Falling into pit	➤ Personal injury	➤ Provide guard rails/barricade with warning signal. ➤ Provide at least two entries/exits. ➤ Provide escape ladders.
	➤ Earth Collapse	➤ Suffocation / Breathlessness ➤ Buried	➤ Provide suitable size of shoring and strutting, if required. ➤ Keep soil heaps away from the edge equivalent to 1.5m or depth of pit whichever is more. ➤ Don't allow vehicles to operate too close to excavated areas. Maintain at least 2m distance from edge of cut. ➤ Maintain sufficient angle of repose. Provide slope not less than 1:1 and suitable bench of 0.5m width at every 1.5m depth of excavation in all soils except hard rock. ➤ Battering/benching the sides.
	➤ Contact with buried electric cables ➤ Gas/ Oil Pipelines	➤ Electrocution ➤ Explosion	➤ Obtain permission from competent authorities, prior to excavation, if required. ➤ Locate the position of buried utilities by referring to plant drawings. ➤ Start digging manually to locate the exact position of buried utilities and thereafter use

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 26 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			mechanical means.
Pit Excavation beyond 3.0m	➤ Same as above plus Flooding due to excessive rain/ underground water	➤ Can cause drowning situation	➤ Prevent ingress of water ➤ Provide ring buoys ➤ Identify and provide suitable size dewatering pump or well point system
	➤ Digging in the vicinity of existing Building/ Structure	➤ Building/ Structure may collapse ➤ Loss of health & wealth	➤ Obtain prior approval of excavation method from local authorities ➤ Use under-pining method ➤ Construct retaining wall side by side
	➤ Movement of vehicles / equipments close to the edge of cut.	➤ May cause cave-in or slides ➤ Persons may get buried	➤ Barricade the excavated area with proper lighting arrangements ➤ Maintain at least 2m distance from edge of cut and use stop block to prevent over-run. ➤ Strengthen shoring and strutting
Narrow deep excavations for pipelines, etc.	➤ Same as above plus ➤ Frequent cave-in or slides	➤ May cause severe injuries or prove fatal	➤ Battering/benching of sides ➤ Provide escape ladders
	➤ Flooding due to Hydrostatic testing	➤ May arise drowning situation	➤ Same as above plus ➤ Bail out accumulated water ➤ Maintain adequate ventilation
Rock excavation by blasting	➤ Improper handling of explosives	➤ May prove fatal	➤ Ensure proper storage, handling & carrying of explosives by trained personnel. ➤ Comply with the applicable explosive acts & rules.
	➤ Uncontrolled explosion	➤ May cause severe injuries or prove fatal	➤ Allow only authorized persons to perform blasting operations. ➤ Smoking and open

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 27 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			flames are to be strictly prohibited.
	➤ Scattering of stone pieces in atmosphere	➤ Can hurt people	➤ Use PPE like goggles, face mask, helmets etc.
Rock excavating by blasting (Contd)	➤ Entrapping of persons/ animals.	➤ May cause severe injuries or prove fatal	➤ Barricade the area with red flags and blow siren before blasting.
	➤ Misfire	➤ May explode suddenly	➤ Do not return to site for at least 20 minutes or unless announced safe by designated person.
Piling Work	➤ Failure of pile-driving equipment	➤ Can hurt people	➤ Inspect Piling rigs and pulley blocks before the beginning of each shift.
	➤ Noise pollution	➤ Can cause deafness and psychological imbalance	➤ Use personal protective equipments like ear plugs, muffs, etc.
	➤ Extruding rods / casing	➤ Can hurt people	➤ Barricade the area ➤ an install sign boards ➤ Provide first-aid
	➤ Working in the vicinity of 'Live-Electricity'	➤ Can cause electrocution / asphyxiation	➤ Keep sufficient distance from Live-Electricity as per IS code. ➤ Shut off the supply, if possible ➤ Provide artificial/rescue breathing to he injured.
(B) CONCRETING	➤ Air pollution by cement	➤ May affect Respiratory System	➤ Wear respirators or cover mouth and nose with wet cloth.
	➤ Handling of ingredients	➤ Hand s may get injured	➤ Use gloves and other PPE.
	➤ Protruding reinforcement rods.	➤ Feet may get injured	➤ Use Safety shoes. ➤ Provide platform above reinforcement for movement of workers.
	➤ Earthing of electrical mixers,	➤ Can cause electrocution / asphyxiation	➤ Ensure earthing of equipments and proper functioning of

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 28 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	vibrators, etc. not done		electrical circuit before commencement of work.
	➤ Falling of materials from height	➤ Persons may get injured	➤ Use hard hats ➤ Remove surplus material immediately from work place ➤ Ensure lighting arrangements during night hours.
	➤ Continuous pouring by same gang	➤ Cause tiredness of workers and may lead to accident.	➤ Insist on shift pattern ➤ Provide adequate rest to workers between subsequent pours.
	➤ Revolving or concrete mixer/ vibrators	➤ Parts of body or clothes may get entrapped.	➤ Allow only mixers with hopper ➤ Provide safety cages around moving motors ➤ Ensure proper mechanical locking of vibrator
Super-structure	➤ Same as above plus ➤ Deflection in props or shuttering material	➤ Shuttering / props may collapse and prove fatal	➤ Avoid excessive stacking on shuttering material ➤ Check the design and strength of shuttering material before commencement of work ➤ Rectify immediately the deflection noted during concreting
	➤ Passage to work place	➤ Improperly tied and designed props / planks may collapse	➤ Ensure the stability and strength of passage before commencement of work ➤ Do not overload and under the passage.
(C) REINFORCEMENT	➤ Curtailment and binding of rods	➤ Persons may get injured	➤ Use PPE like gloves, shoes, helmets, etc. ➤ Avoid usage of shift tools
	➤ Carrying of rods for short distance/ at	➤ Workers may injure their hands and shoulders	➤ Provide suitable pads on shoulders and use safety

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 29 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	heights		gloves. ➤ Tie up rods in easily liftable bundles ➤ Ensure proper staging.
	➤ Checking of clear distance/ cover with hands	➤ Rods may cut or injure the finger	➤ Use measuring devices tape, measuring rods, etc.
	➤ Hitting projected rods and standing on cantilever rods	➤ Persons may get injured and fall down	➤ Use safety shoes and avoid standing unnecessarily on cantilever rods ➤ Avoid wearing loose clothes
	➤ Falling of material from height	➤ May prove fatal	➤ Use helmets ➤ Provide safety nets
	➤ Transportation of rods by trucks / trailers	➤ Protruded rods may hit the persons	➤ Use red flags/lights at the ends ➤ Do not protrude the rods in front of or by the side of driver's cabin. ➤ Do not extend the rods 1/3rd of deck length or 1.5 m which is less
(D) WELDING AND GAS CUTTING	➤ Welding radiates invisible ultraviolet and infrared rays	➤ Radiation can damage eyes and skin.	➤ Use specified shielding devices and other PPE of correct specifications ➤ Avoid throated tungsten electrodes for GTAW.
	➤ Improper placement of oxygen and acetylene cylinders	➤ Explosion may occur	➤ Move out any leaking cylinder ➤ Keep cylinder in vertical position ➤ Use trolley for transportation of cylinders and chain them ➤ Use flash back arrestors
	➤ Leakage / cuts in hoses	➤ May cause fire	➤ Purge regulators immediately and then turn off ➤ Never use grease or

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 30 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			oil on oxygen line connections and copper fittings on acetylene lines ➤ Inspect regularly gas carrying hoses ➤ Always use red hose for acetylene & other fuel gases and black for oxygen.
	➤ Opening-up of cylinder	➤ Cylinder may burst	➤ Always stand back from the regulator while opening the cylinder ➤ Turn valve slowly to avoid bursting ➤ Cover the lug terminals to prevent short circuiting.
	➤ Welding of tanks, container or pipes storing flammable liquids	➤ Explosion may occur	➤ Empty & purge them before welding ➤ Never attach the ground cable to tanks, container or pipe storing flammable liquids ➤ Never use LPG for gas cutting
(E) RADIOGRAPHY	➤ Ionizing Radiation	➤ Radiations may react with the skin and can cause cancer, skin irritation, dermatitis, etc.	➤ Ensure safety regulations as per BARC/AERB before commencement of job. ➤ Cordon off the area and install Radiation warning symbols ➤ Restrict the entry of unauthorized persons ➤ Wear appropriate PPE and film badges issued by BARC/AERB
	➤ Transportation and Storage of Radiography source	➤ Same as above	➤ Never touch or handle radiography source with hands ➤ Store radiography source inside a pit in an exclusive isolated

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 31 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			storage room with lock and key arrangement. The pit should be approved by BARC/AERB ➤ Radiography source should never be carried either in passenger bus or in a passenger compartment of trains. ➤ BARC/AERB have to be informed before source movement. ➤ Permission from Director General of Civil Aviation is required for booking radio isotopes with airlines.
	➤ Loss of Radio isotope	➤ Same as above	➤ Try to locate with the help of Survey Meter. ➤ Inform BARC/AERB(*) (*) Atomic Energy Regulatory Board (AERB), Bhabha Atomic Research Centre (BARC) Anushaktinagar, Mumbai – 400 094
(F) ELECTRICAL INSTALLATION AND USAGE	➤ Short circuiting	➤ Can cause Electrocution or Fire	➤ Use rubberized hand gloves and other PPE ➤ Don't lay wires under carpets, mats or door ways. ➤ Allow only licensed electricians to perform on electrical facilities ➤ Use one socket for one appliance ➤ Ensure usage of only fully insulated wires or cables ➤ Don't place bare wire ends in a socket

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 32 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			➤ Ensure earthing of machineries and equipments ➤ Do not use damaged cords and avoid temporary connections ➤ Use spark-proof/flame proof type field distribution boxes. ➤ Do not allow open/bare connections ➤ Provide all connections through ELCB ➤ Protect electrical cables / equipment's from water and naked flames ➤ Check all connections before energizing.
	➤ Overloading of Electrical System	➤ Bursting of system can occur which leads to fire	➤ Display voltage and current ratings prominently with 'Danger' signs. ➤ Ensure approved cable size, voltage grade and type. ➤ Switch off the electrical utilities when not in use. ➤ Do not allow unauthorized connections. ➤ Ensure proper grid wise distribution of Power.
	➤ Improper laying of overhead and underground transmission lines / cables	➤ Can cause electrocution and prove fatal	➤ Do not lay unarmored cable directly on ground, wall, roof of trees ➤ Maintain at least 3m distance from HT cables ➤ All temporary cables should be laid at least 750 mm below ground on 100 mm

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 33 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			fine sand overlying by brick soling ➤ Provide proper sleeves at crossings/ intersections ➤ Provide cable route markers indicating the type and depth of cables at intervals not exceeding 30m and at the diversions / termination.
(G) FIRE PREVENTION AND PROTECTION	➤ Small fires can become big ones and may spread to the surrounding areas	➤ Cause burn injuries and may prove fatal.	➤ In case a fire breaks out, press fire alarm system and shout "Fire, Fire" ➤ Keep buckets full of sand & water/fire extinguishing equipment near hazardous locations ➤ Confine smoking to 'Smoking Zones' only ➤ Train people for using specific type of fire equipments under different classes of fire ➤ Keep fire doors/ shutters, passages and exit doors unobstructed ➤ Maintain good house keeping and first-aid boxes (for detail refer Annex-2) ➤ Don't obstruct access to Fire extinguishers ➤ Do not use elevators for evacuation during fire ➤ Maintain lightening arrestors for elevated structures ➤ Stop all electrical motors with internal combustion. ➤ Move the vehicles from dangerous

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 34 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			locations. ➤ Remove the load hanging from the crane booms. ➤ Remain out of the danger areas.
	➤ Improper selection of Fire Extinguisher	➤ It may not extinguish the fire	➤ Ensure usage of correct fire extinguisher meant for the specified fire (for details refer Appendix-C) ➤ Do not attempt to extinguish Oil and electric fires with water. Use foam cylinders/CO ₂ /sand or earth.
	➤ Improper storage of highly inflammable substances	➤ Same as above	➤ Maintain safe distance of flammable substances from source of ignition ➤ Restrict the distribution of flammable materials to only min. necessary amount ➤ Construct specifically designed fuel storage facilities ➤ Keep chemicals in cool and dry place away from hat. Ensure adequate ventilation ➤ Before welding operation, remove or shield the flammable material properly ➤ Store flammable materials in stable racks, correctly labeled preferably with catchments trays. ➤ Wipe off the spills immediately

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 35 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	➤ Short circuiting of electrical system	➤ Same as above ➤ Can cause Electrocution	➤ Don't lay wires under carpets, mats or door ways ➤ Use one socket for one appliance ➤ Use only fully insulated wires or cables ➤ Do not allow open/bare connections ➤ Provide all connections through ELCB ➤ Ensure earthing of machineries and equipments
(H) VEHICULAR MOVEMENT	➤ Crossing the Speed Limits (Rash driving)	➤ Personal injury	➤ Obey speed limits and traffic rules strictly ➤ Always expect the unexpected and be a defensive drive ➤ Use sat belts/helmets ➤ Blow horn at intersections and during overtaking operations. ➤ Maintain the vehicle in good condition ➤ Do not overtake on curves, bridges and slopes
	➤ Adverse weather condition	➤ Same as above	➤ Read the road ahead and ride to the left ➤ Keep the wind screen and lights clean ➤ Do not turn at speed ➤ Recognize the hazard, understand the defense and act correctly in time.
	➤ Consuming alcohol before and during he	➤ Same as above	➤ Alcohol and driving do not mix well. Either choose

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 36 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	driving operation		➤ alcohol or driving. ➤ If you have a choice between hitting a fixed object or an oncoming vehicle, hit the fixed object ➤ Quit the steering at once and become a passenger. Otherwise take sufficient rest and then drive. ➤ Do not force the driver to drive fast and round the clock ➤ Do not day dram while driving
	➤ Falling objects / Mechanical failure	➤ May prove fatal	➤ Ensure effective braking system, adequate visibility for the drives, reverse warning alarm. ➤ Proper maintenance of the vehicle as per manufacturer instructions
(I) PROOF TESTING (HYDROSTATIC/ PNEUMATIC TESTING	➤ Bursting of piping ➤ Collapse of tanks ➤ Tanks flying off	➤ May cause injury and prove fatal	➤ Prepare test procedure & obtain CONSULTANT/ Owner's approval ➤ Provide separate gauge for pressurizing pump and piping/equipment ➤ Check the calibration status of all pressure gauges, dead weight testers and temperature recorders ➤ Take dial readings at suitable defined intervals and ensure most of them fall between 40-60% of the gauge scale range ➤ Provide safety relief valve (set at

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 37 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			pressure slightly higher than test pressure) while testing with air/nitrogen ➤ Ensure necessary precautions, stepwise increase in pressure, tightening of bolts/ nuts, grouting, etc. before and during testing ➤ Keep the vents open before opening any valve while draining out of water used for hydro testing of tanks ➤ Pneumatic testing involves the hazard of released energy stored in compressed gas. Specific care must therefore be taken to minimize the chance of brittle failure during a pneumatic leak test. Test temperature is important in this regard and must be considered when the designer chooses the material of construction ➤ A pressure relief device shall be provided, having a set pressure not higher than the test pressure plus the lesser of 345 KPa (50 psi) or 10% of the test pressure. The gas used as test fluid, if not air, shall be nonflammable and nontoxic.
(J) WORKING AT HEIGHTS	➤ Person can fall down	➤ May sustain severe injuries or	➤ Provide guard rails/barricade at the

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO.	Page 38 of 59
		MEC/S/05/21/65	REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
		prove fatal	➤ work place ➤ Use PPE like safety belts, full body harness, life line, helmets, safety shoes, etc. ➤ Obtain a permit before starting the work at height above 3 meters ➤ Fall arrest systems like safety nets, etc. must be installed ➤ Provide adequate working space (min. 0.6 m) ➤ Tie/weld working platform with fixed support ➤ Use roof top walk ladder while working on a slopping roofs ➤ Avoid movement on beams
		➤ May hit the scrap / material stacked at the ground or in between	➤ Keep the work place neat and clean ➤ Remove the scrap immediately
	➤ Material can fall down	➤ May hit the workers working at lower levels and prove fatal.	➤ Same as above plus ➤ Do not throw or drop material or equipment from height ➤ All tools to be carried in a toolkit bags or on working uniform ➤ Remove scrap from the planks ➤ Ensure wearing of helmet by the workers at low level
(K) CONFINED SPACES	➤ Suffocation / drowning	➤ Unconsciousness, death	➤ Use respiratory devices, if required ➤ Avoid over crowding inside a confined space ➤ Provide Exhaust Fans for ventilation ➤ Do not wear loose clothes, neck ties,

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 39 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			etc. ➤ Fulfill conditions of the permit. ➤ Check for presence of hydrocarbons, O ₂ level ➤ Obtain work permit before entering a confined space ➤ Ensure that the connected piping of the equipment which is to be opened is pressure free, fluid has been drained, vents are open and piping is positively isolated by a blind flange
	➤ Presence of foul smell and toxic substances	➤ Inhalation can pose threat to life.	➤ Same as above plus ➤ Check for hydrocarbon and Aromatic compounds before entering a confined space ➤ Depute one person outside the confined space for continuous monitoring and for extending help in case of an emergency
	➤ Ignition / flame can cause fire	➤ Person may sustain burn injuries or explosion may occur	➤ Keep fire extinguishers at a hand distance ➤ Remove surplus material and scrap immediately ➤ Do not smoke inside a confined space ➤ Do not allow gas cylinders inside a confined space ➤ Use low voltage (24V) lamps for lighting ➤ Use tools with air motors or electric tools with max.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO.	Page 40 of 59
		MEC/S/05/21/65	REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			➤ voltage of 24V Remove all equipments at the end of the day
(L) HANDLING AND LIFTING EQUIPMENTS	➤ Failure of load lifting and moving equipments	➤ Can cause accident and prove fatal	➤ Avoid standing under the lifted load and within the operating radius of cranes ➤ Check periodically oil, brakes, gears, horns and tyre pressure of all moving machinery ➤ Check quality, size and condition of all chain pulley blocks, slings, U-clamps, D-shackles, wire ropes, etc. ➤ Allow crane to move only on hard, firm and leveled ground ➤ Allow lifting slings as short as possible and check gunny packings at the friction points ➤ Do not allow crane to tilt its boom while moving ➤ Install Safe Load Indicator ➤ Ensure certification by applicable authority.
	➤ Overloading of lifting equipments	➤ Can cause electrocution and fire	➤ Safe lifting capacity of derricks and winches written on them shall be got verified. ➤ The max safe working load shall be marked on all lifting equipments ➤ Check the weight of columns and other heavy items painted on them and accordingly decide about the crane

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO.	Page 41 of 59
		MEC/S/05/21/65	REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			capacity, boom and angle of erection ➤ Allow only trained operators and riggers during crane operation
	➤ Overhead electrical wires	➤ Can cause electrocution and fire	➤ Do not allow boom or other parts of crane to come within 3 m reach of overhead HT cables ➤ Hook and load being lifted shall preferably remain in full visibility of crane operator.
(M) SCAFFOLDING, FORMWORK AND LADDERS	➤ Person can fall down	➤ Person may sustain severe injuries and prove fatal	➤ Provide guard rails for working at height ➤ Face ladder while climbing and use both hands ➤ Ladders shall extend about 1m above landing for easy access and tying up purpose ➤ Do not place ladders against movable objects and maintain base at ¼ unit of the working length of the ladder ➤ Suspended scaffolds shall not be less than 500 mm wide and tied properly with ropes ➤ No loose planks shall be allowed ➤ Use PPE, like helmets, safety shoes, etc.
	➤ Failure of scaffolding material	➤ Same as above	➤ Inspect visually all scaffolding materials for stability and anchoring with permanent structures. ➤ Design scaffolding

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 42 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			for max. load carrying capacity Scaffolding planks shall not be less than 50x250 mm full thickness lumber or equivalent. These shall be cleared or secured and must extend over the end supports by at least 150mm and not more than 300 mm Don't overload the scaffolds Do not splice short ladders to make a longer one. Vertical ladders shall not exceed 6m.
	➤ Material can fall down	➤ Persons working at lower level gets injured.	➤ Remove excess material and scrap immediately ➤ Carry the tools in a tool-kit bag only ➤ Provide safety nets
(N) STRUCTURAL WORKS	➤ Personal negligence and danger of fall	➤ Can cause injury or casualty	➤ Do not take rest inside rooms built for welding machines or electrical distribution system ➤ Avoid walking on beams at height ➤ Wear helmet with chin strap and safety belts when working at height ➤ Use hand gloves and goggles during grinding operations ➤ Cover or mark the sharp and projected edges ➤ Do not stand within the operating radius of cranes
	➤ Lifting / slipping of	➤ Same as above	➤ Do not stand under the lifted load

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 43 of 59
			REVISION : 0
			EDITION : 1

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	material		➤ Stack properly all the materials. Avoid slippage during handling ➤ Control longer pieces lifted up by cranes from both ends ➤ Remove loose materials from height ➤ Ensure tightening of all nuts and bolts
(O) PIPELINE WORKS	➤ Erection / lowering failure	➤ Can cause injury	➤ Do not stand under the lifted Load ➤ Do not allow any person to come within the radii of the side boom handling pipes ➤ Check the load carrying capacity of the lifting tools and tackles ➤ Use safe Load Indicators ➤ Use appropriate PPEs
	➤ Other	➤ Same as above	➤ Wear gum boots in marshy areas ➤ Allow only one person to perform signaling operations while lowering of pipes ➤ Provide night caps on pipes ➤ Provide end covers on pipes for stoppage of pigs while testing/cleaning operations.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 44 of 59
			REVISION : 0
			EDITION : 1

FORMAT NO. HSE-1, REV. 0

HSE CHECKLIST CUM COMPLIANCE REPORT (1/6)

Project: _____
 Date: _____
 Inspection By: _____
 Frequency : Fortnightly

Contractor : _____
 Owner : _____
 Report No. : _____
 Job No : _____

Note: write 'NA' wherever the item is not applicable

SL. NO.	ITEM	YES	NO	REMARKS	ACTION
1	HOUSEKEEPING				
a)	Waste containers provided and used				
b)	Sanitary facilities adequate and clean				
c)	Passageways and Walkways clear				
d)	General neatness of working areas				
e)	Others				
2	PERSONNEL PROTECTIVE EQUIPMENT				
a)	Goggles; Shields				
b)	Face protection				
c)	Hearing protection				
d)	Safety shoes				
e)	Hand protection				
f)	Respiratory Masks etc.				
g)	Safety Belts				
h)	Safety Helmet/Hard Hat				
i)	Others				
3	EXCAVATIONS/OPENINGS				
a)	Openings properly covered or barricaded				
b)	Excavations shored				
c)	Excavations barricaded				
d)	Overnight lighting provided				
e)	Others				
4	WELDING GAS CUTTING				
a)	Gas cylinders chained upright				
b)	Cables and hoses not obstructing				
c)	Screens or shields used				
d)	Flammable materials protected				
e)	Fire extinguisher(s) accessible				
f)	Others				
5	SCAFFOLDING				
a)	Fully decked platforms				
b)	Guard and intermediate rails in place				

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 45 of 59
			REVISION : 0
			EDITION : 1

SL. NO.	ITEM	YES	NO	REMARKS	ACTION
c)	Toe boards in place				
d)	Adequate shoring				
e)	Adequate access				
f)	Others				
6	LADDERS				
a)	Extension side rails 1m above				
b)	Top of landing				
c)	Properly secured				
d)	Angle + 70 from horizontal				
e)	Others				
7	HOISTS, CRANES AND DERRICKS				
a)	Condition of cables and sheaves OK				
b)	Condition of slings, chains, hooks and eyes OK				
c)	Inspection and maintenance logs maintained				
d)	Outriggers used				
e)	Signs/barricades provided				
f)	Signals observed and understood				
g)	Qualified operators				
h)	Others				
8	MACHINERY, TOOLS AND EQUIPMENT				
a)	Proper instruction				
b)	Safety devices				
c)	Proper cords				
d)	Inspection and maintenance				
e)	Others				
9	VEHICLE AND TRAFFIC				
a)	Rules and regulations observed				
b)	Inspection and maintenance				
c)	Licensed drivers				
d)	Others				
10	TEMPORARY FACILITIES				
a)	Emergency instructions posted				
b)	Fire extinguishers provided				
c)	Fire-aid equipment available				
d)	Secured against storm damage				
e)	General neatness				
f)	In accordance with electrical requirements				
g)	Others				
11	FIRE PREVENTION				
a)	Personnel instructed				
b)	Fire extinguishers checked				
c)	No smoking in Prohibited Areas				
d)	Hydrants Clear				

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 46 of 59
			REVISION : 0
			EDITION : 1

SL. NO.	ITEM	YES	NO	REMARKS	ACTION
e)	Others				
12	ELECTRICAL				
a)	Use of 3-core armoured cables				
b)	Usage of 'All insulated' or 'double insulated' electrical tools				
c)	All electrical connection are routed through ELCB				
d)	Natural Earthing at the source of power (main DB)				
e)	Continuity and tightness of earth conductor				
f)	Covering of junction boxes, panels and other energized wiring places				
g)	Ground fault circuit interrupters provided				
h)	Prevention of tripping hazards				
i)	Others				
13	HANDLING AND STORAGE OF MATERIALS				
a)	Properly stored or stacked				
b)	Passageways clear				
c)	Others				
14	FLAMMABLE GASES AND LIQUIDS				
a)	Containers clearly identified				
b)	Proper storage				
c)	Fire extinguishers nearby				
d)	Others				
15	WORKING AT HEIGHT				
a)	Erection plan and work permit obtained				
b)	Safety nets				
c)	Full body harness and lanyards; chute lines				
d)	Health Check record available for workers going up?				
e)	Others				
16	CONFINED SPACE				
a)	Work permit obtained				
b)	Test for toxic gas and sufficient availability of oxygen conducted				
c)	At least one person outside the confined space for monitoring deputed				
d)	Availability of sufficient means of entry, exit and ventilation				
e)	Fire extinguishers and first-aid facility ensured				
f)	Lighting provision made by using 24V lamps				
g)	Proper usage of PPEs ensured				
17	RADIOGRAPHY				
a)	Proper storage and handling of source as per BARC / AREB guidelines				
b)	Working permit obtained				
c)	Cordoning of the area done				

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 47 of 59
			REVISION : 0
			EDITION : 1

SL. NO.	ITEM	YES	NO	REMARKS	ACTION
d)	Use of appropriate PPE's ensured				
e)	Proper training to workers/supervisors imparted				
f)	Minimum occupancy of workplace ensured				
18	HEALTH CHECKS				
a)	Workers medically examined and found to fit for working : i) At heights ii) In confined space.				
b)	Availability of First-aid facilities				
c)	Proper sanitation at site, office and labour camps				
d)	Arrangement of medical facilities				
e)	Measures for dealing with illness				
f)	Availability of Portable drinking water for workmen & staff				
g)	Provision of crèches for children				
h)	Stand by vehicle available for evacuation of injured.				
19	ENVIRONMENT				
a)	Chemical and other effluents properly disposed				
b)	Cleaning liquid of pipes disposed off properly				
c)	Seawater used for hydro-testing disposed off as per agreed procedure				
d)	Lubricant Waste/Engine oils properly disposed				
e)	Waste from Canteen, offices, sanitation etc. disposed properly				
f)	Disposal of surplus earth, stripping materials, oily rags and combustible materials done properly				
g)	Green belt protection				

 Signature of Resident Engineer with Seal

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 48 of 59
			REVISION : 0
			EDITION : 1

FORMAT NO. HSE-2, REV. 0

ACCIDENT / INCIDENT REPORT
(To be submitted by Contractor after every Accident / Incident within 24 hours)

Report No: _____
 Date: _____

Name of Site:- _____
 CONTRACTOR _____

Type of Accident / Incident : ☐ Fatal ☐ Other Lost Time ☐ Non Loss Time ☐ First-Aid case

NAME OF THE INJURED
 AGE
 FATHER'S NAME
 SUB-CONTRACTOR M/S
 DATE & TIME OF ACCIDENT
 LOCATION

BRIEF DESCRIPTION OF ACCIDENT

CAUSE OF ACCIDENT

NATURE OF INJURY/DAMAGE

MEDICAL AID PROVIDED/ACTIONS TAKEN

INTIMATION TO LOCAL AUTHORITIES (IF APPLICABLE)

DATE:

SIGNATURE OF CONTRACTOR
WITH SEAL

To : OWNER.....
 : RCM/SITE-IN-CHARGE, MECON

1 COPY
 3 COPIES

- Divisional Head (Constn.) through RCM
- Project Manager MECON, through RCM

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 49 of 59
			REVISION : 0
			EDITION : 1

FORMAT NO. HSE-3, REV. 0

SUPPLEMENTARY ACCIDENT / INCIDENT INVESTIGATION REPORT

Supplementary to Report No: _____(Copy enclosed)

Project: _____	Site: _____
Name of Work : _____	Date: _____
Contractor: _____	Work Order / LOI No. : _____

NAME OF THE INJURED

AGE :

SUB-CONTRACTOR M/S.....

DATE & TIME OF ACCIDENT / INCIDENT

LOCATION.....

BRIEF DESCRIPTION & CAUSE OF A ACCIDENT/ INCIDENT

NATURAL OF INJURY/DAMAGE

COMMENTS FROM MEDICAL PRACTITIONER WHO ATTENDED THE VICTIM/INJURED

SUGGESTED IMPROVEMENT IN THE WORKING CONDITION IF ANY

LOSS OF MANHOURS AND IMPACT ON SITE WORKS

ANY OTHER COMMENT BY SAFETY OFFICER.

DATE:	SIGNATURE OF CONTRACTOR WITH SEAL

To	:	OWNER.....	1 COPY
	:	RCM/SITE-IN-CHARGE, MECON	3 COPIES

- Divisional Head (Constn.) through RCM
- Project Manager MECON, through RCM

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 50 of 59
			REVISION : 0
			EDITION : 1

FORMAT NO. HSE-4, REV. 0

NEAR MISS INCIDENT SUGGESTED PROFORMA

Name of Site : _____ Report No: _____
 Name of Work : _____ Date : _____
 Contractor : _____

INCIDENT REPORTED BY : _____
 DATE & TIME OF INCIDENT : _____
 LOCATION : _____

BRIEF DESCRIPTION OF INCIDENT

PROBABLE CAUSE OF INCIDENT

SUGGESTED CORRECTIVE ACTION

STEPS TAKEN TO AVOID RECURRENCE YES ☐ NO ☐

DATE: _____ SIGNATURE OF CONTRACTOR
 WITH SEAL

To : OWNER..... 1 COPY
 : RCM/SITE-IN-CHARGE, MECON 3 COPIES

- Divisional Head (Constrn.) through RCM
- Project Manager MECON, through RCM

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 51 of 59
			REVISION : 0
			EDITION : 1

FORMAT NO. HSE-5, REV. 0

MONTHLY HEALTH, SAFETY ENVIRONMENT (HSE) REPORT
(To be submitted by each Contractor)

Actual work start Date: _____ For the Month of: _____
 Project: _____ Report No: _____
 Name of the Contractor: _____ Status as on: _____
 Name of Work: _____ Name of Safety officer: _____

ITEM		UPTO PREVIOUS MONTH	THIS MONTH	CUMU-LATIVE
a)	Average number of Staff & Workmen (average daily headcount, not man days)			
b)	Manhours Worked			
c)	Number of HSE meeting organized at site			
d)	Number of HSE awareness programmes conducted at site			
e)	Number of Lost Time Accidents (LTA)	Fatal		
		Other LTA		
f)	Number of Loss time Injuries (LTI)	Fatalities		
		Other LTI		
g)	Number of Loss Time Accidents			
h)	Number of First Aid Cases			
i)	Number of Near Miss Incidents			
j)	Man-days lost due to accidents			
k)	LTA Free Manhours i.e. Number of LTA free manhours from the Lst LTA			
l)	Compensation cases raised with Insurance			
m)	Compensation case resolved and paid to workmen			
n)	Whether workmen compensation policy taken	Y/N		
o)	Whether workmen compensation policy valid	Y/N		
p)	Whether workmen registered under ESI Act	Y/N		
Remark				

DATE: _____ Safety Officer /Resident Engineer
 (Signature and Name)

To : OWNER
 : RCM/, MECON (2 COPIES)

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO.	Page 52 of 59
		MEC/S/05/21/65	REVISION : 0
			EDITION : 1

FORMAT NO. HSE-6, REV. 0

PERMIT FOR WORKING AT HEIGHT (ABOVE 2 METER)

Project Site : Sr. No.:
 Name of the work: Date:
 Name of Contractor : Nature of Work :
 Total No.of Workers: Exact location of work :
 Duration of work: from to

The following items have been checked and compliance shall be ensured during the currency of the permit:

Sl.	ITEM	DONE	NOT REQD.
1.	Equipment/Work Area inspected	☐	☐
2.	Considered hazard from other routine/non-routine operations and concerned person alerted	☐	☐
3.	ELCB provided	☐	☐
4.	Proper lighting provided	☐	☐
5.	Area cordoned off.	☐	☐
6.	Precautions against public traffic taken	☐	☐
7.	Sound Scaffolding provided	☐	☐
8.	Adequate protected Platform provided	☐	☐
9.	Acces and Exit to the area (Ladder properly fixed)	☐	☐
10.	Floor Openings covered	☐	☐
11.	Safety Net provided	☐	☐
12.	Heath check of personnel	☐	☐

- A. Following personal protective equipment are provided (mark) and used as relevant Safety helmet/Gloves/Goggles/Shoes/Face Shield/Life Line/Safety Belt/Safety Harness.
- B. This permit shall be available at the work site at all times.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 54 of 59
			REVISION : 0
			EDITION : 1

FORMAT NO. HSE-7, REV. 0

CONFINED SPACE ENTRY PERMIT

Project Site : Sr. No.:
 Name of the work: Date:
 Name of Contractor : Nature of Work :
 Exact location of work :

Safety Re uirements POSITIVE ISOLATION OF THE VESSEL IS MANDATORY

(A) Has the e uipment been					
Y	NR		Y	NR	
☐	☐	isolated from power / steam / air	☐	☐	radiation sources removed
☐	☐	isolated from liquid or gases	☐	☐	Proper lighting provided
☐	☐	depressurized &/or drained	☐	☐	
☐	☐	blanked / blinded / disconnected	☐	☐	adequately cooled

(B) Expected Residual Ha ards					
Y	NR		Y	NR	
☐	☐	lack of O ₂	☐	☐	H ₂ S / toxic gases
☐	☐	corrosive chemicals	☐	☐	electricity / static
☐	☐	Heat / stream / frost	☐	☐	ionizing radiation
☐	☐		☐	☐	

(C) Protective Measures					
Y	NR		Y	NR	
☐	☐	gloves	☐	☐	goggles / face shield
☐	☐	protective clothing	☐	☐	personal gas alarm
☐	☐	Grounded air educator / blower / AC	☐	☐	rescue equipment / team
☐	☐	Fire fighting arrangements	☐	☐	communication equipment
☐	☐		☐	☐	

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 55 of 59
			REVISION : 0
			EDITION : 1

Authori ation / Renewal (It is safe to enter the confirmed space)

Date	No. of Persons Allowed	Name of Persons allowed	Signature		Time		Signatur e Workman
			Contractor s Supervisor	Contractor s Safety Officer	From	To	

Permit Closure :

- (A) Entry ☐ was closed ☐ stopped ☐ will continue on
- (B) ☐ Site left in a safe condition
☐ Housekeeping done
- (C) Multi lock ☐ removed ☐ key transferred
☐ Ensured all men have come out ☐ Manways barricaded

Remarks, if any :

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 56 of 59
			REVISION : 0
			EDITION : 1

FORMAT NO. HSE-8, REV. 0

RADIATION WORK PERMIT

Project : _____ Sr. No.: _____
 Name of the work : _____ Date: _____
 Name of Contractor : _____ Job No. : _____

Location of work : _____

Source Strength : _____

Cordoned distance (m) : _____

Name of Radiographing agency : _____

Approved by Owner / MECON ☐

The following items have been checked & compliance shall be ensured during currency of the permit :

S. No.	Item Description	Done
1.	Safety regulations as per BARC/AERB ensured while source in use/ in transit & during storage.	☐
2.	Area cordoned off.	☐
3.	Lighting arrangements for working during nights ensured.	☐
4.	Warning signs / flash lights installed.	☐
5.	Cold work permit taken (if applicable)	☐
6.	PPEs like film badges, dosimeters used.	☐

Additional precautions, if any _____

(Radiography Agency's BARC / AREB authorized Supervisor)

(Contractor's Safety Officer)

Permission is granted.

Permit is valid from _____ AM/PM _____ Date to _____ AM/PM _____
 Date

(Signature of permit issuing authority)

Name :

Designation :

Date :

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 57 of 59
			REVISION : 0
			EDITION : 1

Permit renewal

Permit extended upto		Additional precautions re uired, if any.	Sign of issuing authority with date
Date	Time		

Work completed / stopped / area cleared at _____ Hrs. of Date _____

(Sign of permit issuing authority)
Name :

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 58 of 59
			REVISION : 0
			EDITION : 1

FORMAT NO. HSE-9, REV. 0

RADIATION WORK PERMIT

Project : Sr. No.:
 Name of the work : Date:
 Name of Contractor : Job No. :

Name of Contractor :

Line No. / Equipment No. /Structure to be dismantled :

Location details of dismantling / demolition with sketch : (Clearly indicate the area)

The following items have been checked & compliance shall be ensured during currency of the permit :

S. No.	Item Description	Done	Not Applicable
1.	Services like power, gas supply, water, etc. disconnected.	☐	☐
2.	Dismantling / Demolishing method reviewed & approved.	☐	☐
3.	Usage of appropriate PPEs ensured.	☐	☐
4.	Precautions taken for neighboring structures	☐	☐
5.	First-Aid arrangements made	☐	☐
6.	Fire fighting arrangements ensured	☐	☐
7.	Precautions taken for blasting	☐	☐

(Contractor's Supervisor)

(Contractor's Safety Officer)

Permission is granted.

(Permit issuing authority)

Name :

Date :

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT	DOCUMENT NO. MEC/S/05/21/65	Page 59 of 59
			REVISION : 0
			EDITION : 1

Completion Report

Dismantling / Demolishing is completed on _____ Date at _____ Hrs.

Materials / debris transported to identified location ☐

Tagging completed (as applicable) ☐

Services like power, gas supply, water, etc. restored ☐

(Permit issuing authority)

**TECHNICAL NOTES TO SPECIFICATION FOR HEALTH,
SAFETY AND ENVIRONMENT (HSE) MANAGEMENT
SPECIFICATION NO.: MEC/S/05/21/65 (Revision-0, Edition-1)**

1. General Definition:

a) Disaster :- Section 2 (d) of DMP Act 2005 states that “disaster” means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.”

b) Major Incident :- Major Incident mean if any of the following incident occurs.

- i. Any incidents of fire not extinguished in 15 minutes.
- ii. Any incident causing shutdown of operations on account of fire / explosion / blowout / leakage.
- iii. Any incident causing financial loss above Rs. 20 lakhs.
- iv. Any incident leading to fatality(s) within plant / location premises.
- v. Any incident causing major loss of containment and having adverse impact outside the plant / location premises including disaster defined under Section 2 (d) of DMP Act 2005.
- vi. Any incident of road accidents (during transportation of Petroleum products) resulting in fire/ explosions which in turn leads to fatality(s).
- vii. Any incidents not covered above in serial no. i to vi but which gets reported in the national media within 24 hours of the occurrence.
- viii. Any incident leading to permanent loss of body part and / or permanent disability within plant / location premises.
- ix. Cumulative man-hours lost, within plant / location premises, is more than 500 hrs.

c) Minor Incident :-Any incident not falling under any of the categories of major incident.

d) Near Miss :

- i. Any incident which does not result in any injury or damage to property but has the potential to result in injury and/or property damage.
- ii. An undesirable event, if not timely controlled, would have led to a major/minor incident.

2. Guidelines for filling the Quarterly Incident Report of OISD

- a) All Major, Minor and Nearmiss incidents shall be reported in the quarterly report.
- b) Incident Reporting form shall be filled up for all Major, Minor and Near miss Incidents.
- c) Summary report shall be enclosed with every quarterly report.
- d) Investigations shall be carried out for all Major, Minor and Nearmiss Incidents.
- e) Investigation report of all Major incidents shall be submitted to PMC / Client.
- f) The following events are to be categorized under Major or Minor incident as applicable.
 - Hydrocarbon leakage from pipeline, resulting in stoppage of operation.
 - Collision between vessel and offshore installation/rig
 - Release of toxic gas
- g) Loss time accident shall be monitored till the affected person joins duty. In case the affected person is yet to join the duty, then the status of report submitted will be preliminary. Final report against the same incident shall be sent once the person joins duty and the man-hours lost are known.
- h) All columns must be filled up.
- i) For any additional information, use separate sheets as required.

- j) Quarterly report shall be sent to PMC /Client within 45 days of end of the quarter.
- k) Immediate reporting of incident through fax/telephone followed by email / email shall continue as per prevailing system.

Notes:-

- a) In addition to clause no 5.0 of specification for health, safety and environment (HSE) management, Following formats shall also be followed.

1. Incident Reporting Form	HSE-10
2. Permit for Cold Work	HSE-11
3. Permit for Hot Work	HSE-12
4. Permit for Electrical Isolation / Energisation	HSE-13

- b) In addition to specification and technical notes for health, safety and environment (HSE) management; Contractor shall be fully responsible for planning and implementing HSE requirement as per requirement of following OISD Standards:
 - 1. OISD-105: Work permit system.
 - 2. OISD-GDN-207: Contractor Safety.
 - 3. OISD-GDN-192: Safety practices during Construction.

INCIDENT REPORTING FORM

1. Organisation		2. Sector	
3. Location		4. Incident Sr. No.	
5. Date of Incident		6. Time of Incident	
7. Major / Minor / Near miss		8. Report - Preliminary / Final	
9. Fire / Accident		10. Duration of fire - Hrs. / Min	
11. Type of Incident with loss of life / injury, Fire, Explosion, Blowout, Electrocution, Fall from Height, Inhalation of Gas, Driving, Slip / Trip, Others,			
12. Location of Incident (Name of Plant / Unit / Area / Facility / Tank farm / Gantry / Road / Parking area etc.)			
13. Whether plant shutdown / caused outage of the facility? Yes / No			
14. Fatalities nos.	a) Employees = Nil	b) Contractor = Nil	c) Others = Nil
15. Injuries nos.	a) Employees = Nil	b) Contractor = Nil	c) Others = Nil
16. Man - hours Lost	a) Employees = Nil	b) Contractor = Nil	c) Others = Nil
17. Direct Loss due to the incident (Rs.in Lac). Loss to equipment / Machinery as per Insurance claim etc.			
18. Indirect Losses : Through put / Production Loss			
19. Status of the Facility: Construction / Commissioning / Operation / Shutting down / Turn around, Maintenance / Start-up / Any other.			

20. Brief Description of the Incident including post incident measures.			
21. Whether similar Incident has occurred in past at the same location, If yes, give brief description of the incident and attach details in separate sheet.			
22. Whether Internal Investigation has been completed. If no, likely date by which it will be completed.			
23. Whether internal investigation report (Major Incident) has been submitted to OISD. If no, likely date by which it will be submitted.			
24. Cause of the Incident (Tick the most relevant cause preferably one, maximum two)			
A) Deviation from Procedure		I) Not using the PPE	
B) Lack of Job Knowledge		J) Equipment failure	
C) Lack of supervision		K) Poor design / Layout etc.	
D) Improper Inspection		L) Inadequate facility	
E) Improper Maintenance (Mech. / Elec. / Inst.)		M) Poor House Keeping	
F) Improper material handling		N) Natural Calamity	
G) Negligent Driving		O) Pilferage / Sabotage	
H) Careless walking / climbing etc.		P) Any other (give details)	
25. Cause of leakage - Oil, Gas or Chemical (Tick one only)			
A) Weld leak from equipment / lines		E) Leakage due to improper operation	
B) Leak from flange, gland etc.		F) Leak due to improper maintenance	
C) Leak from rotary equipment		G) Normal operation - Venting / draining	
D) Metallurgical failure		H) Any other	
26. Cause of Ignition leading to fire (Tick only one cause)			
A) Near to hot work		F) Static Electricity	
B) Near to Furnace / Flare etc.		G) Hammering / Fall of object	

C) Auto - ignition		H) Heat due to Friction	
D) Loose electrical connection		I) Lightning	
E) Near to hot surface		J) Any other (pyrophoric etc.)	
27. Was the incident Avoidable? (Yes / No)			
28. The incident could have been avoided by the use of / or by: (Tick the most relevant point preferably one, maximum two)			
A) Better supervision		F) Personal Protective Equipment	
B) Adhering to specified operating procedure		G) Better equipment	
C) Imparting Training		H) Management Control	
D) Giving adequate time to do the activity through proper planning.		I) Adhering to specified maintenance procedure	
E) Adhering to the work permit system		J) Adhering to specified Inspection / Testing procedures.	
K) Any other:			

FORMAT NO. :HSE-11 REV-0

(NAME OF COMPANY)

(LOCATION)

PERMIT FOR COLD WORK

Sl.No. _____

Work clearance from _____ hrs of date _____ To _____ hrs of date _____ (**Valid for the shift unless renewed**)

Issued to (Department / Section / Contractor) _____

Exact Location of work (Area / Unit / Equipment no. etc) _____

Description of work _____

THE FOLLOWING ITEMS SHALL BE CHECKED BEFORE ISSUING THE PERMIT
(Tick mark in the appropriate box. Checklist items marked with asterisk (*) shall be complied by receiver)

Sr. no.	Item	Done	Not. Reqd	Sr. no	Item	Done	Not Reqd
1	Equipment / Work Area inspected			6	Equipment water flushed		
2	Surrounding area checked, cleaned and covered			7	Equipment properly steamed / purged		
3	Equipment blinded/disconnected / closed / isolated / wedge opened			8	Proper ventilation and lighting provided		
4	Equipment properly drained and depressurized			9*	Area cordoned off & caution boards / tags provided.		
5	Equipment electrically isolated and tagged vide Permit no. -----			10	Gas test: HCs / Toxic etc. HCs = % LEL Toxic gas = ppm		

Remarks:

1. The activity has the following expected residual hazards (Tick the relevant items): Lack of Oxygen / H₂S, Toxic Gases / Combustible gases / Pyrophoric Iron / Corrosive Chemicals / Steam – Condensate / Others _____

2. Following additional PPE to be used in addition to standards PPE (Helmet, Safety Shoes, Hand gloves, Boiler suit): Face Shield / Apron / Goggles / Dust Respirator / Fresh Air Mask / Lifeline / Safety Belt / Airline / Earmuff etc.

3. Additional precaution if any:

Issuer Name & Designation	Issuer Signature	Receiver Name & Designation	Receiver Signature

Closing of the work permit:

Receiver : Certified that the subject work has been completed / stopped and area cleared.			Issuer: Verified that the job has been completed and area cleaned and is safe from any hazard.		
Date & Time	Name & Designation	Signature	Date & Time	Name & Designation	Signature

Clearance renewal

Date	Time		Additional precautions if any, Otherwise mention "NIL"	Issuer's Name, Designation & Signature	Receiver's Name, Designation and Signature
	From	To			

General Instructions:

1. The work permit shall be filled up carefully and accurately in clear handwriting ensuring that complete information is provided in all the sections / subsections. Sketches should be provided wherever possible to avoid miscommunication.
2. Appropriate safe guards and required personnel protective equipment (PPEs) shall be determined by a careful analysis of the potential hazards and the operations to be performed prior to starting the work.
3. Requirement of standby personnel from Process / Maintenance / Contractor / Fire / Safety etc if any shall be mentioned in the additional requirement.
4. In case of fire alarm / siren, all work must immediately be stopped.
5. For renewal of work clearance, the issuer shall ensure that the conditions are satisfactory for the work to continue. If the conditions have changed, it may be necessary to issue a new permit or amend the existing permit.
6. This clearance on the same permit can be renewed / extended upto a maximum of seven calendar days.
7. This permit must be available at work site at all times.
8. On completion of the work, the permit shall be closed. The industry may add other relevant instruction based on their operating and maintenance practices.

(NAME OF COMPANY)
(LOCATION)

PERMIT FOR HOT WORK

Sl.No. _____

Work clearance from _____ hrs of date _____ To _____ hrs of date _____ **(Valid for the shift unless renewed)**

Issued to (Department / Section / Contractor)

Exact Location of work (Area / Unit / Equipment no. etc) _____

Description of work

THE FOLLOWING ITEMS SHALL BE CHECKED BEFORE ISSUING THE PERMIT

(Tick mark in the appropriate box. Checklist items marked with asterisk (*) shall be complied by receiver)

Sr no	Item	Done	Not Reqd	Sr no	Item	Done	Not Reqd
A	General points			B	For Hot work		
1	Equipment / Work Area inspected			1	Proper ventilation and Lighting providing		
2	Surrounding area checked, cleaned and covered			2	Proper means of exit / escape provided		
3	Sewers, manholes, CBD etc and hot surfaces nearby covered			3	Standby personnel provided from Process / Maint / Contractor / Fire / Safety dept.		
4	Considered hazard from other operations and concerned persons alerted.			4	Checked for oil and Gas trapped behind the lining in Equipment		
5	Equipment blinded/disconnected / closed/ isolated / wedge opened			5*	Shield provided against spark		
6	Equipment properly steamed / purged			6*	Portable equipment / nozzles properly grounded		
7	Equipment properly steamed / purged			7*	Standby persons provided for entry to confined space		
8	Equipment Water Flushed						
9	Iron sulphide removed / kept wet			C	For Vehicle Entry		
10	Equipment electrically			1*	Spark Arrestor on the mobile		

	isolated and tagged vide permit no				equipment / Vehicle provided.		
11	Gas test : HCs = %LEL Toxic gas = ppm, O2 = %						
12 *	Running water hose / Fire extinguisher provided. Fire water system available.			D	For Excavation works		
13 *	Area cordoned off and Precautionary tag /Boards provided.			1	Clearance obtained for excavation / road cutting / Dyke cutting from concerned depart.		

REMARKS:

1. The activity has the following expected residual hazards (Tick the relevant items): Lack of Oxygen / H2S, Toxic Gases / Combustible gases / Pyrophoric Iron / Corrosive Chemicals / Steam-Condensate / Others
2. Following PPEs to be used in addition to standards PPEs (Helmet, Safety Shoes, Hand gloves, Boiler suit): Face Shield / Apron / Goggles / Dust Respirator / Fresh Air Mask / Lifeline / Safety Belt / Airline / Earmuff etc.
3. Additional precautions if any , _____

Issuer Name & Designation	Issuer Signature	Receiver Name & Designation	Receiver Signature

Date	Time		Gas Test Values for HC's Toxic, O2 etc	Additional Precaution if any, Otherwise mention "NIL"	Issuer's Name , Designation & Signature	Receiver Name, Designation and Signature
	From	To				

Closing of the work permit:

Receiver: Certified that the subject work has been completed / stopped and area cleaned.			Issuer: Verified that the job has been completed and area cleaned and is safe from any hazard.		
<i>Date & Time</i>	<i>Name & Designation</i>	<i>Signature</i>	<i>Date & Time</i>	<i>Name & Designation</i>	<i>Signature</i>

General Instructions:

1. The work permit shall be filled up carefully and accurately in clear handwriting ensuring that complete information is provided in all sections / subsections and none of column is left blank. Sketches should be provided wherever possible to avoid miscommunication.
2. Appropriate safe guards and required personnel protective equipment shall be determined by a careful analysis of the potential hazards and the operations to be performed prior to starting the work.
3. In case of fire alarm / siren, all work must immediately be stopped.
4. Only certified vehicle / engines and permitted type of electrical equipment and tools are allowed in operating areas.
5. Welding machines should be located in non-hazardous and ventilated areas.
6. No hot work should be permitted unless the explosive meter reading is Zero.
7. When a person is entering confined space, the receiver must keep minimum two standby-designated persons at the manhole or entry point.
8. Before box up of any vessel manhole cover, ensure that no men / materials are inside the vessel.
9. For renewal of work clearance, the issuer shall ensure that the conditions are satisfactory for the work to continue. If the conditions have changed, it may be necessary to issue a new permit or amend the existing permit.
10. This clearance on the same permit can be renewed / extended upto a maximum of seven calendar days.
11. This permit must be available at work site at all times.
12. On completion of the work, the permit must be closed and kept as record.
13. The industry may add other relevant instructions based on their operating and maintenance practices.

(NAME OF COMPANY)
(LOCATION)

Electrical Isolation / Energisation Permit

Sl.No. _____

Section-A: Isolation Permit.

Request for Isolation: _____ Date: _____
Time: _____

Department / Section / Area issuing the permit

Equipment number to be isolated:

Name of the equipment / circuit to be isolated:

The above-mentioned equipment / circuit shall be de-energized and isolated from all live conductors to carry out the maintenance work by _____ section / for operational requirement.

_____	_____	_____
Issuer Name	Designation	Signature

Certificate of Isolation: _____ Date: _____
Time: _____

Certified that Equipment / Circuit no. _____ of _____ plant has been electrically isolated by switches / isolators / links / fuses (tick as applicable) and the danger tag is put on the supply panel. Actions in respect of electrical isolation have been recorded in the electrical shift log book.

_____	_____	_____
Name of Authorized Person	Designation	Signature

Section-B: Energisation Permit.
Sl.No. _____

Request for Energisation:

Date: _____

_____ Time: _____

Department / Section / Area issuing the permit _____

Equipment number to be energized: _____

Name of the equipment / circuit to be energized: _____

Work on the above mention equipment / circuit has been completed and all the applicable permits closed. This equipment / circuit may be energized.

Issuer Name_____
Designation_____
Signature**Certificate of Energisation:**

Date: _____

_____ Time: _____

Certified that Equipment / circuit no. _____ of _____ plant has been electrically energized and the danger tag removed from the supply panel. This is also recorded in the electrical shift log Book.

Name of Authorized Person_____
Designation_____
Signature