



Bharat Heavy Electricals Limited

(A Govt. of India Undertaking)

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CORRIGENDUM - 13 TO NIT NO-63119

Subject: Corrigendum-13 to Tender enquiry for Pre-bid Tie up for Supply & Services of 220kV GIS for IOCL PANIPAT (P25) PROJECT.

Project : IOCL PANIPAT (P25) PROJECT
Equipment / Item : SUPPLY & SERVICES OF 220KV GIS.
Enquiry No/Date : NIT 63119_61G2200211 dated 16.02.2022
BHEL NIT NO : 63119.
Original Tender due date : 23.02.2022

The Corrigendum is being issued by BHEL TBG against above mentioned NIT/ enquiry for following:

1. To incorporate Technical corrigendum-1 & Revised BOQ and price bid format.
2. To extend due date for Offer submission/opening up to **04.05.2022**.

All other terms and conditions for this tender enquiry shall remain unchanged.

Bidder to ensure submission of offer on or before due.

Note: Tender ID in CPP Portal is **2022_BHEL_8362_1**.

Thanking you

Vineet Gupta
BHEL TBG, NOIDA

TECHNICAL CORRIGENDUM - 1**Dated 18 April 2022****220kV KV GAS INSULATED SWITCHGEAR for IOCL, Panipat**

SL	DESCRIPTION	REMARKS
2	ANNEXURE_BOQ, REV.01	REPLACED WITH ANNEXURE_BOQ, REV.02 . THE CHANGES MADE HAS BEEN HIGHLIGHTED.
1	SECTION-1, Rev.0 SCOPE, PROJECT SPECIFIC TECHNICAL REQUIREMENTS & BILL OF QUANTITIES	REPLACED WITH SECTION-1, REV.01
3	TECHNICAL AMENDMENT NO: 01 (ELECTRICAL)	TECHNICAL AMENDMENT NO: 01 FOR COMPLIANCE
4	TECHNICAL CLARIFICATION NO. 01	CONSOLIDATED REPLY TO BIDDER'S QUERY FOR INFORMATION. PLEASE FOLLOW TECHNICAL AMENDMENT & TECHNICAL SPECIFICATION TB-PBT-316-PN1
5	SPECIAL NOTE	Any clarification(s) for 220kV GIS published by M/s IOCL with reference to Tender No. SG/B269-999-EB-T-0020/22, Pre Bid Tie up for 220 kV GIS Package for Panipat Refinery Expansion Project (P25) of M/s Indian Oil Corporation Limited (IOCL) will also valid for this specification.

TECHNICAL AMENDMENT NO: 01 (ELECTRICAL)
TO
TENDER: B269-999-16-50-EB-T-0020 FOR 220KV GIS PACKAGE
(PROJECT: P-25, M/s IOCL-PANIPAT)

11.04.2022	Issued as Technical Amendment-1	MKM	RG	HK
DATE	PURPOSE	BY	CHECKED	APPROVED

SUBJECT : **Technical Amendment No.: 01**
TENDER NO. : **B269-999-16-50-EB-T-0020**

The terms, conditions and specifications of Bidding Document stand modified to the extent indicated under column "MODIFICATIONS/ADDITION/DELETION". Corresponding implications of the same, else-where in the bid package shall be taken care appropriately. All other terms & conditions, stipulations and specifications of Bidding Document shall remain unaltered.

S.No	Section No./ Document No.	Clause No./ Item No.	Subject	Modifications / Additions/Deletions/ Clarification
1.	B269-999-16-50-SP-0020 Rev.C	Complete Document	Scope of Work & Job Specification	Modification: Scope of work & Job Specification (Electrical) for 220kV GIS Package (B269-999-16-50-SP-0020 Rev.C) has been replaced by Scope of work & Job Specification (Electrical) for 220kV GIS Package (B269-999-16-50-SP-0020 Rev.D). Copy enclosed herewith.
2.	B269-999-16-50-DS-0031 Rev.C	Note-3	220kV Gas Insulated Switchgear Datasheet	Modification: Mandatory spare list-Electrical (B269-999-16-50-SL-0020 Rev.C) has been replaced by next revision (B269-999-16-50-SL-0020 Rev.E). Copy enclosed herewith. Equipments mentioned in note-3 in 220kV Gas Insulated Switchgear data sheet (B269-999-16-50-DS-0031 Rev. C) & 66kV Gas Insulated Switchgear data sheet (B269-999-16-50-DS-0032 Rev. B) shall be part of mandatory spares as specified in SL-0020.
3.	B269-999-16-50-DS-0034 Rev.C	Complete Document	220kV Feeder Details Datasheet	Modification: 220kV Feeder Detail data sheet (B269-999-16-50-DS-0034 Rev.C) has been replaced by B269-999-16-50-DS-0034 Rev.D. Copy enclosed herewith.
4.	B269-999-16-50-DS-0035 Rev.C	Complete Document	66kV Feeder Details Datasheet	Modification: 66kV Feeder Detail data sheet (B269-999-16-50-DS-0035 Rev.C) has been replaced by B269-999-16-50-DS-0035 Rev.D. Copy enclosed herewith.
5.	B269-999-16-50-DS-0052 Rev.B	Complete Document	Relay & SAS System Architecture for 220kV GIS	Modification: Data sheet (B269-999-16-50-DS-0052 Rev.B) has been replaced by B269-999-16-50-DS-0052 Rev.C. Copy enclosed herewith.
6.	B269-999-16-50-DS-0071 Rev.B	Complete Document	Datasheet for 33kV Isolating Breaker Panel	Modification: Data sheet (B269-999-16-50-DS-0071 Rev.B) has been replaced by B269-999-16-50-DS-0071 Rev.C. Copy enclosed herewith.
7.	B269-999-16-50-DS-0130 Rev.B	Complete Document	System Architecture for IBPs & MV Switchboard	Modification: Data sheet (B269-999-16-50-DS-0130 Rev.B) has been replaced by B269-999-16-50-DS-0130 Rev.C. Copy enclosed herewith.

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TO
220KV GIS PACKAGE**

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8.	B269-999-16-50-DS-0301 Rev.C	Complete Document	Datasheet for 220/66kV power transformer	Modification: Following have been revised in data sheet (B269-999-16-50-DS-0301 Rev.C): a. Sr. No. 16, No negative tolerance shall be considered for Impedance at max. MVA i.e. ONAF. b. Sr. no. 25, Range of OLTC shall be considered as -17.5% to +12.5%. Nos. of tap shall be considered as 24 nos.
9.	B269-999-16-50-DS-0306 Rev.B	Complete Document	Datasheet for 220/33kV power transformer	Modification: Following have been revised in data sheet (B269-999-16-50-DS-0306 Rev. B): a. Sr. No. 16, No negative tolerance shall be considered for Impedance at max. MVA i.e. ONAF. b. Sr. no. 25, Range of OLTC shall be considered as -17.5% to +12.5%. Nos. of tap shall be considered as 24 nos.
10.	B269-999-16-50-00200 Rev.C	Complete Document	Key SLD	Modification: Key SLD (B269-999-16-50-00200 Rev.C) is replaced by B269-999-16-50-00200 Rev.D. Copy enclosed herewith.
11.	B269-999-16-50-OD-0020 Rev.C	Complete Document	Approved Vendor List	Modification: Vendor list (B269-999-16-50-OD-0020 Rev. C) has been replaced by B269-999-16-50-OD-0020 Rev. D. Copy enclosed herewith.
12.	B269-999-16-50-EDB-1001 Rev.0	5.7.1 (Note-5)	EHV GIBD	Modification: The note 5 of cl. No. 5.7.1 (EHV GIBD) of EDB stands deleted and is replaced with the following: 66kV GIBD shall be 3 phase enclosure or single phase enclosure as per vendor standard design as per cl. No. 6.15.1 of EIL standard specification 6-51-0066.

13.	Table of Contents	-	Data sheet (Electrical)	Addition: Following datasheets have been added (copy enclosed): 66/6.9kV power transformer (B269-999-16-50-DS-0304 Rev.D) 66kV Cable (B269-999-16-50-DS-0215 Rev.A) 33kV & 6.6kV Cable (B269-999-16-50-DS-0200 Rev.A) - Neutral Grounding resistor (B269-999-16-50-DS-0351 Rev.A) 6.6kV bus duct (B269-999-16-50-DS-0002 Rev.B) 6.6kV Switchboard datasheet (B269-999-16-50-DS-0001 Rev.B) - Feeder list for 6.6kV switchboard (B269-999-16-50-DS-0075 Rev.A) 6.6kV capacitor bank (B269-999-16-50-DS-0150 Rev.A) - ECS I/O list for 6.6kV Switchboard (B269-999-16-50-DS-0686 Rev.A) - SAS for New Gantry system ((B269-999-16-50-DS-0131 Rev.A) - Experience Record performa for 66kV GIS (B269-999-16-50-ERP-0020 Rev. 0) - Experience Record performa for 66kV GIBD (B269-999-16-50-ERP-0021 Rev. 0) - Hardware datasheet for various feeders of 6.6kV switchboard: - B269-999-16-50-DS-0003 Rev.B (Incomer from transformer) - B269-999-16-50-DS-0005 Rev.B (Bus coupler with FBT) - B269-999-16-50-DS-0006 Rev.B (Outgoing transformer feeder) - B269-999-16-50-DS-0008 Rev.B (Capacitor feeder) - B269-999-16-50-DS-0010 Rev.B (Control supply) - B269-999-16-50-DS-0011 Rev.A (Bus PT) - B269-999-16-50-DS-0016 Rev.B (Bus coupler with manual change over) - B269-999-16-50-DS-0028 Rev.A (Outgoing plant feeder)
14.	Table of Contents	-	EIL Standard specification	Addition: Following EIL standard specification have been added (copy enclosed): 6-51-0020 Rev.6 (HV Capacitor Bank) 6-51-0043 Rev.8 (Neutral Grounding Resistor) 6-51-0065 Rev-01 Specification for high voltage gas insulated switchgear 6-51-0067 Rev.1 (Extra High Voltage Cable & Accessories)
15.	Table of Contents	-	EIL Inspection & Test Plan	Addition: Following Inspection & Test Plan have been added: 6-81-1020 Rev.5 (HV Capacitor bank) 6-81-1043 Rev.4 (Neutral grounding resistor) 6-81-1067 Rev.0 (Extra high voltage cables and accessories)

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16.	Annexure-A	-	Existing System Details	Details pertaining to existing 220kV BHEL substation (S/S-64) has been added under Annexure-A for reference including following details. a. 220kV BHEL Substation details (SS-64) b. Busbar differential protection c. PD monitoring system d. Substation automation system e. Fire alarm system f. PLCC panel g. Location of (95x95) mtr. area & existing 220kV BHEL substation (SS-64)
17.	TABLE OF CONTENTS	-	Electrical Attachments (latest standard specification)	Modification: (i) 6-51-0004 Rev. 5 is replaced with 6-51-0004 Rev. 6 * (ii) 6-51-0018 Rev. 5 is replaced with 6-51-0018 Rev. 6 * (iii) 6-51-0019 Rev. 5 is replaced with 6-51-0019 Rev. 6 * (iv) 6-51-0047 Rev. 3 is replaced with 6-51-0047 Rev. 4 * *Copy of latest standard specification is attached herewith.
18.	TABLE OF CONTENTS	-	Electrical Attachments (latest standard)	Modification: (i) 7-51-0002 Rev. 5 is replaced with 7-51-0002 Rev. 6* (ii) 7-51-0011 Rev. 5 is replaced with 7-51-0011 Rev. 6* (iii) 7-51-0021 Rev. 5 is replaced with 7-51-0021 Rev. 6* (iv) 7-51-0103 Rev. 6 is replaced with 7-51-0103 Rev. 7* (v) 7-51-0104 Rev. 5 is replaced with 7-51-0104 Rev. 6* (vi) 7-51-0105 Rev. 6 is replaced with 7-51-0105 Rev. 7* (vii) 7-51-0106 Rev. 5 is replaced with 7-51-0106 Rev. 6* (viii) 7-51-0107 Rev. 5 is replaced with 7-51-0107 Rev. 6* (ix) 7-51-0108 Rev. 6 is replaced with 7-51-0108 Rev. 7* (x) 7-51-0109 Rev. 5 is replaced with 7-51-0109 Rev. 6* (xi) 7-51-0111 Rev. 5 is replaced with 7-51-0111 Rev. 6* (xii) 7-51-0115 Rev. 5 is replaced with 7-51-0115 Rev. 6* (xiii) 7-51-0116 Rev. 7 is replaced with 7-51-0116 Rev. 8* (xiv) 7-51-0214 Rev. 5 is replaced with 7-51-0214 Rev. 6* (xv) 7-51-0215 Rev. 5 is replaced with 7-51-0215 Rev. 6* (xvi) 7-51-0325 Rev. 4 is replaced with 7-51-0325 Rev. 5* (xvii) 7-51-0332 Rev. 3 is replaced with 7-51-0332 Rev. 4* (xviii) 7-51-0335 Rev. 3 is replaced with 7-51-0335 Rev. 4* (xix) 7-51-0336 Rev. 3 is replaced with 7-51-0336 Rev. 4* *Copy of latest standard is attached herewith.

(SIGNATURE AND STAMP OF BIDDER)

SECTION-2. Rev.01

SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) FOR 220kV GIS PACKAGE (TENDER NO. B269-999-16-50-EB-T-0020)

PROJECT : P25 PROJECT

OWNER : M/s INDIAN OIL CORPORATION LTD.

EPMC : ENGINEERS INDIA LTD.

JOB NO. : B269

D	11.04.2022	REVISED AND REISSUED WITH TA-01	MKM	RG	HK
C	27.09.2021	REVISED AND REISSUED WITH TENDER	AKG	HK	HK
B	05.07.2021	REVISED AND REISSUED WITH TENDER	AKG	HK	HK
A	12.05.2020	ISSUED WITH TENDER	AKG	HK	HK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

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1 GENERAL

1.1 INTRODUCTION

- 1.1.1 This section defines the electrical scope of work and job specification for 220 kV Gas Insulated Substation Package for P25 Project of IOCL – Panipat Refinery. This specification along with design basis, design philosophy, equipment datasheets, equipment specifications, drawings/ documents and other codes/ standards attached or referred shall form the basis for detailed design and engineering, manufacturing, supply, erection, testing, pre-commissioning, commissioning of the electrics covered in this tender of 220 kV Gas Insulated Substation Package for P25 Project of IOCL – Panipat Refinery.
- 1.1.2 The work shall be carried out to the best workmanship, in conformity with the specifications, approved drawings/ construction drawings and the instructions of the owner or Engineer-in-Charge from time to time.
- 1.1.3 The contract shall include clearing of temporary constructions, waste materials and loose earth, which might get collected in and nearby the work site during execution of work and after final completion.

1.2 STANDARDS

- 1.2.1 The work / equipment shall also comply with the requirements of latest revision of codes & standards attached or referred with the tender document. In case of any conflict between the various documents, the most stringent one shall be followed and Owner's/ EIL decision in this regard shall be final and binding. It is the responsibility of the Contractor to highlight any contradictions between various documents at the bid stage itself.
- 1.2.2 In case of imported equipment, codes and standards of the country of origin may be followed, if these standards are equivalent or stringent than the applicable Indian standards and meet the statutory regulations of approving Indian statutory bodies.
- 1.2.3 In addition, the work shall also conform to the requirements of latest editions/ amendments of the following:
- The CEA guidelines and rules framed there under.
 - The fire insurance Regulations.
 - Indian Petroleum Rules.
 - The regulations laid down by Electrical Inspectorate (CEA).
 - The regulations laid down by the Factory Inspectorate
 - The regulations laid down by the Chief Controller of Explosives.
 - The regulations laid down by Oil Industries Safety Directorate (OISD).
 - Any other regulations laid down by the Central, State or Local Authorities from time to time during the execution of this contract.

1.3 GUARANTEE

- 1.3.1 The contractor shall guarantee the installation for satisfactory operation against any defects of workmanship and materials (supplied by the contractor) for a period as specified elsewhere. Any damage or defect connected with the erection of materials, equipments or fittings supplied by the contractor that may be discovered at the time of issue of the completion certificate, or 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 Owner or Engineer-in-Charge within the time limit specified by the Owner or Engineer-in-Charge.
- 1.3.2 The above guarantee shall be applicable for the quality of the work executed as well as for all equipment/ cables/ fixtures/ fittings/ other materials supplied by the contractor.

1.4 SITE CONDITION

For site conditions refer the clause 5.1 of Electrical Design Basis document B269-999-16-50-EDB-1001 enclosed with the package.

1.5 UTILIZATION VOLTAGE

For details of the utilization voltage refer the electrical design basis document B269-999-16-50-EDB-1001 enclosed with the package.

For the works to be executed in existing refinery area, utilisation voltage for control supplies i.e. 110V / 220V DC OR 110V AC UPS, shall be finalised during detailed engineering.

1.6 ENGINEERING AND JOB SPECIFIC REQUIREMENTS

- 1.6.1 Various equipment (to be supplied by contractor) covered in this tender, shall be in compliance with the requirements defined in design philosophy, equipment datasheets and specifications attached/ referred. Besides these, the requirements as defined in respective clauses for individual equipment, referred elsewhere in this document shall also be considered/ complied with.
- 1.6.2 Contractor shall ensure that all electrical equipment shall comply with the site and system conditions, ratings and other technical requirement specified elsewhere with the documents attached with the tender.
- 1.6.3 CONTRACTOR shall use this specification, datasheet, design philosophy document and OWNER/ Consultant's standard specifications for various equipments. For equipments, where OWNER/Consultant standard specifications are not available, have not been attached, CONTRACTOR/ SUPPLIER shall use their own specification, developed based on project specific requirement and good engineering practices prevalent in petroleum industry, so as to ensure satisfactory operation and maintenance conditions. CONTRACTOR to however check from OWNER/ EIL with respect to availability of EIL standard/ specification, before use of their own specification
- 1.6.4 CONTRACTOR shall note that data sheets for some of the equipment are not enclosed separately. Equipment data sheets for such equipments shall be prepared by the CONTRACTOR/ SUPPLIER based on relevant codes and specifications and the data sheet shall contain all technical data and information which is essential for the purpose of review and technical acceptability, detailed engineering, installation, testing, repair and maintenance, replacement, etc. of the equipments. CONTRACTOR to however check from OWNER/ EIL with respect to availability of standard datasheet, before use of their own datasheet
- 1.6.5 The CONTRACTOR shall also prepare data sheets mentioned in OWNER/ Consultant standard specifications, but not enclosed with the package.
- 1.6.6 The equipment shall in general conform to latest revision of statutory regulations, Indian Standards, IEC/ Other international standards applicable for the country of origin of the equipment
- 1.6.7 All equipment shall be subjected to routine and acceptance tests as per applicable specifications.
- 1.6.8 CONTRACTOR shall clearly specify in their purchase specifications, the requirement of conducting other special tests/ type tests, envisaged for various electrical equipment. Same shall be conducted without any time/ cost implication to OWNER/ Consultant.

2 POWER SYSTEM DESCRIPTION

To meet the power requirement of P25 Project in IOCL Panipat Refinery, power will be received at 220kV from two sources.

First source shall be from the 220kV GIS in existing Panipat Refinery, which will provide two nos. plant feeders with single core copper cables. These plant feeders will be connected to the 220kV GIS for P25 Project.

Second source of power shall be from state electricity board through double circuit overhead line at 220kV. These lines shall be terminated on the outdoor gantry located in existing refinery area along with outdoor type 220kV GIS bays and further connection will be made to the 220kV GIS for P25 Project through single core copper cables.

Once this power is received at the 220kV GIS, same shall be then stepped down to 66kV using 220/66kV power transformers. These power transformers in turn will be connected to 66kV GIS.

Primary distribution in the plant shall be done at 66kV using the 66kV GIS located in Main Receiving Substation (MRSS). 66kV transformer feeders from MRSS, each rated for 100% load, will supply power to downstream substation. Power will be received at 66/6.9kV power transformers (located outdoor) via 66 kV (Earthed grade) cables. The step down power at 6.6 kV shall be fed to 6.6 kV switchboard having two incomers & two bus sections interconnected by means of a bus coupler set (one normal buscoupler & one dummy buscoupler) and having fast bus transfer system. This 6.6kV board shall cater to all 6.6 kV loads. All HV motors rated above 160kW shall be at 6.6 kV fed from 6.6 kV switchboard. Power shall be stepped down to 415 V using 6.6 kV / 0.433 kV distribution transformers for feeding 415V loads through power control centers, motor control centers and Auxiliary service boards.

MV motors up to 55 kW will be fed from MCC whereas, motors rated above 55 kW and up to 160 kW will be fed from PCC. Auto/Manual changeover facility shall be provided in PCC & MCC while mechanical interlock shall be provided in incomers for ASB/LDB.

Auxiliary service board (ASB) shall have two incomers, one from normal PCC and other from emergency PCC. Normally bus coupler in auxiliary switchboard shall remain closed while incomer from emergency PCC shall remain open. During normal supply failure, buscoupler and normal supply incomer shall be opened. Auxiliary service board shall feed miscellaneous loads like welding receptacles, power panels etc.

220kV, 66 kV and 415 V systems are solidly earthed, whereas, 6.6 kV system is resistance earthed.

A separate EPMC has been envisaged for feeding plant emergency loads. EPMC will be fed via 1 no. 6.6/0.433 kV distribution transformer and through DG to provide reliability in the system.

EPMC will have two sections interconnected by a normally open buscoupler. EPMC shall be provided with auto transfer facility.

Plant normal lighting loads will be fed through normal lighting distribution board having two incoming supplies fed through 415V/415V lighting transformers fed from each bus section of normal PCC.

25% of plant lighting will be on emergency. Emergency lighting load will be fed through an emergency lighting distribution board having both incoming supplies fed through 415V/415V lighting transformers from each bus section of emergency PMCC.

230V AC UPS shall be provided in the substation for feeding control supply for ECS Panels, LAN, HMIs, etc., in substation.

220V DC battery and chargers shall be provided to feed critical DC lighting, and 110V DC system for switchgear protection and control circuits which will be located in the substation building.

ECS system shall be procured by Owner. All equipments shall be connected to ECS for monitoring and control as per ECS IO list.

Refer key single line diagram and scope demarcation drawing for typical power distribution scheme and broad scope demarcation.

3 SCOPE OF WORK (ELECTRICAL)

3.1 GENERAL

The electrical scope of work under this tender shall include but not be limited to basic and detailed engineering, manufacturing, supply, transportation to site, storage at site, inspection at manufacturer's work, erection, testing, commissioning of all equipments, supply of all mandatory spares, commissioning spares, special tools and tackles, cabling, earthing, lighting, fire alarm, plant communication works as defined in the scope document, drawings, installation standards, equipment datasheets, standard specifications, etc. attached or referred with the tender document.

3.2 SCOPE OF BASIC AND DETAILED ENGINEERING

The scope of basic and detailed engineering includes sizing and selection of electrical equipment, cables, earthing, lighting, fire alarm system, and preparation of layouts and other items covered in the scope of CONTRACTOR. This shall include but not be limited to the following

- 3.2.1 Basic and detail engineering activities for design of outdoor switchyard for receiving incoming overhead line and PLCC & Optical ground wire communication from Haryana Vidyut Prasaran Nigam Limited (HVPNL) substation and further connecting it to 220 kV GIS in substation building via cables. Contractor scope also include foundation and structural works for all equipment, to be installed in the switchyard area
- 3.2.2 Basic and detail engineering activities for design of substation buildings (in both P25 & existing refinery areas) and co-ordination with Civil, Mechanical for cut-outs, cable trays, trenches, designing of air conditioning system, EOT crane, etc.
- 3.2.3 Design and engineering of electrical system for air conditioning system, EOT crane, etc.
- 3.2.4 Design and engineering of grid connected rooftop solar photovoltaic system comprising of array layout, SLD, mounting structure design, shadow analysis, etc., on the roof of substation building in P25 plot area.
- 3.2.5 Sizing of cable trenches, design, engineering and complete civil works for RCC cable trench from outdoor switchyard to substation building, including co-ordination with existing and proposed facilities.
- 3.2.6 Basic engineering calculations i.e. load analysis, load flow, short circuit, for selection of electrical equipments.
- 3.2.7 Design, engineering, sizing and selection of equipment and facilities comprising of switchboards, NIFPS, HV water spray system, DC system, UPS system, Fiber Optic transmission system, lighting transformer, etc. and submission of sizing calculation report for OWNER/ PMC review.
- 3.2.8 Design and engineering of Fiber optic transmission system and cyber security system for the entire network as per requirement of GOI, CEA guidelines and HVPNL. CONTRACTOR shall also design system for implementation of load trimming scheme, availability based tariff metering arrangement and SCADA interface for integration with HVPNL.

- 3.2.9 Overall single line diagram and protection & metering SLDs for individual switchboards, DC systems, UPS system, and auxiliary power supply system in CONTRACTOR's scope.
- 3.2.10 Cable sizing, illumination level calculation and preparation of power supply distribution scheme for normal, emergency and critical lighting, design calculation for earthing system (as per IEEE-80 in support of step and touch potential) and lightning protection system (as per IEC 62305) for the 220 kV GIS substation and switchyard area.
- 3.2.11 Preparation of equipment layouts, lighting layouts, cabling layouts, earthing layouts, lightning protection layout, NIFPS piping layout, plant communication layouts, fire alarm layouts, telephone layouts, LAN system layout for 220 kV GIS substation / switchyard substation and outdoor switchyard area.
- 3.2.12 Preparation of bill of materials for cabling, lighting, earthing and lightning protection, communication, plant communication, fire alarm, telephone system, LAN and miscellaneous items.
- 3.2.13 Preparation of system architecture drawings for Substation automation system.
- 3.2.14 Insulation co-ordination studies for the 220 kV GIS substation package to finalize location and quantity of surge arrestors required in addition to those shown in SLD.
- 3.2.15 Calculation of requirement of IOs for ECS Interface Panels (transducer panel, Dummy panel, Interposing relay panel) and ECS RTU Panels etc. for interface of 220 kV GIS substation package with client's ECS System.
- 3.2.16 Relay Co-ordination studies including protection coordination charts, relay setting calculations; relay parameterization for complete system in scope of CONTRACTOR. ETAP Project files (i.e. *.oti file) for the new system along with coordinated relay setting shall be provided by contractor. Contractor to verify and co-ordinate the relay settings with upstream HVPNL Grid feeder & 220kV Plant feeder from GIS in existing refinery and hand over the updated ETAP project file (OTI file) to Owner/ EIL.
- 3.2.17 Preparation of miscellaneous engineering document such as electrical equipment list, lighting/ power panel schedule, cable schedule, interconnection drawing, ECS interface document, etc.
- 3.2.18 3D Modeling shall be done for substation buildings and switchyard area consisting of all the equipment like FA system, HVAC/VAM (including ducts), equipment layout (panels and transformers), outdoor switchyard equipment, etc. to avoid fouling of various systems and subsequent re-work. Also, cable tray and cable trench design in cable cellar and cable trench from switchyard to substation shall be reviewed in 3D model.
- 3.2.19 Preparation of specification for procurement of electrical equipment in CONTRACTOR's scope of supply, review of sub vendor drawings and then submission of electrical equipment drawing for review/ information, preparation of site executable (AFC) engineering drawings and details for installation work, wherever applicable.
- 3.2.20 Preparation of all drawings and documents required for obtaining the approvals from HVPNL for the 220 kV system interface.
- 3.2.21 Collection of data from Site/ Owner as required for carrying out detailed engineering.
- 3.2.22 Shop inspection and testing procedures and QA schedule.
- 3.2.23 Field testing and commissioning procedures.
- 3.2.24 Preparation of as-built drawings on completion of the project for final records.
- 3.2.25 Preparation of operation and maintenance schedule/manuals.
- 3.2.26 The CONTRACTOR while performing design and engineering activities shall adhere to following guidelines:

- 3.2.26.1 CONTRACTOR, if not stated but required shall prepare any additional specifications for equipment or bulk material. CONTRACTOR shall follow current national & international standards/specifications for the equipment that are not covered by OWNER/ EIL's specifications.
- 3.2.26.2 The drawings attached with tender define the basic system design and distribution philosophy for the package and are for guidance purpose only. CONTRACTOR shall develop detailed drawings and submit for EIL review.
- 3.2.26.3 Contractor to note that equipment ratings and quantity, wherever specified in the bid package shall be considered as minimum rating & quantity. Contractor shall be responsible to verify the same and provide equipment with higher rating & quantity subject to minimum rating as per bid package requirements. Compliance to the same shall be without any extra cost and time implications to owner.
- 3.2.27 Interface engineering and drawing, as required for the completeness of erection, testing and commissioning of electrical system.
- 3.2.28 Any other work/activity which is not listed above, but however found necessary for completeness and satisfactory operation of the electrical system.
- 3.2.29 Dedicated tariff metering room of size (3x3) meter (min.) has been envisaged at ground floor of new gantry substation at (95x95) mtr. Area. Accessibility of this room shall be made outside without entering into substation building. Entry shall be restricted for HVPNL personnel only & same shall have dedicated padlock facility.

3.3 SCOPE OF SUPPLY, ERECTION, TESTING AND COMMISSIONING

The electrical scope covered under this package includes but shall not be limited to supply erection, testing and commissioning of the following (**Equipment rating and specifications mentioned here are preliminary and approval has to be taken from HVPNL before finalizing the rating and placing order**) :

- 3.3.1 220 kV Outdoor switchyard complete with substation cum control room building, incoming gantry, lightning arrestor, motorized isolators with earth switch, EHV outdoor CT & PT, HTLS-AAAC conductors, clamps & connectors, lighting, earthing, lightning protection, etc. for receiving power from double circuit 220kV overhead line. Minimum rating/type of various equipment is as listed below :
- 2000 Amps, Double Break Center Rotating, Motorized type Isolator with Earth Switch
 - 220kV/ $\sqrt{3}$ / 110V/ $\sqrt{3}$ Single phase potential transformer for metering with 3 cores (minimum) as per HVPNL standard design philosophy.
 - Single phase Current Transformer for metering with 2 cores (minimum) as per HVPNL standard design philosophy.
 - 220kV/ $\sqrt{3}$ / 110V/ $\sqrt{3}$ Single phase CVTs for wave trap & communication with cores as per HVPNL standard design philosophy.
 - PLCC system with wave traps & 48V DC System for both sending & receiving end shall be procured as part of this tender and sending end equipment shall be free issued to HVPNL end contractor. Make/model/design of same shall be as per HVPNL standard design philosophy.
 - OPGW system including all control panels and other equipment for receiving end (to be matched with make/model at sending end at HVPNL switchyard) as per HVPNL standard design philosophy.
 - Lightning Arrestor for 198kV, 10KA, Zinc Oxide type with discharge counter, insulating base and other accessories
 - Tri-vector meter for tariff metering as per HVPNL standard design philosophy including features and provisions for Open Access metering purpose
 - HTLS -AAAC type Conductor & related connectors, clamps etc.
 - Bus post insulators as required

- Gantry as required
 - All other items as required for outdoor switchyard
 - Cable sealing end as required at substation including new gantry substation.
 - Wave trap shall be vertical post mounted type. However, exact type shall be decided during detailed engineering based on space availability.
- 3.3.2 2 Numbers 220 kV, 2000 Amps, 50 kA (3 Sec), Gas Insulated Outdoor type Isolating breaker panel with Local Control Cubicle and Separate control and relay panel complete with numerical relay, metering and protection panel. Hybrid GIS is not acceptable. Control and relay panel for GIS shall be simplex type. GIS switchboard shall be suitable for 220kV cable termination at incoming side as well as at outgoing side. Requisite conversion from HTLS-AAAC to 220kV cable including all hardware shall be also taken care by contractor.
- 3.3.3 Extension by addition of 2 Number transformer feeder bays in existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear with Local Control Cubicle and Separate control and relay panel complete with numerical relay, metering, protection and synchronization panel. Other details shall be shared with successful contractor. Make of 220kV GIS extension bays and associated LCC & CRP shall be of same make as existing. Regarding details of 220kV existing GIS & associated LCC, CRP, Contractor shall coordinate with BHEL (main execution contractor) & CG (220kV GIS OEM) and obtain the requisite details. UHF sensors for 2 nos. 220kV CG make GIS extension bays envisaged at existing 220kV substation shall be hooked up with existing PD monitoring system. All required hardware, software, interconnecting cable including modification in existing HMI is included in contractor's scope.
- 3.3.4 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear with Local Control Cubicle and Separate control and relay panel complete with numerical relay, metering, protection and synchronization panel. Control and relay panel for GIS shall be simplex type.
- 3.3.5 Communicable type power quality meter along with HMI shall be provided at all 220kV incomer feeders for monitoring of various current & voltage harmonics at 220kV level. Protocol of this meter shall be selected by contractor so that same can be hooked up with 220kV SAS for centralised monitoring at ECS.
- 3.3.6 SCAP panel for 220kV GIS system shall be provided in MRSS-100. The SCAP scheme shall also include momentary paralleling of two separate grid supplies.
- 3.3.7 4 Number of 220/66 kV, 160/200 MVA, ONAN/ ONAF, YNyn0, Z= 12.5% (-0% to +10%), Oil filled transformer with OLTC and RTCC and suitable for bidirectional power flow as per enclosed specification and datasheets. Power transformer shall be provided with Nitrogen Injection Fire Protection System (NIFPS) along with HVWS based fire fighting system. Also Online dehydration facility shall be provided and the RTCC Panel shall be with dual redundant AVR facility.
- 3.3.8 2 Number of 220/66 kV, 60/75 MVA, ONAN/ ONAF, YNyn0, Z= 12.5% (-0% to +10%), Oil filled transformer with OLTC and RTCC and suitable for bidirectional power flow as per enclosed specification and datasheets. Power transformer shall be provided with Nitrogen Injection Fire Protection System (NIFPS) along with HVWS based fire fighting system. Also Online dehydration facility shall be provided and the RTCC Panel shall be with dual redundant AVR facility.
- 3.3.9 2 Number of 220/33 kV, 60/75 MVA, ONAN/ ONAF, YNyn0, Z= 12.5% (-0% to +10%), Oil filled transformer with OLTC and RTCC and suitable for bidirectional power flow as per enclosed specification and datasheets. Power transformer shall be provided with Nitrogen Injection Fire Protection System (NIFPS) along with HVWS based fire fighting system. Also Online dehydration facility shall be provided and the RTCC Panel shall be with dual redundant AVR facility.

- 3.3.10 66kV, 2000A, 50kA (3 sec.), SF6 Gas Insulated, single phase, 3 phase enclosure or single phase enclosure busduct with all bends and flexibles comprising of the Gas monitoring devices, barriers, pressure switches, UHF PD sensors etc.
- 3.3.11 66 kV, 3150 Amps, 40 kA (3 Sec), Double Bus Gas Insulated Switchgear with Local Control Cubicle and Separate control and relay panel complete with numerical relay, metering, protection and synchronization panel. Control and relay panel for GIS shall be simplex type. 66kV outgoing feeder envisaged for power recovery turbine shall be suitable for bidirectional power flow. The hardware mentioned in datasheet (DS-0046) is minimum and any additional including scheme implementation to achieve bidirectional flow power shall be provided by Contractor without any time and cost implication to Owner/EIL.
- 3.3.12 220 kV Fibre Optic cable from incoming gantry to 220 kV GIS substation for Fibre Optic Transmission System. Fibre optic cable (mono or multi-mode) shall be as per HVPNL requirements.
- 3.3.13 Fibre optic transmission system (FOTS) for interface with HVPNL for voice and data communication. FOTS shall be as per HVPNL requirements. Integration with HVPNL is required for implementation of Load trimming scheme, availability based tariff metering arrangement capable of measuring four quadrant reactive energy along with AMR facility with integration to control center, establishment of SCADA interface with real time data visibility to SLDC and all communication and protection through OPgW.
- 3.3.14 2 Nos. of 33 kV, 1600 Amps, 40 kA (3 Sec), Isolating Breaker Panel complete with power cable termination kits, numerical relay, metering and protection as per enclosed specification and datasheet for installation in new gantry substation in exiting refinery area. Note that Internal Arc Classification (IAC) rating of switchboard shall be 40 kA for 0.2 sec. CRP shall be part of 33kV GIS.
- 3.3.15 21 No 6.6 kV, 800 Amps, 40 kA (1 Sec), Isolating breaker panel with earthing truck, lifting truck (wherever applicable) complete with numerical relay, metering and protection as per enclosed specification and datasheet. Note that Internal Arc Classification (IAC) rating of switchboard shall be 40 kA for 0.2 sec.
- 3.3.16 4 Numbers, 6.6/0.433 kV, 2500KVA (minimum), Off Circuit tap changer, Dyn11, oil filled distribution transformer with Energy Efficiency Level 2 as per IS 1180 (Part-1) including amendments, for feeding normal & emergency substation loads.
- 3.3.17 415 V, 4000Amps (minimum), 65 kA (1 Sec) TPN Bus duct air insulated for connection between Transformer and Switchboard.
- 3.3.18 1 no. 415 V, 4000 Amps (minimum), 65 kA (1 Sec) and draw out type TPN switchboard (Power and Motor control center – PMCC) complete with numerical relay, metering and protection as per enclosed specification and datasheet. PMCC shall have two incomer from transformers and one incomer from rooftop solar photovoltaic system and bus coupler with auto changeover facility. Outgoing feeders shall be sufficient to cater CONTRACTOR load, Owner's load and spare feeders as per spare philosophy.
- 3.3.19 1 no. 415 V, 4000 Amps (minimum), 65 kA (1 Sec) and draw out type TPN switchboard (Emergency Power and Motor control center – EPMCC) complete with numerical relay, metering and protection as per enclosed specification and datasheet. EPMCC shall have one incomer from 6.6kV switchboard through 6.6/0.433kV transformer and second incomer from owner's substation SS-106 (CT-1) through 6.6kV IBP, 6.6/0.433kV transformer and bus coupler with auto changeover facility. Outgoing feeders shall be sufficient to cater CONTRACTOR load, Owner's load and spare feeders as per spare philosophy.
- 3.3.20 415 V, 400 Amps (Minimum), 25 kA for 1 Sec (Minimum) and draw out type TPN lighting distribution board (LDB) as per enclosed specification and datasheet for all the normal and emergency lighting transformer including those for owner's use. LDB shall have two incomer

and one bus coupler. Quantity and rating/ type of outgoing feeders shall be sufficient to cater CONTRACTOR load, Owner's load and spare feeders as per spare philosophy.

- 3.3.21 Substation Automation System (SAS) is in the scope of supply of CONTRACTOR. Hardware for Substation Automation system includes all cables, Ethernet switches, gateway, FO cable, HMI, industrial grade laptop for interfacing with Numerical relays over IEC-61850 etc. Provision of hook-up of soft electrical control, monitoring and status signals to ECS system, SCADA system of HVPNL, and other systems shall be provided in SAS. Software for all interfacing & control for Numerical Relays and other system components shall be installed in HMI and Laptop. All hardwired signals shall be connected upto the ECS interface panels by CONTRACTOR.

Separate SAS shall be provided each for 220 kV GIS and 66kV GIS system at MRSS-100. Further common SAS shall be provided for 6.6kV & 415V system at MRSS-100.

Common SAS system shall be provided for 220kV IBP, 33 kV IBP, and 415V system at new gantry substation. Interfacing between this common SAS & ECS RTU at MRSS-100 through FO cable shall be taken care by contractor. Work includes supply, termination, testing & commissioning of requisite FO cable including HDPE duct. Laying of FO cable shall be done by others under supervision of package contractor. Distance between new gantry substation & MRSS-100 shall be considered as approx. 4km. However, FO cable & duct in requisite quantities shall be supplied by the contractor during detailed engineering without any cost & time implication to owner/EIL. Interface between Contractor's SAS & owner's DCS is not envisaged. However for other connectivity of contractor supplied equipment, refer instrumentation part of tender.

Integration with HVPNL is also required for meters/ switchgear for implementation of load trimming scheme, availability based tariff metering and SCADA interface for real time data visibility. All hardware and components, as required by HVPNL for establishing communication shall be in scope of CONTRACTOR. All details of existing system, as required shall be obtained from HVPNL, by CONTRACTOR.

- 3.3.22 Modification of existing SAS & ECS system interface for incorporation of extension panels for existing GIS, including all hardware & software required as per existing systems design / make / model. ECS of MRSS-100 & new gantry substation are new & are included in owner's scope (supply, testing & commissioning). Installation of owner's supplied ECS hardware at gantry substation is kept in contractor's scope.
- 3.3.23 110V DC supply system comprising parallel redundant battery chargers, 2 x 50% Nickel Cadmium battery, DCDB, cell booster and online battery bank monitoring system, for switchgear protection & control including spare feeders and feeders for Owner's use as required. Existing 110V DC feeders available at existing 220kV GIS substation shall be extended by contractor for 2 nos. 220kV GIS extension panels. Contractor's scope shall start from outgoing terminal of 110V DC feeder module. Supply, laying & termination of cable is included in contractor's scope.
- 3.3.24 220V DC supply system comprising parallel redundant battery chargers, 2 x 50% Nickel Cadmium battery, DCDB, cell booster for critical lighting including spare feeders and feeders for Owner's use as required.
- 3.3.25 230V, Double Parallel Redundant UPS with Bypass (2+2 Design) and Ni-Cd battery backup (2 X 100%) with ACDB, Cell Booster and self-powered disturbance recorder with internal battery backup shall be provided for providing for control supply to ECS Panels, LAN, SAS HMIs, etc., installed in substation
- 3.3.26 4 nos. 415V/415V, Off Circuit, Dyn1, dry type lighting transformer for feeding normal & emergency lighting loads of substation buildings & outdoor switchyards. Note that minimum rating of lighting transformers shall be considered as 100KVA (normal lighting) & 50KVA (emergency lighting) at MRSS-100 and 100KVA (normal lighting) & 50KVA (emergency lighting) at switchyard area located in (95x95) mtr. Area.

- 3.3.27 Telephone system for 220 kV GIS package including supply of telephone distribution JB, telephone handsets and wiring from JB upto telephone sockets in substation building.
- 3.3.28 LAN system for 220 kV GIS package complete with LAN wiring, UTP jacks, rack panels, LIUs and associated power sockets is included in CONTRACTOR scope. Connection with refinery LAN system shall be done by others.
- 3.3.29 MV Motors, as required. All MV motors shall be energy efficient IE3 type as per IS 12615.
- 3.3.30 Local control stations/ push button stations for motors/ transformers, lighting control, etc. as required. Lighting panel/ power panel/ Welding receptacles/ convenience sockets/ junction boxes/ marshalling panel, as required, industrial grade, suitable for installation in safe area.
- 3.3.31 Flameproof and corrosion proof, certified for gas group IIC classified locations equipment (Lighting fixture, exhaust fan, etc.) suitable for installation in battery room.
- 3.3.32 All incoming and outgoing, XLPE Insulated, armoured, FRLS type outer sheath MV cables for power, control and space heater complete with laying and termination accessories for equipment supplied by contractor.
- 3.3.33 All fibre optic cables (Single mode type only) required for communication between various equipment supplied & installed by contractor, shall be supplied, laid and terminated by the contractor including all accessories (termination kits, pig tails, LIUs, patch cords, etc.) as required.
- 3.3.34 All cabling accessories i.e. straight through joints, end termination kits, GI pipes, GI cable trays complete with structural supports, top and bottom tray covers, cable glands and lugs, cable markers, HDPE ducts for laying FO cables, etc. as required for the complete package inside substation building including cables being supplied and laid by owner/others.
- 3.3.35 Complete earthing and lightning protection system comprising of maintenance free chemical earth pit with Cu bonded high tensile low carbon steel core electrode, earth grid of MS Rods, earth plates, GI earth strips for earth connection between equipment and earth plates, lightning arrestors, earthing conductor, etc. as required for earthing and lightning protection of the various equipment.
- 3.3.36 Normal and Emergency lighting system comprising of lighting panels, LED type lighting fixtures with clamps/ connectors/ adaptors, for indoor and outdoor lighting, DC critical lighting, plug, socket, etc. as per design basis for the complete 220 kV GIS substation.
- 3.3.37 Free standing floor mounted type PDB for space heater outgoing supply to various switchboards/ bus duct/ other equipment, with 415 V, TPN incomer and 240 V SPN outgoing feeders as required.
- 3.3.38 Solar rooftop photovoltaic system consists of SPV array, Module Mounting Structure, Power Conditioning Unit (PCU), etc. suitable for installation on roof of substation building of MRSS-100 in P25 plot area & new gantry substation at existing PR
- 3.3.39 Electrics for various mechanical systems like EOT cranes, Air conditioning, etc. as applicable.
- 3.3.40 Fire-proof sealing system and fire protection coating system to prevent spreading of fire from one zone to another through the openings in wall / floor, along cables laid in trays / racks and through openings below floor-mounted Electrical Switchgear, PMCC, Distribution Boards, Junction boxes, Cabinets and Panels.
- 3.3.41 Canopies complete with fixing arrangement and hardware for all outdoor electrical equipment in scope of the CONTRACTOR.
- 3.3.42 Distribution boards for various DC & AC supplies.
- 3.3.43 One set of special tools and tackles, erection hardware and touch up paint as required, Startup & commissioning spares, as required during commissioning.
- 3.3.44 Mandatory spares as per the spares list attached elsewhere in the document.

- 3.3.45 List of recommended spares for 2 years of normal operation and maintenance of all electrical equipments, along with unit rates and quantity.
- 3.3.46 All Civil works required for installation of electrical equipment, supports for cables/ cable trays, equipment foundations, etc., for completion of electrical works in substation building.
- 3.3.47 For substation cum control room building in existing refinery area, required service water line of 2" of PMS class A93A shall be in contractor's scope. Hook-up for service water shall be provided within radius of 100 meter from the building. The scope shall cover supply, erection/ construction and testing of service water line from the hook-up to the building. Contractor is required to follow piping requirements as specified in Piping scope of work/ supply (Doc. no. B269-999-16-43-SOW-0020).
- 3.3.48 CONTRACTOR shall include painting and marking of all buses, individual incomers, all outgoing feeders etc. with details such as tag no., feeder rating, CT details, sending end source reference etc. for all switchboards. Painting and marking of important parameters of all other indoor and outdoor equipments, lighting and FA devices, earth pits, etc. (supplied and/ or installed by CONTRACTOR) is also included in CONTRACOTR's scope.
- 3.3.49 Inspection and Factory Acceptance Tests including type tests for electrical equipment. Contractor shall also furnish factory acceptance and site acceptance testing procedures from manufacturers for OWNER/EIL approval. Site acceptance testing shall be included for equipment's such as numerical relays, substation automation system, etc. The equipment manufacturer shall carry out these tests at site only. Site testing procedures shall be got approved from OWNER/EIL before performing these tests at Site
- 3.3.50 For the following equipment, CONTRACTOR shall ensure that installation, testing and commissioning of the equipment at site shall be done by the respective equipment manufacturer (OEM):
- 220 kV Double bus GIS and associated LCC
 - Control and Relay panel for 220 kV Double Bus GIS (Testing & Commissioning only)
 - 66 kV Double bus GIS and associated LCC
 - Control and Relay panel for 66 kV Double Bus GIS (Testing & Commissioning only)
 - NIFPS of Power transformer
 - Fibre optic transmission system
 - PLCC System
 - 33 kV Isolating Breaker Panel (Testing and Commissioning only)
 - 6.6 kV Isolating Breaker Panel (Testing and Commissioning only)
 - Numerical relays and Substation Automation System (Testing and Commissioning only)
 - MV switchboards (Testing and Commissioning only)
 - Complete DC System & AC UPS (Testing and Commissioning only)
 - Solar rooftop photovoltaic system.
- However for other equipment's, contractor shall ensure services of manufacturer's representative as required during testing and commissioning.
- 3.3.51 Contractor is advised to visit site prior to submission of bid in consultation with EIL/ IOCL to collect all interfacing data from site including details of existing equipment / systems which require augmentation / extension for successful execution of job. Contractor shall inform issues, if any along with their resolution to EIL/ IOCL and include the same in the scope of tender after obtaining concurrence from EIL/ IOCL.
- 3.3.52 Contractor shall carry out the installation, field testing and commissioning of all electrical equipment supplied as part of this package, including installation, assistance in field testing and commissioning of free issue items, provision of appropriate test and commissioning reports and as-built documentation as necessary for all but not limited to equipment and systems specified above.

- 3.3.53 The contractor shall obtain approvals from the concerned electrical inspectorate (e.g. CEA, State Authority etc.) for installation drawings and engineering of the electrical system and equipment covered under the contractor's scope. Any modification or additional requirements of the electrical inspectorate shall have to be carried out by the contractor at his own cost without affecting time schedule. Any additional testing, if required, shall be carried out by the contractor without affecting project time schedule at no extra cost to owner.
- 3.3.54 Providing training for TEN number OWNER' s Engineers for a period of at least three days for each item at Site for the following equipment's is included in the Contractor's scope:
- 220 kV Double bus GIS and associated LCC
 - Partial Discharge Monitoring of 220 kV GIS
 - Control and Relay panel for 220 kV Double Bus GIS
 - 66 kV Double bus GIS and associated LCC
 - Partial Discharge Monitoring of 66 kV GIS
 - Control and Relay panel for 66 kV Double Bus GIS
 - NIFPS of Power transformer
 - Fiber optic transmission system
 - PLCC System
 - Online Dehydration Facility for transformer
 - 33 kV Isolating Breaker Panel
 - Numerical relays and Substation Automation System
 - Complete DC System & UPS
 - Solar rooftop photovoltaic system.
- 3.3.55 All other electrical equipment materials and work not explicitly mentioned but nevertheless required to fulfil the following minimum requirements shall deemed to be included in the scope of the CONTRACTOR with no additional cost and time implication to the owner/ EIL.
- 3.3.55.1 To meet equipment and personnel safety.
- 3.3.55.2 To suit site facilities and environmental conditions.
- 3.3.55.3 To meet the requirements of statutory approving authorities.
- 3.3.55.4 To coordinate with other contractors and agencies involved at site for other activities and site work.
- 3.3.56 2 nos. 66/ 6.9 kV, 20/25 MVA, Z=10% (-0% to +10%), Dyn1, ONAN/ONAF transformer with OLTC and RTCC as per attached data sheet. Power transformer shall be provided with HVWS based fire fighting system. Also Online dehydration facility shall be provided and the RTCC Panel shall be with dual redundant AVR facility.
- 3.3.57 2 nos. neutral grounding resistor (3.81kV, 600A for 10 sec.) as per attached data sheet& EIL specification, 6-51-0043.
- 3.3.58 2 sets of 6.6 kV, 2500A, 40kA for 1sec. air insulated segregated phase bus duct as per enclosed datasheet. Drawing of MRSS-100 is attached with tender based on which length of bus duct shall be estimated by contractor.
- 3.3.59 1 no. 6.6kV, 2500Amps, 40kA (1sec.), AIS switchboard as per attached data sheet & feeder list for feeding package loads including owner's loads:
- Note: Supply, laying & termination of 6.6kV power & control cable from outgoing terminal of owner's feeders shall be taken care by owner. Cable route within battery limit shall be provided by contractor. Also the receiving end unit of feeder differential protection (87F) shall be free issued by contractor for installation at the downstream 6.6kV switchboard by the respective package contractor.

- 3.3.60 Design, supply, laying, termination (including termination kit), testing & commissioning of 66kV (E) copper conductor cable with aluminium corrugated sheath (1Rx1Cx300 sqmm.) from outgoing terminal of 66kV GIS switchboard of MRSS-100 to primary cable box of 20/25MVA (min.), 66/6.9kV transformer envisaged at MRSS-100 shall be supplied, laid & terminated by contractor. In this regard, contractor to follow the EIL standard specification, 6-51-0067 & data sheet.
- 3.3.61 Design, supply & laying of 66kV (E) cable from outgoing terminal of contractor supplied GIS switchboard to downstream individual package unit shall be done by others. However, termination of cable including 66 kV termination kits required at contractor supplied GIS at MRSS-100 shall be supplied by contractor.
- 3.3.62 Design, supply, laying, termination (including termination kit), testing & commissioning of 33kV (E) cable from outgoing terminal of 60/75MVA, 220/33kV transformer envisaged at new gantry substation of existing PR to 33kV indoor GIS isolating breaker panel proposed at new gantry substation shall be supplied, laid & terminated by contractor. Contractor to follow cable data sheet & applicable EIL standard specification. Laying & termination of 33kV cable for contractor supplied equipment including supply of cable termination kit is included in contractor's scope.
- Design, supply, laying, termination (including termination kit), testing & commissioning of 6.6kV (UE) cable shall be supplied, laid & terminated by contractor. Contractor to follow the cable data sheet & applicable EIL standard specification. Laying & termination of 6.6kV cable (except the owner's feeders) for contractor supplied equipment including
- 3.3.63 Design, supply, installation, testing & commissioning of fire alarm system of new incoming gantry area at (95x95) mtr. including substation building is included in contractor's scope. Make & model new fire alarm system shall be identical to existing fire alarm system provided in 220kV existing GIS substation located nearby & same shall be hooked up with existing fire alarm system operational at 220kV existing GIS substation. For details of existing FA system, refer Annexure-A.
- 3.3.64 Design, supply, installation, testing & commissioning of plant communication system of new incoming gantry area at (95x95) mtr. including substation building is included in contractor's scope. Make & model of PA system shall be identical to PA system provided in 220kV existing GIS substation located nearby & same shall be hooked up with existing PA system operational at 220kV existing GIS substation. For details of existing FA system, refer Annexure-A.
- 3.3.65 2 nos. adequate rated indoor panel mounted capacitor bank each rated 50% of total rating with APFC relay at 6.6kV level for maintaining power factor at input of 66/6.9kV power transformer as 0.95 (lag). Each bank shall have vacuum contactor for ON/OFF control.
- 3.3.66 Contractor shall provide controlled switching device/synchronous switching device in each of the EHV transformer feeders (including at all spare feeders) at 220kV i.e. at MRSS-100 & at existing 220kV GIS substation to limit voltage dip during closing of transformer incomer breaker. Details of CSD along with reference list of past executed projects & filed proven test record shall be furnished by the contractor for review/approval of EIL/owner. Contractor shall carry out transformer inrush current study for all EHV transformer under various operating conditions including charging through existing CPP SS-28 & complying to requirements of HVPNL in this regard & shall submit the report to EIL/owner for review/approval.
- 3.4 **FREE ISSUE EQUIPMENTS/ ITEMS**

Following equipment/ items shall be free-issued by the owner to the contractor for Engineering/ Installation/ testing and commissioning as per scope of work defined:

- 3.4.1 220 kV Cables shall be supplied and laid by others.
- 3.4.2 220 kV termination kits for GIS shall be supplied by others. Termination of 220 kV Cables at 220 kV GIS end shall be done by others.

- 3.4.3 Fire Alarm devices for 220 kV GIS kV GIS package substation building shall be supplied (free issued) by Owner. Preparation of fire alarm layout, block diagram and installation of fire alarm devices in MRSS-100 substation building as per approved layout including FA system cabling is in scope of CONTRACTOR. Testing and commissioning of Fire alarm devices shall be done by others.
- 3.4.4 Plant communication equipment for 220 kV GIS package substation building shall be supplied (free issued) by Owner. Preparation of PA layout, block diagram, speech diagram and installation of Plant communication devices in MRSS-100 substation building as per approved layout including PA system cabling is in scope of CONTRACTOR. Testing and commissioning of plant communication devices shall be done by others.
- 3.4.5 ECS System in 220 kV GIS substation shall be supplied, installed, tested and commissioned by others. MV power and control cables from CONTRACTOR's equipment to ECS Panels shall be supplied, laid and terminated by CONTRACTOR. Space for ECS panels shall be provided in the GIS building as specified elsewhere.
- 3.4.6 For new gantry substation envisaged at (95x95) mtr. area, owner shall free issue ECS I/O panels. Installation of these panels has been kept in contractor's scope whereas testing & commissioning of the same shall be done by others. Further these I/O panels shall be connected with upstream ECS system available at MRSS-100. Trench within contractor's battery limit is included in Contractor's scope. All LAN System active components such as core/network switches, etc., within package battery limit shall be supplied by owner. Installation of these devices in substation building as per approved layout including cabling is in scope of CONTRACTOR. Testing and commissioning of these devices shall be done by others.
- 3.4.7 Receiving end unit of Feeder Differential relay for installation in 6.6 kV Isolating breaker panel will be free issued to the CONTRACTOR. Installation of relay shall be in scope of CONTRACTOR. Testing and commissioning of relay shall be by others.

3.5 INTERFACE WITH OWNER'S SYSTEM

Following interfaces with other plant system shall be in scope of CONTRACTOR. Contractor to also refer Interface drawing for detail.

- 3.5.1 Incoming 220 kV overhead line from HVPNL substation up to incoming gantry of 220 kV outdoor switchyard in IOCL premises shall be laid and terminated by others. However, tapping of connections for LA, Isolator, Bus Post Insulator, etc. shall be in scope of CONTRACTOR.
- 3.5.2 Incoming OpGW from HVPNL substation up to incoming gantry of 220 kV outdoor switchyard in IOCL premises shall be laid by others. However, jointing FO cable supplied by CONTRACTOR to OPgW, making joint on OpGW including supply of jointing kit, all tests including OTDR testing and other miscellaneous works shall be in scope of CONTRACTOR.
- 3.5.3 Incoming 6.6kV cable up to 6.6kV IBPs shall be supplied and laid by others. However, termination of 6.6kV cable in IBPs shall be in scope of CONTRACTOR.
- 3.5.4 For works related to existing refinery area i.e. (95x95) mtr. in existing PR, suitably rated 4 nos. 415V feeders (2 nos. for normal power & 2 nos. for emergency power) shall be provided by owner from 415V switchboard located at SS-28/SS-63/SS-64. Further extension of power supply including supply, laying, testing & commissioning of power cable including providing cable trench/cable trays from SS-28/SS-63/SS-64 to contractor supplied 415V distribution board located in gantry substation shall be in contractor's scope. Plot plan is attached in which location of gantry substation, SS-28/SS-63/SS-64 are indicated based on which cable estimation shall be done. Contractor to provide load data & feeder rating of above feeders for providing suitable rated feeders by owner CONTRACTOR to supply redundant relays of

different makes Feeder Differential Relay (87F) or Distance Protection Relay (21) for installation (by others) in upstream HVPNL switchyard as required.

- 3.5.5 CONTRACTOR to supply Transformer + Feeder Differential Relay (87T+F) for installation in downstream switchboards outside package battery limit for each outgoing 66 kV transformer feeder. Relay shall be provided with redundant ports for OFC communication. Same OFC with multiple fibers shall be used for redundant communication between these ports on relays at both ends. FO cable (single mode type only) and HDPE conduit for these differential relays shall be supplied Owner/EIL.
- 3.5.6 Receiving end unit of 87F relay in 6.6 kV IBP will be free issued to the CONTRACTOR. Installation of relay and connection to Ethernet switch on RJ45/ FO shall be in scope of this tender. Testing and commissioning of relay shall be by others. CT and end termination accessories of FO cable for 87F shall be in scope of this tender.
- 3.5.7 Space for installation of Panels & HMI for Online Temperature Monitoring System for 220kV incoming cables.
- 3.5.8 Laying and termination of 33 kV cables for CONTRACTOR's equipment including supply of cable termination kits and cable joints, if required shall be in scope of CONTRACTOR.
- 3.5.9 Cabling from CONTRACTOR's equipments (i.e. DC System, AC Supply, Space Heater supply, etc.) to Owner's DGFAP, ECS Panels, etc., shall be supplied, laid and terminated at both ends by CONTRACTOR. Control cable (If any) from CONTRACTOR's equipments to Owner's DGFAP, ECS Panels, etc., shall be supplied, laid and terminated at both ends by CONTRACTOR.
- 3.5.10 Earthing of Owner's equipments installed in 220 kV GIS substation shall be in scope of CONTRACTOR. However, provision of earthing grid/ earth plates, including clean earth, if required, for ECS, shall be in scope of CONTRACTOR.
- 3.5.11 ECS system shall be in scope of OWNER. However, MV power and control cables from CONTRACTOR's equipment to ECS Panels shall be supplied, laid and terminated in ECS panels by CONTRACTOR. Connection of SAS to ECS shall be by ECS vendor. CONTRACTOR to provide redundant FO Port for connection with ECS. PA Junction Box and Telephone Junction box shall be supplied by CONTRACTOR. Incoming PA and Telephone cables shall be supplied and laid by OWNER. However, termination of these cables in PAJB and TJB shall be by CONTRACTOR.
- 3.5.12 In addition to above, interface as required with HVPNL, regarding equipment, components, their rating and their specification and for establishing to & from voice and data communication with HVPNL shall also be in scope of CONTRACTOR. Details of existing system, wherever required, shall be obtained from HVPNL by CONTRACTOR.
- 3.5.13 CONTRACTOR to note that, approval has to be taken from HVPNL before placing order for items, required for HVPNL/ required for interface with HVPNL. CONTRACTOR to take approvals of documents from HVPNL listed below but not limited to the following:
- 3.5.13.1 GIS Building Layout.
- 3.5.13.2 Outdoor switchyard layout
- 3.5.13.3 Outdoor switchyard substation cum control room layout
- 3.5.13.4 Protection and Metering SLD
- 3.5.13.5 Major equipment sizing e.g. outdoor switchyard equipment, selection of GIS components/ CT ratios, cable sizes, etc.
- 3.5.13.6 System architecture drawing for establishing communication with HVPNL.
- 3.5.13.7 FOTS scheme for interfacing with HVPNL for load trimming scheme, ABT metering and SCADA.

- 3.5.13.8 Vendor drawings of above mentioned equipment.
- 3.5.13.9 Any other equipment drawing/ document, required by HVPNL.
- 3.5.13.10 For interface data required from HVPNL regarding FOTS/OPGW, PLCC, distance protection (21) or feeder differential protection (87F), load trimming scheme and conductor details etc. contractor to co-ordinate with HVPNL at their end, obtain the required information & implement the scheme as per HVPNL requirements including all hardware, software as required.

4 EQUIPMENT SIZING AND SELECTION CRITERIA

4.1 ELECTRICAL DESIGN BASIS

- 4.1.1 Engineering design basis for electrical (B269-999-16-50-EDB-1001) & standard design philosophy for electrical facilities (6-51-0099) along with details indicates in this specification shall form the basis for basic design and developing detailed design and engineering for electrical facilities including electrical power system, electrical equipment and electrical installation etc.
- 4.1.2 Wherever applicable technical parameters of relevant equipment shall meet the HVPNL Technical Specifications requirements.

4.2 EQUIPMENT SIZING

- 4.2.1 The fault level for various voltage levels of Electrical system for this complex shall be limited and provided as under. Accordingly the associated electrical equipment shall be selected suitable for same:
- i). 50 kA (RMS) (3 Sec)/ 135 kA (Peak) for 220 kV System.
 - ii). 40 kA (RMS) (3 Sec)/ 100 kA (Peak) for 66 kV System.
 - iii). 31.5 kA (RMS) (1sec.) / 80kA (Peak) for 33 kV systems.
 - iv). 40 kA (RMS) (1sec.) / 100kA (Peak) for 6.6 kV systems.
 - v). 65 kA (RMS) (1sec.) / 143kA (Peak) for 415 V System.
 - vi). 25kA (RMS) (1 sec.) / 62.5 kA (Peak) for 415V System for LDB/ ELDB
- 4.2.2 CONTRACTOR to note that during sizing and selection of the equipment (i.e. oil filled and dry type transformers, DC system, UPS System, 415V switchboard, Ethernet switches, etc.), 20% spare feeders and 20% spare capacity (25% in case of DC System) shall be provided. This shall be over and above design margin.
- 4.2.3 CONTRACTOR to consider maximum cable de-rating factor of 0.5 for sizing of cables on ground rating at 30 degree specified in cable catalogue. This shall be considered for all underground cables.
- 4.2.4 CONTRACTOR to consider sizing factor for normal, standby and intermittent loads as per EIL Spec. 6-51-0099. Contractor to consider 10% design margin and 20% spare capacity for future.
- 4.2.5 CONTRACTOR to note that each switchboard/ transformer shall be loaded upto maximum 80% of its bus bar/ transformer capacity.
- 4.2.6 Lightning protection of building shall be designed for LPS level as per IS/IEC-62305 based on the geographical location of the package. Lightning strip size shall be minimum 25 x 3 mm.
- 4.2.7 Earth Resistivity Value shall be measured by CONTRACTOR before earthing system design calculation. For earthing conductor sizing, duration of earth fault current duration to be considered, shall be minimum one second.
- 4.2.8 For lighting system design, overall maintenance factor shall not be more than 0.63

4.3 SUBSTATION BUILDING

- 4.3.1 Design, engineering and construction of Main substation building MRSS-100 in P25 plot area and substation cum control room for outdoor switchyard in existing refinery area, is included in the scope of CONTRACTOR. For detailed scope refer Civil/ Structural scope of work. Main Substation building MRSS-100 shall have cable cellar and battery room on ground floor and GIS Hall of double height, Switchgear hall, ECS Hall, UPS Room on first floor. Substation cum control room for outdoor switchyard shall be with elevated floor & trenches and shall have battery room, operator room and switchgear hall etc. Refer indicative architectural layout for detail wherein the minimum substation sizing requirements are indicated. Contractor to also accommodate additional 2 nos. power transformer bays each of size 12 x 12 m and additional 2 nos. distribution transformer bays in place of tie transformer bays each of size 18m x 18m. Final substation building layout shall be developed and submitted by Contractor for review/ approval by EIL/Owner.
- 4.3.2 Cut-outs shall be provided along the complete length of switchgear hall. Beams in between cut-outs shall be provided with PVC sleeves of 150 mm dia. Opening of 200 x 100 mm shall be provided in all under slab beams of switchgear hall slab for FA cable laying. Cut-out of 1200 x 200 mm shall be provided in slab along columns on switchgear floor for cabling to wall mounted panels. Base frame work for all switchgear hall cut-outs is in scope of Contractor. All unused cut-outs shall be covered with 6 mm thick chequered plate after installation of all equipment. Cut outs provided for switchboards shall be covered with 6mm thick chequered plate during construction to prevent falling of people through cut outs.
- 4.3.3 All door/ gates in substation shall be provided with facility to padlocking the doors. Monorail shall be provided for equipment loading/ unloading.
- 4.3.4 All switchboards shall be installed considering provision for installation of two future panels on each side of switchboard.
- 4.3.5 CONTRACTOR to keep space for installation of Owner's ECS System panels in the switchgear hall. Approx. area of ECS Panel Room and ECS Operator Room is indicated in the architectural layout. Exact dimension of both the rooms shall be finalized during detailed engineering.
- 4.3.6 Structural support for Owner's supplied panels is also in the scope of CONTRACTOR. In addition to the base frame of panel, additional framework base channels for embedding in the concrete/ welding to the insert plates on concrete surface shall be supplied and erected by the CONTRACTOR. Supporting structure for 220 kV & 66 kV Cables from cable cellar to GIS structure shall also be provided by CONTRACTOR.
- 4.3.7 Power transformers shall be provided with a RCC oil soak pit below the transformer. Following guidelines shall be followed in this regard:
- 4.3.7.1 The RCC oil soak pit shall be dimensioned such that the clearance between the pit extension and the transformer body shall be 20% of the height of the transformer (highest point) or minimum 800 mm beyond transformer body (Tank and Radiator) all around.
- 4.3.7.2 For the transformers, which are having their soak pits connected to a common waste oil pit, the individual soak pit shall be sized to hold one third of the oil content of the particular transformer (Tank, Cooler, Conservator, OLTC and Cable Box) plus volume of water due to HV water spray system and a margin of approximately 20% for rain water.
- 4.3.7.3 However, the transformers with oil capacity more than 2000 litres, but not connected to waste oil pit, soak pit shall be sized to take the whole of the oil of the transformer plus 30% design margin
- 4.3.7.4 The pit shall be filled with 40 mm size gravel and a porosity factor of 40% shall be considered for sizing of the pit.

- 4.3.7.5 Total pit volume shall also account for the transformer foundation or any other foundation in the pit.
- 4.3.7.6 Pit shall be raised at least 150 mm above the external level.
- 4.3.8 In addition, provision shall also be made to drain away the oil from individual soak pit to a separate waste oil tank/ pit, where use of more than 9,000 liters of oil in any oil tank/ pit or chamber is involved. This tank/pit shall be connected by a suitable Hume/ HDPE drain pipe of not less than 200 mm diameter to each soak pit. Waste oil tank/ pit shall be located away from the transformer, in the lowest part of the switchyard to assist drainage. The tank/ pit shall be of sufficient capacity to receive, without overflowing, the contents of the largest transformer plus the water of any fixed fire-fighting system and a certain quantity of rain water collected from all tanks/ pits. No other drain shall lead to the tank/pit. This pit shall be provided with an air vent large enough to avoid over pressure during operation. The whole internal surface shall be impermeable.
- 4.3.9 This pit shall not have stone filling. Suitable manhole with ladder shall be provided for the waste oil pit. For taking out the oil from the waste oil pit, a portable pump of suitable rating as per OISD-173 shall be provided.
- 4.3.10 Rail track/ Channel shall be provided for the movement of the main transformers. Same shall be extended on the main approach road. Mooring post shall be provided at a suitable location. Necessary arrangement along with suitable foundation shall be provided for jacking pad, wherever it is required to change the direction of transformer wheels.
- 4.3.11 Wherever cables cross the rail-track/ foundation, suitable size ducts in Concrete block shall be provided.
- 4.3.12 Main gate for power transformers and Maintenance Gates for routine operation & maintenance shall be provided in transformer bay. Transformer bays to be covered with concrete roof at double height.
- 4.3.13 Each transformer bay shall be provided with 1 Nos. 100 Amps outlet for oil filtration and other maintenance activities.
- 4.3.14 Fire wall between two adjacent transformers shall be extended at least 1 meter above the top most point of the Transformers. Fire wall shall also be designed to withstand the explosion of transformer bushing. Firewall thickness shall be minimum 355 mm in case of brick construction or 230 mm in case of RCC construction.
- 4.3.15 Battery room shall be well ventilated along with necessary exhaust system and water connection with sink. Battery room shall be provided with minimum two exhaust fans and louvered opening in the opposite wall/door. Floor of the battery room and walls up to 1.5 M height shall have acid/alkaline (as applicable) resistant protective material coating. Maintenance platform and wash basin/sink shall be provided in the battery room. Neutralization pit for battery room shall be considered, which shall be connected to plant drain.
- 4.3.16 Switchgear/ control room shall have fire-fighting equipment, first aid boxes, insulating floor mats all around the switchboards, hand-gloves and other safety equipment as per statutory requirements. Flooring of switchgear hall shall be painted with insulation paint.
- 4.3.17 Epoxy based insulation coating with breakdown voltage as per IS, suitable for installation on concrete flooring shall be applied on switchgear hall and GIS Hall of substation in air-conditioned/ non-air-conditioned area. Rubber mats shall also be provided around switchboards as per CEA safety regulations.
- 4.3.18 The fire-proof sealing system and fire protection coating system are required to prevent the spreading of fire from one place to another (or one zone to another) through the openings in wall / floor, along cables laid in trays / racks and through openings below floor-mounted Electrical Switchgear, PMCC, Distribution Boards, Junction boxes, Cabinets and Panels. The

systems shall be installed in the specified locations in consultation with the purchaser's engineer after all cables have been laid and terminated.

- 4.3.19 Emergency escape route is mandatory to be maintained and marked from all locations in the cable cellar of substation.
- 4.3.20 Contractor shall note that 220kV & 66kV EHV cables inside cable cellar of MRSS-100 shall be laid in RCC trenches. Accordingly, required facility for the same shall be considered by contractor.

4.4 SINGLE LINE DIAGRAM

It is the responsibility of the contractor to provide number of outgoing feeders in each switchboard as per actual loads, other electrical system requirements plus spare feeders in each switchboard in line with engineering design basis.

Contractor shall prepare Single line diagram for complete package and submit the same to Owner/ Consultant for approval. Equipment s as required, as per the bid package to cater the load demand of package and owner's load shall be supplied without any price and time impact to Owner/Consultant.

5 EQUIPMENT SPECIFICATIONS

5.1 POWER TRANSFORMER

- 5.1.1 Tag Number for various transformers is as per table below:

Tag Number	Rating	Impedance	Cable Termination	
TR-100013	220/66 kV, 160/200 MVA, ONAN/ ONAF, YNyn0, OLTC -17.5% to +12.5%(In step of ± 1.25%)	Z = 12.5%(-0% to +10% tolerance)	At 220 kV Side 245 kV (E), 1 Run/ phase, 1C x 630 Sq.mm, Cu Conductor, XLPE Insulated, Armoured, Corrugated Aluminium, PVC Outer sheath Cable	At 66 kV Side GIBD
TR-100014				
TR-100015				
TR-100016				
TR-100011	220/66 kV, 60/75MVA, ONAN/ ONAF, YNyn0, OLTC -17.5% to +12.5% (In step of ± 1.25%)	Z = 12.5%(-0% to +10% tolerance)	At 220 kV Side 245 kV (E), 1 Run/ phase, 1C x 400 Sq.mm, Cu Conductor, XLPE Insulated, Armoured, Corrugated Aluminium, PVC Outer sheath Cable	At 66 kV Side GIBD
TR-100012				
TR-100001	220/33 kV, 60/75 MVA, ONAN/ ONAF, YNyn0,	Z = 12.5%(-0% to +10% tolerance)	At 220 kV Side 245 kV (E), 1 Run/ phase, 1C x 400 Sq.mm, Cu Conductor,	At 33kV Side 33kV (E), 4 Run/ phase, 1C x 630 Sq.mm.,

Tag Number	Rating	Impedance	Cable Termination	
TR-100002	OLTC -17.5% to +12.5%(In step of $\pm 1.25\%$)		XLPE Insulated, Armoured, Corrugated Aluminium, PVC Outer sheath Cable	Cu Conductor, XLPE Insulated, Armoured, PVC FRLS outer sheathed
TR-100029	66kV/ 6.9kV 20/25 MVA, Dyn1, ONAN/ONAF	Z=10% (-0% to +10%),	At 66 kV Side 1 Run/ phase, 1C x 300 Sq.mm, Cu Conductor, XLPE Insulated, Armoured, Corrugated Aluminium, PVC Outer sheath Cable	At 6.9kV Busduct (phase segregated)
T-100030	66kV/ 6.9kV 20/25 MVA, Dyn1, ONAN/ONAF			

5.1.2 220kV Grid transformer shall be as per the enclosed power transformer datasheet and EIL standard specification 6-51-0068 attached with the tender. In addition to the requirements specified in 6-51-0068, following clauses shall also be complied.

a) Lighting Impulse Withstand	:	1050 kV _p
b) Power Frequency Withstand	:	460 kV _{rms}
c) Conservator for Cable Box	:	Separate from main tank conservator
d) Conservator for OLTC	:	Common/ Separate, as per vendor design
e) Air Cell Puncture Detection Relay	:	Not Required
f) Sudden/ Rapid Pressure Rise Relay	:	Required
g) Automatic Regenerative Breather	:	Not Required
h) Remote Indication for pressure relief devices	:	Through separate measuring system
i) NIFPS System	:	Required separately for tank and 220 kV cable box
j) HV Water Spray System	:	Required
k) Rollers	:	Flat type
l) 220 kV Termination	:	Oil insulated phase separated cable box with oil/ oil bushings
m) 66 kV Termination	:	Phase separated cable chambers suitable for Gas Insulated Busduct termination
n) 33 kV Termination	:	Air Insulated Phase segregated cable box
o) Dissolve Gas Analyser	:	Required (Offline Type)
p) Gases to be monitored	:	H ₂ , CH ₄ , C ₂ H ₄ , C ₂ H ₆ , C ₂ H ₂ , CO, CO ₂
q) Online Moisture Removal System	:	Required (Refer doc. –SP-0023)
r) OLTC	:	Bi-directional
s) Microprocessor bases AVR Interface for communication	:	FO Port on IEC 61850. LIU shall be provided to terminate armoured cable.
t) Impact Recorders	:	Required

- u) Type tests to be conducted on offered transformers, even if type test reports are available:
 - i. Temperature Rise : Required (One transformer of each rating)
 - ii. Loss Measurement : Required
 - iii. Short Circuit : Not Required
 - iv. Dielectric Test (As per IS 2026 Part 3) : Not Required
For both transformer and cable box
 - v. Dissolved Gas Analysis of transformer Oil : Required
 - vi. Frequency Response Analysis : Required (At works and at site)
 - vii. Measurement of the harmonics of the no load current : Not Required
 - viii. Fault current withstand capacity test of 220 kV oil filled cable box. : Not Required
 - ix. Pressure Test : Required (On each tank size) & Cable box
 - x. Vacuum Test : Required (On each tank size) & Cable box
 - xi. Parallel operation : Yes
 - xii. SFRA test : To be done on all 220kV EHV Grid transformer at factory (before dispatch) & at site as part of pre-commissioning procedure.
- 5.1.2.1 Neutral point at 220 kV side shall be provided by means of the outdoor type bushing with minimum continuous voltage rating of 33 kV.
- 5.1.2.2 Contractor to ensure that valid type test certificates of offered design of transformer are available for Heat run test, short circuit test, IP test of panels, dielectric test, etc. as per type tests listed in IS:2026. In case of non-availability of short circuit test reports, dielectric test reports, IP test reports, impulse test reports, etc. same shall be conducted without any cost and time implication to Owner/ EIL. Type test certificates for EHV bushings and other transformer components shall also be furnished. Type test of transformer shall only be acceptable provided the offered transformer have been manufactured from the same plant/works from where type tested transformer was manufactured..
- 5.1.2.3 The transformer cable chambers shall be provided with disconnecting arrangement for 220kV terminations to facilitate testing of cables and/or transformers independently. It shall also facilitate removal of the transformer without disturbing cables. The disconnecting arrangement can consist of links in the cable chamber or in a separate disconnecting chamber. The disconnecting arrangement shall be suitably insulated with provision of vermin proof breathing arrangement where applicable.
- 5.1.2.4 The clearances between the cable terminals and transformer bushings shall be adequate to subject each cable or transformer separately to high voltage tests. The cable box and the disconnecting arrangement shall be capable of withstanding both at the time of the first test on cables and at any subsequent time as required.
- 5.1.2.5 Supply of termination kits for entry of 220 kV cables in the oil filled chambers is excluded from CONTRACTOR's scope however all data / details required for procurement of same by owner and provision of required facilities & earthing connection shall be in CONTRACTOR's scope.
- 5.1.2.6 For each cable chamber of 220 kV cable terminal box, separate PRV shall be provided along with prismatic level gauges on both the legs of the cable chamber i.e. cable end and transformer end.

- 5.1.2.7 Separate conservator provided for 3-phase cable chambers shall be provided with a flexible oil resistance air bag and shall also be supplied with following accessories as a minimum :
- Buchholz relay (double float type) with separate normally open trip and alarm contacts for each cable chamber connection
 - Prismatic level gauge
 - De-hydrating breather
 - Air release Device
 - Oil filling hole with cover
 - Oil Level indicator with alarm contact
 - Pressure relief valve shall be provided (with alarm contact).
 - Sampling valve
 - Conservator drain valve
 - Top oil filter valve
 - Drain cum bottom filter valve
 - NIFPS System
- 5.1.3 Buchholz relay, OTI & WTI shall be provided with reed type switches in place of mercury switches.
- 5.1.4 Supporting arrangement for raising the power cable to transformer end termination shall be provided.
- 5.1.5 Power transformers shall be provided with OLTC and shall have RTCC facility.
- 5.1.6 Power transformers shall be used for bi-directional flow of rated power. Tap changer shall be suitable for bidirectional power flow. The tap changer rating shall be more than maximum rated current of transformer at selected tap position and at ONAF rating.
- 5.1.7 CT for 51G and 64R shall be provided at both sides of transformer. CT for 51G shall be class 5P10 and CT for 64R shall be class PS for all the transformers. Technical details of class PS CT (CT Ratio, V_k , I_{mag} and RCT) shall be submitted by contractor for EIL review.
- 5.1.8 Power transformer shall be transported with transformer tank/ OLTC/ terminal box/ etc. filled with dry air or nitrogen at positive pressure to ensure that no ingress of moisture, humidity or contamination takes place. Necessary arrangement shall be ensured by the contractor to take care of pressure drop of dry air or nitrogen during transit and storage till completion of oil filling during erection. A dry air or nitrogen pressure testing valve with necessary pressure gauge and adaptor valve shall be provided.
- 5.1.9 Transformer shall be fitted with sufficient number of electronic impact recorders (on returnable basis) during transportation to measure the magnitude and duration of the impact in all three directions. The acceptance criteria and limits of impact in all three directions which can be withstood by the equipment during transportation and handling shall be submitted by the contractor during detailed engineering. The recording shall commence in the factory and must continue till the units reach site. The data of electronic impact recorders shall be downloaded at site and a soft copy of it shall be handed over to Engineer – in –charge.
- 5.1.10 GA of transformer shall be planned in such a manner, that it is possible to pull transformer tank outside the bay without withdrawing the radiators/ any other accessories of transformer.
- 5.1.11 Power transformers shall be provided with Dissolved Gas Analyser (DGA) kit (This kit shall be supplied as Mandatory spare, defined elsewhere in this document). Provision shall be provided on tank and cable box for connecting the supplied DGA kit for online analysis
- 5.1.12 220kV EHV Grid transformers shall be provided with Nitrogen Injection Fire Protection System (NIFPS) along with HVWS based fire fighting system. NIFPS shall be as per EIL specification attached with tender. NIFPS system shall be separate for cable box. Contractor to furnish PTR of NIFPS supplier before finalization of vendor.

- 5.1.13 Power transformers shall be provided with Online Moisture Removal System. This systems shall be as per the specification attached with the tender. Contractor to furnish PTR of Online dehydration system supplier before finalization of vendor.
- 5.1.14 Bushing for voltage above 52 kV shall be RIP bushing with composite layer insulator. RIP type bushing shall be provided with tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable. Bushing shall be removable without disturbing the current transformer.
- 5.1.15 The Maximum Limit of value of tan delta shall be 1% for windings, 0.5% for bushings and 0.2 % for oil.
- 5.1.16 All the instruments, meters, etc., used for testing shall be duly calibrated at NABL laboratory and necessary calibration certificate shall be made available during inspection.
- 5.1.17 All transformers shall have WTII/ OTI transducer for interfacing with SCAP/ ECS. Duplicate set of terminals shall be provided for interface with SCAP and ECS. All contacts including "spare contacts" and "contacts for owner's interface" shall be duly wired and terminated upto the terminal block.
- 5.1.18 All signals as per ECS IO List shall be provided for interface with the Electrical control system.
- 5.1.19 All internal wiring inside RTCC Marshalling Box etc. shall be with FRLS insulation.
- 5.1.20 Transformers shall be provided with emergency trip pushbutton station in the transformer bay. Push button station shall have Dual pushbutton with logic to press both for transformer trip.
- 5.1.21 As per Ministry of Environment, Forest and Climate Change (MoEF&CC), Regulation of Polychlorinated Biphenyls Order, 2016, manufacture and import of the Polychlorinated Biphenyls (PCBs) and PCBs containing equipment is banned and hence compliance of same in transformer oil shall be ensured.
- 5.1.22 Contractor to ensure that valid type test certificates for offered design of transformer are available for heat run test, short circuit test and impulse test. The same shall also be furnished for Owner's review/approval during detail engineering. In case the valid type test certificates are not available, contractor shall carryout the type tests without any additional cost and time implication to Owner/EIL. In case of non-availability of short circuit test reports, manufacturer certified comparative statement in line with IEC-60076 part 7 / IS 2026 part 5 shall be furnished.

5.1.23 CONTRACTOR to also ensure the following:

5.1.23.1 TRANSFORMER CORE

Core material type shall be low loss, non-ageing, high permeability PRIME GRADE, CRGO M4 Grade or better. Design of the core shall fulfil the requirements as listed below.

- It shall be perfectly insulated and clamped to minimize noise and vibrations
- Lower thickness material grades shall be used. Prime grade Cold rolled grain oriented M4 grade or better (Hi-B Grain Oriented Steel grades (HG-OS)) shall be used.
- Lap joints for core shall be of Step type.
- Yoke for the core shall be of boltless.
- The derived building factor shall range from 1.05 to 1.15.
- Certified Mill Test Report for core material shall be submitted.

5.1.23.2 DESIGN CRITERIA

Following vendor data shall also be submitted for scrutiny after design finalization post order.

Yoke Lamination, Type of Core Joint, Number of Lamination/ Lay, Overlap length, Angle of Overlap, Gaps at Joint, Operational Flux density, Proportion of corner weight, X0/ R0, X/R, Z variation at $\pm 10\%$ Tap position (@ ONAF) on Maximum, Normal and Minimum Tapping.

5.1.23.3 OVER-EXCITATION TEST REPORTS

Over excitation conditions and test reports for the following level and duration of supply voltage shall be submitted post order for review by Client/ EIL.

- 110% continuous
- 125% for 1 min
- 140% for 5 sec
- 150% for 1 sec.

Over excitation graphs meeting the requirements specified above may also be accepted.

5.1.23.4 CORE LAMINATIONS ASSEMBLY

Core lamination assembly shall be done while taking care of following points

- Shall be done appropriately (preferably using automatic pressure bed) to ensure that no air pockets are trapped within the laminations.
- Stage inspections of material during fabrication of the Laminations shall be carried out to ensure that only Prime material is being used.

5.1.23.5 ACCREDITED LABS

Labs where heat run, loss measurements tests can be carried out shall either be CPRI Bhopal /Bangalore or any other NABL accredited labs under supervision of CPRI.

5.2 DISTRIBUTION TRANSFORMER

- 5.2.1 Maximum rating of distribution transformer shall be limited to 2500kVA however the transformer rating shall be finalized based on load analysis, considering 10% design margin and 20% capacity for future load. Each transformer shall be sized to feed the complete load independently
- 5.2.2 Transformers shall be provided with emergency trip pushbutton station in the transformer bay. Push button station shall have Dual pushbutton with logic to press both for transformer trip.
- 5.2.3 The transformers impedances shall be chosen to suit switchgear fault withstand capabilities and large motor start-up (if any).
- 5.2.4 Distribution transformer rated upto 2500kVA shall comply to latest IS-1180 (Part-1): 2014 and its amendments including but not limited to amendment-4 and latest Gazette of India Order. Accordingly, efficiency of transformer at 50% and 100% load shall be considered with total losses at 50% and 100% loading not exceeding maximum losses values specified in Table-6 of IS-1180 (Part-1) for Energy Efficiency Level-2.
- 5.2.5 The transformer shall bear standard mark of Bureau of Indian Standards in line with Gazette of India. Copy of license obtained from Bureau of Indian Standards in compliance with IS 1180(Part-1) shall be furnished by the contractor along with transformer vendor drawings post order.
- 5.2.6 The overall dimensions of the transformers shall be limited in accordance with 7-51-0337 enclosed with the package.
- 5.2.7 Bucholz relay, OTI & WTI shall be provided with reed type switches in place of mercury switches.

- 5.2.8 Fire fighting system is generally not envisaged for distribution transformers, accordingly, oil quantity for distribution transformer shall be restricted up to 2000 liters. In case, oil quantity is more than 2000 litre, HVWS system shall be provided by contractor.
- 5.2.9 CT for 51G shall be class 5P10 and CT for 64R shall be class PS for all the transformers. Technical details of class PS CT (Vk, Imag and RCT) shall be submitted by contractor for EIL review.
- 5.2.10 All transformers shall have WTI/ OTI transducer for interfacing with ECS.
- 5.2.11 All contacts including “spare contacts” and “contacts for owner’s interface” shall be duly wired and terminated upto the terminal block.
- 5.2.12 Contractor to ensure that valid type test certificates for offered design of transformer are available for heat run test, short circuit test and impulse test. The same shall also be furnished for Owner’s review/approval during detail engineering. In case the valid type test certificates are not available, contractor shall carryout the type tests without any additional cost and time implication to Owner/EIL. In case of non-availability of short circuit test reports, manufacturer certified comparative statement in line with IEC-60076 part 5 / IS 2026 part 5 shall be furnished.
- 5.2.13 Heat run test shall be done on one distribution transformer of each rating, even if type test report for same is available with the vendor. Pressure test and vacuum test shall be done on one transformer tank of each size.
- 5.2.14 All signals as per ECS IO List shall be provided for interface with the Electrical control system.
- 5.2.15 As per Ministry of Environment, Forest and Climate Change (MoEF & CC), Regulation of Polychlorinated Biphenyls Order, 2016, manufacture and import of the Polychlorinated Biphenyls (PCBs) and PCBs containing equipment is banned and hence compliance of same in transformer oil shall be ensured.
- 5.2.16 Transformers with 80% loading shall be equal to Peak Demand (including 10% design margin) & does not include 20% spare capacity for future.

5.3 OUTDOOR SWITCHYARD

- 5.3.1 Contractor shall design the switchyard based on the enclosed single line cum relay & metering diagram. The enclosed 220 kV switchyard layout plan is only indicative and contractor shall design and furnish the switchyard layout plan and various sections meeting the enclosed specifications of switchyard, data sheets, guaranteed particulars, other statutory requirements and the following specific requirements.
- 5.3.2 Total area available for installation of outdoor switchyard along with the substation cum control room is 95m x95m. Substation cum control room shall be located towards east side of this plot area however exact location shall be finalised during detailed engineering in consultation with owner. This shall be used for installation of lightning arrestors, double break, centre rotating motorized isolator with earth switch, outdoor cable termination kits, AAAC/ ACSR conductors/busbars, clamps and connectors, tension, suspensions including those for 220 kV incoming line receiving gantry, outdoor 220kV GIS bays, 220/33kV Power transformers and shall also include the peripheral road required for access and maintenance of various switchyard equipment.
- 5.3.3 Switchyard equipment shall have hot dip galvanized structure and switchyard shall be complete with lighting, welding socket, power socket, lighting and power panels, earthing, lighting protection, high masts/ lighting masts, etc. along with civil/ structural works. Cable trenches/ trays from switchyard to substation and within switchyard and substation is in CONTRACTOR scope. Special tools and tackles, trolley mounted telescopic type aluminium ladders, are also included in scope of CONTRACTOR.
- 5.3.4 Following data shall be considered for designing the switchyard in addition to the requirement of EIL specification for Outdoor Switchyard 6-51-0085:

- 5.3.4.1 Short circuit level: 50kA (3 sec.)
- 5.3.4.2 Busbar/Gantry height (minimum) shall be as per latest edition of CBIP.
- 5.3.4.3 Contractor shall design the switchyard based on the actual calculation for various hardware equipment, however the minimum sizes of various hardware equipment shall be as follows:-
- ACSR conductor: HTLS -AAAC
 - Size of earthing conductor: 75x12mm GI strip or equivalent MS Rod
- Contractor shall note that type of conductor at 220kV outdoor switchyard shall be considered as AAAC-HTLS. Exact size shall be finalized by contractor based on 400MVA power requirement & considering all other parameters/de-rating factors required for sizing. Also necessary co-ordination shall be done by contractor with HVPNL regarding conductor size of upstream circuit transmission line.
- 5.3.4.4 Wherever cables cross roads / rail track, cables shall be taken in ERC/concrete blocks.
- 5.3.5 Outdoor isolators shall be Double break, centre rotating type suitable for electrical and mechanical operation from local or remote. Isolator shall be of M2 class and earthing switch shall be of M0 class. Isolators shall be suitable to carry rated current of 2000 Amps continuously and short circuit current of 50 kA for 3 second.
- 5.3.6 For lightning protection of switchyard suitable lightning masts shall be provided in the Switchyard. The masts may also be used for installation of lighting fixtures for switchyard lighting. Contractor shall make suitable provision for access to the lighting fixtures installed on the lightning mast for maintenance.
- 5.3.7 Operating handles for isolator main box, earth switch and discharge counter of LA shall be at a height of 1500 mm (maximum) from FGL.
- 5.3.8 Solid Core insulators shall be provided for supporting the ACSR Conductors.
- 5.3.9 Suitably supported steel grating shall be provided on the top of oil soak pit to facilitate movement.
- 5.3.10 All control cabinets, junction boxes etc. located in outdoor switchyard area shall have enclosure protection of IP55 (minimum) and shall be provided with additional GI canopy.
- 5.3.11 The drawings enclosed are for contractor's guidance in understanding the scope and type of work and shall form an integral part of the specification. However, it is the responsibility of the contractor to provide safe and reliable system meeting all the requirements stipulated in standards and guidelines issued by electricity boards and Chief Electrical Inspector.
- 5.3.12 For various equipment of the outdoor switchyard refer to the respective datasheets attached with the tender.
- 5.3.13 All around peripheral road of 7m width along with clearance of approx. 9m from road center to gantry support tower center shall be ensured while preparing the switchyard layout.
- 5.3.14 Separate metering room in outdoor switchyard of minimum size 3x4m shall be provided for HVPNL. Final dimension of same shall be as per HVPNL requirement.
- 5.3.15 Tri vector meter to be provided shall have function to measure MWH, MVAH, MVARH, MD, as a minimum. Additional functional & specification requirements and accuracy class shall be as per HVPNL requirements. Approval for make & mode of tri vector meter shall be obtained from HVPNL before placement of order.
- 5.3.16 For Open Access metering purpose, at least one separate dedicated core in the metering CTs in the Incoming line bays to be kept of 0.2S class and One Core of Line VT to be kept of 0.2 class for open access metering. The VA shall have to be selected based on the net burden ensuring 90% loading of CTs and PTs for open access metering purposes. The VA rating shall be decided during detailed engineering stage.

- 5.3.17 Burden of CTs, PTs & CVTs shall be meet the technical specification for respective equipments as issued by HVPNL.
- 5.3.18 Suitable interlocking shall be provided between various Isolators / Circuit Breakers / Earth Switches during close/open operations as per protection philosophy guidelines of HVPNL.
- 5.3.19 Contractor to ensure that valid type test certificates as per IS/ IEC and ITP attached is available with manufacturer for offered design of outdoor switchyard equipment. In case of non-availability of type test certificates same shall be conducted without any cost and time implication to Owner/ EIL.
- 5.3.20 PLCC system with wave traps & 48V DC System for both end shall be procured as part of the new switchyard tender and sending end equipments shall be free issued to HVPNL end contractor. Installation, testing commissioning at the sending end shall be taken care by others.
- 5.3.21 OPGW system including all control panels and other equipment at sending end at HVPNL switchyard shall be taken care of by others.
- 5.3.22 While preparing the layout & procuring equipment for installation in outdoor switchyard, CONTRACTOR to ensure that HVPNL specification are complied with as same shall be required to be mandatorily followed for statutory approval from HVPNL.

5.4 EHV GAS INSULATED BUSDUCT (GIB) FOR 66kV

- 5.4.1 Maximum weight of gas in gas tight section of GIB shall not exceed 250kg.
- 5.4.2 GIS bus ducts of each circuit shall be arranged in preferably horizontal formation and the clearance (outer to outer) between nearest bus ducts of two adjacent circuits shall be minimum one meter.
- 5.4.3 GIB shall be generally in only one horizontal layer. However in exceptional circumstance two horizontal GIB layers can be provided with the approval of owner/EIL and the vertical clearance between layers shall be minimum one meter in such case.
- 5.4.4 The minimum outer to outer horizontal clearance between each GIS bus duct shall be 0.5 meter.
- 5.4.5 The minimum vertical ground clearance of GIB at road crossing shall be 5.5 meters.
- 5.4.6 The horizontal clearance between GIB and GIS building /any other building wall shall be minimum three meters for GIB running parallel to the building/wall.
- 5.4.7 The GIB route inside the GIS Hall shall not obstruct easy access to GIS and control room buildings and shall not obstruct movement of crane, equipment including HV test equipment for maintenance works.
- 5.4.8 The GIB height outside the GIS hall in switchyard area shall not obstruct easy access to GIB, movement of crane for maintenance work.
- 5.4.9 For the maintenance of GIB of one circuit, only that circuit shall be isolated.
- 5.4.10 Contractor shall finalise the make of 66kV GIBD meeting the criteria indicated in attached Experience Record Proforma (ERP), B269-999-16-50-ERP-0021. Completely filled in ERP sheet along with all supporting documents shall be furnished along with bid.

5.5 HV & MV BUSDUCT

- 5.5.1 Bus duct shall be provided for connection between the transformer and switchboards where the board rating is more than 1250A.
- 5.5.2 Note-4 of EDB doc. No. B269-999-16-50-1001 rev-0 (page 39 of 49) stands deleted and is replaced by following:

“Non segregated phase air insulated type MV bus duct shall be provided in place of sandwich type busduct.”

- 5.5.3 Bus-duct layout drawings shall be prepared by the CONTRACTOR based on substation equipment layout and Structural and Architectural drawings of substation and transformer drawings at the time of detail engineering.
- 5.5.4 It is CONTRACTOR's responsibility to close the gap between the bus-duct and the cut-out left for bus-duct routing. Closing of gap shall be done with material suitable for minimum 2 hours fire rating.
- 5.5.5 All other requirements for HV & MV Bus duct shall be as per EIL Specification 6-51-0054 and HV & MV bus duct datasheet attached with the tender.
- 5.5.6 All the offered HV, MV bus duct shall be type tested. CONTRACTOR to ensure at the time of order placement that copies of valid type test certificates for the following tests conducted on identical design of offered bus ducts are available.
- Short time current withstand test
 - Power frequency & lightning impulse voltage withstand capacity
 - Heat run test.
 - Ingress Protection test.
- 5.5.7 CONTRACTOR to conduct heat run test on each rating of MV bus duct at vendor's works as part of scope of this tender and no extra payment for the same shall be provided.
- 5.5.8 The busduct bus bar material shall be same as that used for switchgear busbar. In case different material are provided for busbar of switchboards/transformers and busduct, bimetallic washer/plates shall be provided.
- 5.6 GENERAL REQUIREMENT FOR ALL EHV, HV & MV SWITCHGEAR**
- 5.6.1 Selection, sizing and suitability of all components shall be the CONTRACTOR's responsibility. The equipment as required for safe and satisfactory operation shall be considered included in CONTRACTOR's scope even if not specifically mentioned.
- 5.6.2 Hardware data sheet for feeders include only the major relays, meters and control switches. Any auxiliary relays, timers, switches, etc., as required, while developing the control schematics and for safe operation, even if these are not specifically mentioned, shall be supplied by the CONTRACTOR without any price and time implication. All logic shall be implemented in the relay itself and not externally. Provision of adequate I/O count in the relays shall be ensured.
- 5.6.3 The CONTRACTOR's shall be solely responsible to coordinate the relay characteristics with relay supplier for the proper selection of all CTs with special care to select class PS CTs. The VA burden, knee-point voltage, CT resistance and magnetizing current shall be calculated by the vendor for Owner/ EIL's review before proceeding with manufacturing.
- 5.6.4 Following sizing calculation for Class PS CT's shall be submitted by CONTRACTOR's during drawing review stage.
- Knee point voltage V_k
 - Metrosil
 - Stabilizing resistor.
- 5.6.5 CT ratios/ details, load details, cable sizes, feeder nos., name plate details etc., for all feeders at switchboards shall be finalized at the time of review of vendor drawings which shall be taken care by the CONTRACTOR without any impact on cost and time to Owner.
- 5.6.6 The size of bus-bar from horizontal bus to breaker and breaker to outgoing shall be designed based on breaker rating and not on CT/feeder rating.
- 5.6.7 Relay Setting

- 5.6.7.1 Relay settings for other outgoing feeders in CONTRACTOR's scope shall be undertaken by the CONTRACTOR/ Vendor and CONTRACTOR/ Vendor shall furnish the relay setting chart and relay coordination curves. During drawing review stage, vendor shall furnish numerical relay selection chart showing complete model no. of numerical relay and various functionalities offered meeting all requirements specified in tender.
- 5.6.7.2 Any other data required for relay setting to be done by the CONTRACTOR's shall be provided during engineering stage.
- 5.6.7.3 Design calculations for selection of relay setting and relay parameterization, relay coordination, providing relay-setting table & relay parameterization, etc. for all feeders is included in the CONTRACTOR's scope. Relay parameterization for all relays shall be provided and implemented by vendor.
- 5.6.8 Dummy panels and rear extensions, as required, to avoid fouling with beam/ column, adequacy of space for cable terminations, bus trunking, mounting of relays, meters, control components etc. shall be supplied as required without time & cost implication to owner.
- 5.6.9 Breaker rating as specified in the data sheet is 'in-panel' rating at design ambient. CONTRACTOR may select higher rating of breaker if there is de-rating factor for 'in-panel' rating and due to design ambient. No force cooling shall be accepted
- 5.6.10 Breaker control switches shall be hardwired type. All TNC and Trip Switch shall be lockable type.
- 5.6.11 Spring charging motors shall be suitable for 110V DC supply.
- 5.6.12 All feeders/switchboards shall have provision for LOTO implementation. Photographs of LOTO provision in each type of panels shall be submitted during drawing review for approval.
- 5.6.13 All transformer incipient faults signals shall be wired through interposing contactors in the panel to avoid nuisance tripping.
- 5.6.14 4-Pole MCB shall be considered in all the PT panels. 4th pole contact of the MCB shall be used for blocking under voltage protection function. Bi-stable relays shall be considered in PT panels for multiplication of the contact for under voltage blocking function in each feeder.
- 5.6.15 In Control logics / schemes, contacts of vacuum/ SF6 circuit breaker shall be utilized. In case, same is not available, then Bi-stable relays shall be considered for multiplication of Circuit breaker contacts.
- 5.6.16 Wherever failsafe contact concept is used, it shall use mechanical contacts. In case mechanical contacts cannot be provided, failsafe concept shall not be used.
- 5.6.17 The details of all Instrument transformers comprising their full name plate and connection diagram shall be displayed with stickers at an easily accessible location (In addition to Instrument transformer itself), during normal operation.
- 5.6.18 All the CT & PT connection should be through ring type reliable connection/terminations only.
- 5.6.19 Terminal connectors of all other control terminals shall be screwed type only. Separate terminal block shall be provided for further wiring to ECS/ upstream breaker/ Transformer, etc. for tripping/ interlock/ annunciation, etc.
- 5.6.20 All the NO, NC contacts of breaker, Relay DI/DO, RTD inputs, etc. shall be wired upto terminal block, even if the contacts are not used in the scheme.
- 5.6.21 Terminal multiplication to be done, wherever double control cable termination is done, i.e. only one control cable wire shall be connected to one terminal.
- 5.6.22 Additional 2 set of spare CT and PT terminals shall be provided for tapping CT and PT supply for future purpose in Incomers/ bus couplers/ Line PT and Bus PT of all switchboards.

- 5.6.23 It is required to interface EHV, HV and MV switchgears with the ECS Panel for control, monitoring and annunciation purpose. For ECS Interface, typical ECS IO list is attached.
- 5.6.24 In addition to above, terminals as required for interface with upstream and downstream switchgear needs to be provided to fulfil the operational requirements.
- 5.6.25 Hardware, as required, including selector switches, auxiliary relays, etc. during detail engineering to meet the operation requirement shall be supplied by vendor without any time and cost implication.
- 5.6.26 Vendor to note that the control cables used shall be 2.5 sq. mm. twisted pair shielded cables.
- 5.6.27 All signals as per ECS IO List shall be provided for interface with the Electrical control system.
- 5.6.28 Terminals for DCS & ECS, input & output shall be segregated & separate terminal block shall be provided. While wiring these signals from respective feeder module to marshalling, it shall be ensured that separate cables are used for status & commands & same shall be segregated.
- 5.6.29 Current rating for interface contacts shall be 2A, 220V DC or 240V AC.
- 5.6.30 For the DC Control supply to the various breaker panels in EHV GIS, HV IBPS & 415V Switchboards, there shall be one common control switch for all control supply to the panel. Separate fuses for following branch circuit shall be provided:
- 5.6.30.1 Spring charging circuit
- 5.6.30.2 Closing circuit
- 5.6.30.3 Tripping, contact multiplier & digital input circuit
- 5.6.30.4 Indication circuit
- 5.6.30.5 Each Numerical relay supply (incoming of numerical relay supply fuse shall be tapped before the control supply switch)
- 5.6.31 Separate control supply switch shall be provided for differential protection relays.
- 5.6.32 Bus differential scheme shall have dedicated supply from the same bus section.
- 5.6.33 CT Bypassing relay shall be latched type.
- 5.6.34 Bus differential multiplier relay shall be VAJH type only.
- 5.6.35 Common lock key shall be provided for breakers in place of individual lock key for each breaker.
- 5.6.36 Requirements For Online Temperature Monitoring System For HV & MV Switchboards:
- 5.6.36.1 Online Temperature Monitoring System (OTMS) for HV Switchboards at all critical point mentioned below shall be provided for each switchboard and isolating breaker panels. In each vertical, wireless sensors shall be located as per the following:
- Each horizontal bus bar terminal/tap-off connection in busbar compartment.
 - Each cable /bus duct connection points in cable compartment.
 - One sensor per phase of cable connection points shall be considered irrespective of number of runs of cable.
- 5.6.36.2 Online Temperature Monitoring System (OTMS) for MV Switchboards shall conform to the following: In each vertical panel, sensors shall be located as per the following :
- For MV Switchboard (PCC/PMCC/EPMC) having Air circuit breaker panels:
 - Each horizontal bus bar terminal/tap-off connection in busbar compartment.
 - Each bus duct/cable connection points in cable compartment.

c. One sensor per phase of cable connection points shall be considered irrespective of number of runs of cable

ii. OTMS is not required for MCC, ASB, LDB & ELDB.

5.6.36.3 The temperature sensors installed shall be suitable for wireless, with direct contact to hot point, operating range from -10°C to 125 °C. The accuracy shall be as per the following: $\pm 3^{\circ}\text{C}$ accuracy for 0°C to 80 °C range. $\pm 4^{\circ}\text{C}$ accuracy for full range (-10°C to 0°C and 80°C to 125 °C)

5.6.36.4 The system shall allow at least 1 configurable threshold (alarm).

5.6.36.5 OTMS system shall have the provision to send complete data to SAS/ Owner's ECS for monitoring and investigation. The system shall be online to immediately provide an abnormal temperature alarm (with identification/location of the abnormal temperature) to the owner's operator system.

5.6.36.6 Complete data of OTMS shall be accessible in the SAS (through switchboard level Ethernet switches) & associated SAS Laptop/ HMI. The protocol for communication shall be either IEC 61850 or MODBUS TCP/IP or MODBUS RTU or other open protocol and shall be decided by CONTRACTOR. Accordingly, protocol convertors/gateways at suitable locations as required shall be provided by CONTRACTOR for data integration on IEC 61850 protocol from Master Ethernet switch to Owner's ECS system.

5.6.36.7 Online temperature monitoring data shall be available in both owner's ECS as well as Substation Automation System (SAS). OTMS shall be integrated with owner's ECS.

5.7 220 kV & 66kV GAS INSULATED SWITCHGEAR

5.7.1 220 kV, 2000 Amps, 50 kA (3 Sec) Double Bus Bar GIS Panel & 66kV, 3150A, 40kA (3 Sec) Double Bus Bar GIS Panel shall be as per EIL standard specification 6-51-0066, complete with metering and protection as per datasheet attached with tender. LCC and separate CRP shall be supplied for each bay. Tag number of various equipment shall be as follows:

Tag Number	Item
HV-100101	Outdoor 220kV GIS Isolating Breaker Panel
LCC-100101	Outdoor LCC of 220 kV GIS Isolating Breaker Panel
CRP-100101	Control & Relay Panel of 220kV GIS Isolating Breaker Panel
HV-100102	Outdoor 220kV GIS Isolating Breaker Panel
LCC-100102	Outdoor LCC of 220 kV GIS Isolating Breaker Panel
CRP-100102	Control & Relay Panel of 220kV GIS Isolating Breaker Panel
HV-100103	220kV GIS Switchgear
LCC-100103	LCC of 220kV GIS Switchgear
CRP-100103	Control & Relay Panel of 220kV GIS Switchgear
HV-100111	66kV GIS Switchgear
LCC-100111	LCC of 66kV GIS Switchgear
CRP-100111	Control & Relay Panel of 66kV GIS Switchgear

5.7.2 The equipment shall be designed for operation in applicable seismic zone for earthquake resistance. The seismic loads are due to the horizontal and vertical acceleration which may be assumed to act on concurrently. Seismic Qualification requirements shall be as per IEC

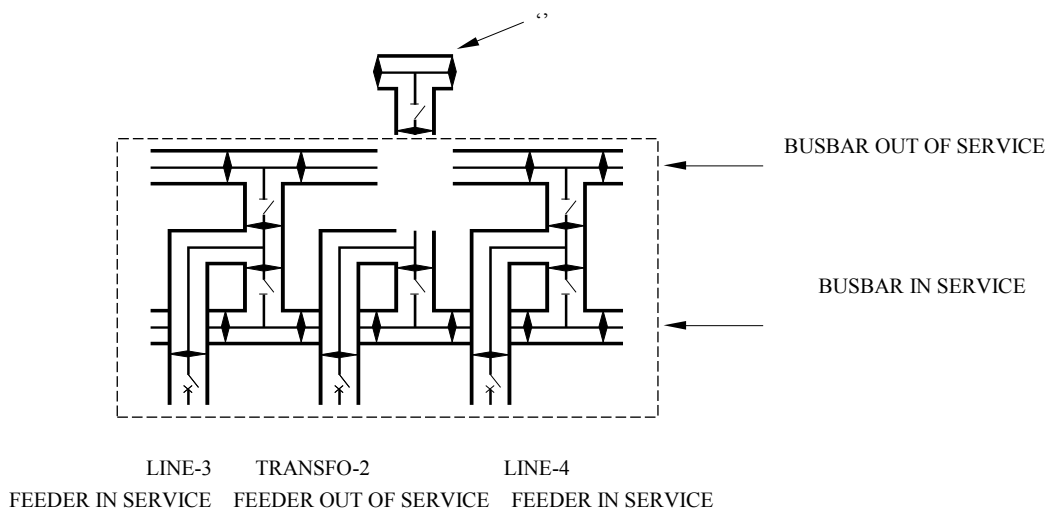
62271-207 for the design of equipment. To prevent the movement of GIS sub-assemblies i.e. various bay modules during the earthquake, suitable devices shall be provided for fixing the sub-assemblies to the foundation. The contractor shall supply necessary bolts for embedding in the concrete foundation. The fixing of GIS sub-assemblies to the foundation shall be designed to withstand the seismic events. It will also be ensured that the special devices as well as bolts shall not be over stressed. The details of the devices used and the calculations for establishing the adequacy shall be furnished by the supplier and shall be subject to Owner's/ EIL approval.

- 5.7.3 For feeder details and power cable termination kits, refer SLD & feeder detail datasheets attached with tender. Sequence/position of various feeder as shown in the SLD is indicative and same shall be finalised during detailed engineering without any cost and time implication to Owner/EIL.
- 5.7.4 The offered GIS equipment and components shall conform to the type tests as per IEC 62271-203. CONTRACTOR to ensure at the time of order placement that copies of valid type test certificates for tests conducted on identical design of offered equipment is available. In case of non-availability of type test certificates, same shall be conducted without any cost and time implication to Owner/ EIL. Validity of type test certificate applicable for 220kV, 66kV GIS switchboard & 66kV GIBD shall be considered as 'Till Design Change'. Type test certificate of parent company is also acceptable subject to meeting the tender & statutory requirement.
- 5.7.5 GIS shall be designed in such a way that transfer from one bus isolator to another bus isolator shall be possible in energised condition without any break in supply to the loads.
- 5.7.6 Redundant relays of different makes for Feeder Differential Relay (87F) or Distance Protection Relay (21) of same make / model as installed in 220kV GIS CRP, for installation in upstream 220 kV HVPNL switchyard sending end feeder relay panel, shall be supplied loose (free issued by contractor) under scope of this tender. Also end termination accessories for termination of Optical fiber cable (fiber cable shall be supplied by others) such as pigtails, patch cords, LIUs etc., shall be supplied under scope of this tender. Testing and commissioning of loose supplied relays is also included in scope of CONTRACTOR.
- 5.7.7 Feeder differential relay (87F) matching with the make/ model as installed in the client's existing upstream 220 kV GIS feeder relay panel shall be supplied under scope of this tender. Testing and commissioning of this relay along with establishing of communication & any other requirement is also included in scope of CONTRACTOR. Make/model of existing relay shall be informed during detailed engineering.
- 5.7.8 Transformer + Feeder differential relay (87T+F) of same make/ model as installed in the GIS CRP for 66 kV outgoing transformer feeder, for installation in client's/other downstream 6.6kV incomer panel shall be supplied loose (free issued by contractor) under scope of this tender. Testing and commissioning of loose supply relay is also included in scope of CONTRACTOR.
- 5.7.9 In addition to the requirements specified in 6-51-0066, following clauses shall also be complied.
- 5.7.9.1 The GIS assembly shall consist of separate modular compartments e.g. Circuit Breaker compartment, Bus bar compartment filled with SF6 gas & separated by gas tight partitions so as to minimize risk to human life, allow ease of maintenance and limits the effects of gas leaks failure and internal arcs, etc. These compartments shall be such that maintenance, repair, extension on one feeder may be performed without de-energising the adjacent feeders. These compartments shall be designed to minimize the risk of damage to adjacent sections and protection of personnel in the event of a failure occurring within the compartments. Rupture diaphragms with suitable deflectors shall be provided to prevent uncontrolled bursting pressures developing within the enclosures under worst operating conditions, thus providing controlled pressure relief in the affected compartment.
- 5.7.9.2 The switchgear shall be of modular design and shall have complete phase segregation for the active components (i.e. Isolators, breakers, earth switch, etc.). The conductors and the live

parts shall be mounted on high grade epoxy resin insulators. These insulators shall be designed to have high structural strength and electrical dielectric properties and shall be free of any voids and free of partial discharge at a voltage recommended by IEC. These shall be shaped so as to provide uniform field distribution and to minimize the effects of particle deposition either from migration of foreign particles within the enclosures or from the by-products of SF6 breakdown under arcing conditions.

- 5.7.9.3 Gas barrier insulators shall be provided so as to divide the GIS into separate compartments. These shall be suitably located in order to minimize disturbance in case of leakage or dismantling. They shall be designed to withstand any internal fault thereby keeping an internal arc inside the faulty compartment. Due to safety requirement for working on this pressurized equipment, whenever the pressure of the adjacent gas compartment is reduced during maintenance, this compartment shall be designed so that it shall remain in service to perform its intended duty. The gas tight barriers shall be clearly marked on the outside of the enclosures.
- 5.7.9.4 The bus enclosure should be sectionalized in a manner that maintenance, repair or extension work on any bus disconnecter (when bus and bus disconnecter are enclosed in a single/ three phase enclosure) can be carried out by isolating and evacuating the small effected section and not the entire bus. The design of 220 kV GIS shall be such that in case a circuit breaker/ any other module of a feeder is removed for maintenance, both bus bars shall remain in service. For achieving the above requirements, adequate mechanical support and number of intermediate gas tight compartments as required, shall be provided to ensure equipment and operating personnel's safety.
- 5.7.9.5 Adequate nos. of gas sectionalizer shall be provided in 220kV GIS & 66kV GIS for ensuring safety, ease of maintenance/repair & lower gas handling requirements during bus faults, regular maintenance/repair activities or extension work

Gas partitions shall be provided in GIS switchboard (220kV & 66kV) as per Fig: F.6 of IEC-62271-203 as a minimum. Typical sketch is as below:



- 5.7.9.6 The material and thickness of the enclosures shall be such as to withstand an internal flash over for a period of 300 mill second at rated short time withstand current.
- 5.7.9.7 Each pressure filled enclosure shall be designed and fabricated to comply with the requirements of the applicable pressure vessel codes to which it is subjected in service (ASME/ CENELEC code for pressure vessel) and based on the design temperature and design pressures as defined in IEC-62271-203.
- 5.7.9.8 The bursting strength of Aluminium castings has to be at least 5 times the design pressure. A bursting pressure test shall be carried out at 5 times the design pressure as a type test on

each type of enclosure. Each enclosure has to be tested as a routine test at 1.5 times the design pressure for one minute.

- 5.7.9.9 The thermal rating of all current carrying parts shall be minimum for three second for the rated symmetrical short-circuit current.
- 5.7.9.10 The ladders and walkways shall be provided wherever necessary for access to the equipment. The enclosure and support structure shall be designed that a person of 1780 mm in height and 80 kg in weight is able to climb on the equipment for maintenance.
- 5.7.9.11 In general the contours of energized metal parts of the GIS and any other accessory shall be such, so as to eliminate areas or points of high electrostatic flux concentrations. The surfaces shall be smooth with no projection or irregularities which may cause visible corona. No corona shall be visible in complete darkness when the equipment is subjected to specified test voltage. There shall be no radio interference from the energized switchgear at rated voltage.
- 5.7.9.12 The GIS shall be designed, so as to take care of the Very Fast Transients (VFT) over voltages generated as a result of pre-strikes and re-strikes during isolator operation. Maximum VFT over voltages peak shall not be higher than rated lightning impulse withstand voltage of the equipment. Necessary measures shall be under taken by GIS manufacturer to restrict maximum VFT over voltages lower than the lightning impulse withstand voltage. Manufacturer shall submit the study report of VFTO generated for GIS installation.
- 5.7.9.13 The enclosure shall be of continuous design and shall meet the requirement as specified in clause no. 10 (special considerations for GIS) of IEEE- 80, Year- 2000. The enclosure shall be sized for carrying induced current equal to the rated current of the Bus. The conductor and the enclosure shall form the concentric pair with effective shielding of the field internal to the enclosure.
- 5.7.9.14 The enclosure shall be designed to practically eliminate the external electromagnetic field and thereby electro-dynamic stresses even under short circuit conditions. The average intensity of electromagnetic field shall not be more than 50 micro –Tesla on the surface of the enclosure. The contractor shall furnish all calculations and documents in support of the above during detailed engineering.
- 5.7.9.15 Alarm circuit shall not respond to faults for momentary conditions. The following indications including those specified elsewhere in the specifications shall be provided in the alarm and indication circuits.

Gas Insulating System

- Loss of Gas Density.
- Loss of Heater power (if required)
- Any other alarm necessary to indicate deterioration of the gas insulating system.

Operating System

- Low operating pressure.
 - Loss of Heater power.
 - Loss of operating power.
 - Loss of control supply.
 - Pole Discordance
- 5.7.9.16 Metallic bellows for permitting the movement during expansion and contraction may be of following types:
- Lateral / Vertical mounting units
 - Axial compensators
 - Parallel compensators
 - Tolerance compensators
 - Vibration compensators

- 5.7.9.17 The contractor shall provide suitable measure to mitigate transient enclosure voltage caused by high frequency currents caused by lightning strikes, operation of surge arrestor, phase to earth fault and discharges between contacts during switching operation. The earthing system shall ensure safe touch & step voltages in all the enclosures.
- 5.7.9.18 In order to ensure the security of personnel, equipotential earth mat shall be provided, where the enclosures and fixed accessories are accessible for the floor and manual operation of apparatus or locking system is located.
- 5.7.9.19 Contractor shall provide adequate number of UHF sensors in the offered GIS for detection of Partial discharge (of 5 pC and above) as per IEC 60270 through Partial Discharge (PD) monitoring system and the number and location of these sensors shall be subject to approval of Owner/ EIL. Further UHF sensors shall necessarily be provided in close proximity to VT compartments.
- 5.7.9.20 However adequacy of number of sensors and their location shall be verified at site by the contractor as per recommendations of CIGRE task force TF 15/33.03.05 (Task force on Partial discharge detection system for GIS: Sensitivity verification for the UHF method and the acoustic method). In case during site testing additional UHF sensors are required, the same shall also be supplied & installed to complete the technical requirement without cost and time implication to purchaser.
- 5.7.9.21 The arrangement of gas sections or compartments shall be such as to facilitate future extension of any make without any drilling, cutting or welding on the existing equipment. To add equipment, it shall not be necessary to move or dislocate the existing switchgear bays. Contractor shall make available during detailed engineering stage, the complete design detail of interface module such as cross section, enclosure material, enclosure dimensions (inner & outer), Flange diameter (inner & outer), conductor connection arrangement, bolt spacing & dimension, rated gas pressure, etc. GIS manufacturer shall furnish all the required details in addition to those mentioned above necessary for design and successful implementation of an interface module during later stage while extending GIS by any other GIS make, without any help of GIS manufacturer who has supplied the GIS equipment in present scope.
- 5.7.9.22 **Refer clause 5.5.4 of 6-51-0066**, Note that metallic bellows shall be provided for lateral and vertical alignment based on calculation.
- 5.7.9.23 **Refer clause 5.6 of 6-51-0066, following shall also be complied**
- The corona rings/ stress shields for the control of electrical field in the vicinity of the isolation gap shall be provided by the GIS manufacturer.
 - The opening for access shall be provided in each phase terminal enclosures as necessary to permit removal of connectors to isolate the XLPE cables to allow carrying out the insulation tests.
 - Type test reports of radio interference voltage (RIV) level shall be submitted for approval
- 5.7.9.24 **Refer clause 5.14.3 (a) and (d) of 6-51-0066**, Note that manual closing and opening of disconnector is not allowed.
- 5.7.9.25 **Refer clause 6.1.1 of 6-51-0066, following shall also be complied**
- The circuit breaker shall be capable of
- Interrupting the steady and transient magnetizing current for transformers upto 150 MVA.
 - Interrupting line/ cable charging current as per IEC without re-strikes and without use of opening resistors. The breaker shall be able to interrupt the rated line charging current as per IEC-62271-100 with test voltage immediately before opening equal to the product of $U/\sqrt{3}$ and 1.4.

- iii. Breaking 25% the rated fault current at twice the rated voltage under phase opposition condition.
- iv. The breaker shall satisfactorily withstand the high stresses imposed on them during fault clearing, load rejection and re-energization of shunt reactor and/or series capacitor compensated lines with trapped charges.
- v. Withstanding all dielectric stresses imposed on it in open condition at lock out pressure continuously (i.e. shall be designed for 2 p.u. across the breaker continuously, for validation of which a power frequency withstand test conducted for a duration of at least 15 minutes is acceptable).
- vi. Circuit breakers shall be able to switch in and out the shunt reactor of rating upto 100 Ampere with maximum rise of overvoltage limited upto 2.3 p.u.
- vii. **Total Break Time** :The total break time shall not be exceeded under any of the following duties :
 - Test duties T10,T30,T60,T100 (with TRV as per IEC- 62271-100)
 - Short line fault L90, L75 (with TRV as per IEC-62271-100)

The total break time of the breaker shall not be exceeded under any duty conditions specified such as with the combined variation of the trip coil voltage (70-110%), pneumatic/ hydraulic pressure and SF6 gas pressure etc. While furnishing the proof for the total break time of complete circuit breaker, the contractor may specifically bring out the effect of non-simultaneity between poles and show how it is covered in the total break time.

The values guaranteed shall be supported with the type test reports.

5.7.9.26 Refer clause 6.1.5 of 6-51-0066, following shall also be complied

- i. Any device provided for voltage grading to damp oscillations or, to prevent re-strike prior to the complete interruption of the circuit or to limit over voltage on closing, shall have a life expectancy comparable of that of the breaker as a whole.
- ii. Provisions shall be made for attaching an operational analyser to record travel, speed and making measurement of operating timings etc. after installation at site. The contractor shall supply three set of transducer for substation covered under the scope.

5.7.9.27 Refer clause 6.1.6 (b) (viii) of 6-51-0066, clause shall be read as

Densimeter contacts and pressure switch contacts shall be suitable for direct use as permissive in closing and tripping circuits. Separate contacts have to be used for each of tripping and closing circuits.

5.7.9.28 Refer clause 6.1.6 (e) of 6-51-0066, following shall also be complied

- i. As long as power is available to the motor, a continuous sequence of the closing and opening operations shall be possible. The motor shall have adequate thermal rating for this duty.
- ii. After failure of power supply to the motor one close open operation shall be possible with the energy contained in the operating mechanism.
- iii. Breaker operation shall be independent of the motor which shall be used solely for compressing the closing spring. Facility for manual charging of the closing spring shall also be provided. The motor rating shall be such that it requires preferably not more than 90 seconds for full charging of the closing spring.

5.7.9.29 Refer clause 6.1.6 (c) of 6-51-0066, following shall also be complied

- i. The hydraulic oil used shall be fully compatible for the temperature range to be encountered during operation.

- ii. The oil pressure switch controlling the oil pump and pressure in the high pressure reservoir shall have adequate no. of spare contacts, for continuous monitoring of low pressure, high pressure etc. at switchyard control room.
- iii. The mechanism shall be suitable for at-least two close open operations after failure of AC supply to the motor starting at pressure equal to the lowest pressure of auto reclose duty plus pressure drop for one close open operation.
- iv. The mechanism shall be capable of operating the circuit breaker correctly and performing the duty cycle specified under all conditions with the pressure of hydraulic operated fluid in the operating mechanism at the lowest permissible pressure before make up.
- v. Trip lockout shall be provided to prevent operations of the circuit breaker below the minimum specified hydraulic pressure. Alarm contacts for loss of Nitrogen shall also be provided.
- vi. All hydraulic joints shall have no oil leakage under the site conditions and joints shall be tested at factory against oil leakage

5.7.9.30 Refer clause 6.2.1 of 6-51-0066, following shall also be complied

- i. The signalling of the closed position of the Disconnecter shall not take place unless it is certain that the movable contacts will reach a position in which the rated normal current, peak withstand current and short-time withstand current can be carried safely.
- ii. The signalling of the open position of the Disconnecter shall not take place unless the movable contacts have reached such a position that the clearance between the contacts is at least 80 percent of the rated isolating distance.
- iii. Continuous current rating of the Safety earthing switch and high speed make proof earthing switches (not less than 100A) shall be specified by the manufacturer, which can be safely injected for Bay/ Bus equipment testing.

5.7.9.31 Refer clause 6.2.4 of 6-51-0066, following shall also be complied

All portions of the earthing switch and operating mechanism required for earthing shall be connected together utilizing flexible copper conductors having a minimum cross-sectional area of 100 sq. mm.

5.7.9.32 Refer clause 6.2.5 of 6-51-0066, following shall also be complied

Earthing switches located at the beginning of the line/ transformer feeder bay modules shall be of the high speed, make proof type and will be used to discharge the respective charging currents, trapped charge in addition to their safety earthing function. These earthing switches shall be capable of interrupting the inductive and capacitive currents and to withstand the associated TRV. These shall conform to class B and electrical endurance class E1 as per annexure – C of IEC: 62271-102

5.7.9.33 Refer clause 6.3 of 6-51-0066, following shall also be complied

- i. Surge arrester for GIS shall be installed within the GIS enclosure. Outdoor type surge arrester are not permitted.
- ii. The contractor shall be fully responsible for complete insulation co-ordination of substation including GIS. Contractor shall carry out detailed studies and design calculations to evolve the required parameters locations, energy capability etc. of surge arrestors such that adequate protective margin is available between peak impulse, surge and power frequency discharge voltages and BIL of the protected equipment. The locations of surge arrestors shown in single line diagram is indicative only. If at some more locations the surge arrestors are required to be provided the same should also be deemed included in the scope of work.

- iii. The contractor shall perform all necessary studies and the report shall detail the limits of all equipment parameters which could affect the insulation co-ordination. The report shall also detail the characteristics of the surge arrester and shall demonstrate that the selected arrester's protective and withstand levels, discharge and coordinating currents and arrester ratings to comply with the requirement of specification.
- iv. The contractor shall also consider in the studies the open circuit breaker condition, fast transients generated by slow operation of disconnecting switches. The study report and design calculations shall be submitted for Owner's approval.
- v. 245 kV class arrester shall be capable of discharging energy equivalent to class 3 of IEC for 245 kV system on two successive operations.
- vi. The reference current of the arresters shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.
- vii. Each arrester shall be fitted with an online continuous resistive leakage current monitoring system. The system shall be provided with an interface to integrate with the substation automation system.

5.7.9.34 **Refer clause 6.4.2 of 6-51-0066**, Note that LCC shall be powder coated.

5.7.9.35 **Refer clause 6.6 of 6-51-0066, following shall also be complied**

- i. Current transformer, characteristics shall be such as to provide satisfactory performance of burdens ranging from 25% to 100% of rated burden over a range of 5% to 120% (or specified rated extended current whichever is higher) of rated current in case of metering CTs and up to the accuracy limit factor/ knee point voltage in case of relaying CTs.
- ii. The instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CTs/reactor are used in the current transformers then all parameters specified shall have to be met treating auxiliary CTs as an integral part of the current transformer. The auxiliary CTs/reactor shall preferably built in construction of the CTs.
- iii. Provisions shall be made for primary injection testing.
- iv. Note that 1.1 kV bushing mentioned in 6.6.4 for taking CT connections to terminal box is not mandatory.

5.7.9.36 **Refer clause 6.7 of 6-51-0066, following shall also be complied**

- i. VT's for GIS shall be installed within the GIS enclosure. Outdoor type VTs are not permitted.
- ii. The supplier shall ensure that there is no risk of Ferro resonance in inductive type voltage transformers, due to the capacitance of the GIS.

5.7.9.37 **Refer clause 6.9.4 of 6-51-0066, following shall also be complied**

For SF6 gas site tests for moisture, air content, flash point and dielectric strength to be done during commissioning of GIS. Gas bottles should be tested for leakage during receipt at site. The contractor shall indicate diagnostic test methods for checking the quality of gas in the various sections during service. The method proposed shall, as a minimum check the moisture content & the percentage of purity of the gas on annual basis. The contractor shall also indicate clearly the precise procedure to be adopted by maintenance personnel for handling equipment that are exposed to the products of arcing in SF6 Gas so as to ensure that they are not affected by possible irritants of the skin and respiratory system. Recommendations shall be submitted for suitable protective clothing, method of disposal of cleaning utensils and other relevant matters. The contractor shall also indicate the details and type of filters used in various gas sections, and should also submit the operating experience with such filters.

5.7.9.38 Refer clause 6.10.2 of 6-51-0066, following shall also be complied

For “Compartments except Circuit Breaker” and for “Circuit Breaker” compartment, SF6 low level shall be used to annunciate the need for urgent gas filling. Zone trip level shall also be provided for circuit breaker compartment.

5.7.9.39 Refer clause 6.10 of 6-51-0066, following shall also be complied

The contractor should furnish temperature v/s pressure curves for each setting of density monitor along with details of the monitoring device.

It shall be possible to test all gas monitoring relays/devices without de-energizing the primary equipment & without reducing pressure in the main section. Plugs & sockets shall be used for test purposes. It shall also damp the pressure pulsation while filling the gas in service, so that flickering of the pressure switch contacts does not take place.

In case gas leakage under specified conditions is found to be greater than 0.5% after one year of commissioning, the manufacturer will give additional warranty for FIVE years.

5.7.10 It is required to interface the GIS switchboards, LCC and CRP with the ECS Panel for control, monitoring and annunciation purpose. For ECS Interface, typical ECS IO list is attached. All the Bus PTs shall have four stages of under-frequency & df/ dt protection and separate contact for each stage shall be provided for ECS interface. In addition to above, terminals as required for interface with upstream and downstream switchgear needs to be provided to fulfil the operational requirements.

5.7.11 For control of GIS switchboards through ECS, One Local/ Remote (L/R) selector switch shall be provided in each individual panel of GIS. Where Local means Operation from panel itself and Remote means ECS.

- When L/ R selector switch is in Local mode, all controls are transferred to GIS switchboard. Following operations shall be possible from the GIS
 - Closing of all incomers and bus coupler breakers in test position only.
 - Closing of all outgoing breakers in test and service position.
 - Tripping of all breakers, irrespective of position of Local/ Remote selector switch.

5.7.12 Manufacturer shall furnish the following information for Owner's/ EIL review

5.7.12.1 Details regarding the loosely distributed metallic particles within the GIS encapsulation and calculations of critical field strength for specific particles of defined mass and geometry.

5.7.12.2 Study report of VFTO generated for GIS installation.

5.7.12.3 The methodology and all the equipment for electrical partial discharge (PD) detection.

5.7.12.4 The calculations and documents in support of the average intensity of electromagnetic field on the surface of the enclosure during detailed engineering.

5.7.12.5 The detailed criteria/ design regarding location of pressure relief devices/rupture diaphragms

5.7.12.6 Calculations to show that there is no Ferro resonance due to capacitance of GIS for the voltage transformers

5.7.12.7 Design calculation for simulated parameters for Seismic level as applicable

5.7.12.8 Insulation Coordination studies including studies to recommend for additional surge arrestor

5.7.12.9 Calculation in support of touch & step voltages in all enclosures and earthing of complete GIS installation.

5.7.12.10 Equipotential earth mat drawings along with design calculations.

5.7.12.11 Measures to mitigate transient enclosure voltage by high frequency currents.

5.7.13 All transport packages containing critical units viz. Circuit breakers and Voltage transformers shall be provided with sufficient number of electronic impact recorders (on returnable basis)

during transportation to measure the magnitude and duration of the impact in all three directions. The acceptance criteria and limits of impact in all three directions which can be withstood by the equipment during transportation and handling shall be submitted by the contractor during detailed engineering. The recording shall commence in the factory and must continue till the units reach site. The data of electronic impact recorders shall be downloaded at site and a soft copy of it shall be handed over to Engineer – in –charge.

5.7.14 Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. Either dry nitrogen/ air or dry SF₆ gas shall be used and the pressure shall be such as to ensure that, allowing for reasonable leakage, it will always be greater than the atmospheric pressure for all variations in ambient temperature and the atmospheric pressure encountered during shipment to site and calculating the pressure to which the sections shall be filled to ensure positive pressure at all times during shipment. The type of gas, the maximum pressure to which sections will be filled prior to shipment and the minimum allowable pressure during shipment shall be advised prior to dispatch. Necessary arrangement shall be ensured by the contractor to take care of pressure drop of dry air or nitrogen during transit and storage till completion of erection.

5.7.15 Following equipments shall be supplied along with GIS (These equipments shall be supplied as Mandatory spare, defined in EDB-1001 & SL-0020 attached with tender/technical amendment)

5.7.15.1 SF₆ Gas leakage detector

The detector shall be portable, battery operated with built in battery charger, hand held type and having a minimum SF₆ gas leakage sensitivity of 5gm/year. The test kit shall be compatible for EMI/EMC environment as per IEC 1000. The equipment shall have on/off switch & suitable indicating lamps/LEDs, variable pitch audible signal for leakage indication, and a head phone jack. The equipment shall have automatic zeroing of background signals suitable for detecting SF₆ gas leakage in charged substation.

5.7.15.2 Gas filling and evacuating cart

- i. This shall include all the necessary gas cylinders for temporarily storing the evacuated SF₆ gas. The capacity of the temporary storage facilities shall be at least be sufficient for storing the maximum quantity of gas that could be removed from at least one phase of one complete Bay (switchgear and associated equipment) or continuous bus section (whichever is higher).
- ii. The minimum capacity of cart will be as under:
 - Vacuum Pump: 60 M³/Hour (Nominal suction pressure)
 - Compressor: 15 M³/Hour (Delivery).

5.7.15.3 SF₆ gas analyser

The SF₆ gas analyser should be of portable type and instruments shall have following features

- i. In-built calibration facility.
- ii. Sensitivity of the equipment shall not be affected by any atmospheric conditions like dust, humidity, heat, wind etc.
- iii. Equipment shall work on zero gas loss principle i.e. gas should be pumped back to the compartment after measurement without any exposure to the atmosphere.
- iv. Equipment shall be supplied with suitable regulator which can be used to connect SF₆ cylinder if required.
- v. Following acidic/impurities products should be detected as per IEC 60480 and IEC 60376
 - SF₆ purity – Range: 0-100% & Accuracy: +/- 0.5 %

- Dew point - Range : -60 to +20 °C & Accuracy: +/- 0.5 °C
- SO₂ - Range : 0-150 ppm & Accuracy : +/- 2 %
- CF₄ – Range : 0-60% volume & Accuracy : +/- 1 %
- HF - Range : 0-200 ppm & Accuracy : +/- 5 %

vi. Instrument should work on AC source as well as on rechargeable battery

vii. Input pressure: upto 10 bar

viii. It should be housed in a robust IP67 case with wheels

5.7.15.4 Online Partial Discharge(PD) monitoring system for both indoor & outdoor GIS

- i. The equipment shall be used for detecting different types of defects in Gas Insulated Stations (GIS) such as Particles, Loose shields and Partial Discharges as well as for detection of Partial discharges in other types of equipment such as Cable Joints, CTs and PTs.
- ii. It shall be capable for measuring PD in charged GIS environment as EHV which shall have bandwidth in order of 100 MHz–2GHz with possibility to select a wide range of intermediate bandwidths for best measurement results. The principle of operation shall be based on UHF principle of detection. The instrument should also be able to detect partial discharges in cable joints and terminations.
- iii. Detection and measurement of PD and bouncing particles shall be displayed on provided HMI for the system and the measurement shall be stored in the PC for further analysis to locate actual source of PD such as free conducting particles, floating components, voids in spacers, particle on spacer surfaces etc. Software for display and diagnosis of PD signals and an expert software system for accurate interpretation of cause of PD shall also be supplied and installed on the provided HMI by the contractor.
- iv. The equipment shall meet the following requirements
 - Measurement shall be possible in noisy environment.
 - Stable reading shall be possible in presence of vibrations within complex GIS assemblies, which can produce signals similar to PD.
 - Equipment should have necessary synchronizing circuits to obtain PD correlation with power cycle and power frequency.
 - The equipment shall be battery operated with built-in-battery charger. It shall also be suitable for 230V AC/ 50 Hz input.
 - Measurement shall be possible in the charged substation/ switchyard in the presence of EMI/EMC. Supplier should have supplied similar detector for GIS application to other utilities. Performance certificate and the list of users shall be furnished for evaluation during detail engineering.
 - Instrument shall be supplied with standard accessories i.e., re-locatable sensors with mounting arrangements, connecting cables (duly screened) to sensors, Laptop PC, diagnostic and expert interpretation software, carrying case, rechargeable battery pack with charger suitable for 230V AC, 50Hz supply connecting cables (duly screened) to view in storage.
- v. The function of software shall be covering the following:
 - Data recording, storage and retrieval in computer
 - Data base analysis
 - Template analysis for easy location of fault inside the GIS
 - Evaluation of PD measurement i.e. Amplitude, Phase Synchronization etc.
 - Evaluation of bouncing/loose particles with flight time and estimation on size of particle.
 - Expert software system for accurate interpretation of cause of PD.
 - Report generation.

- vi. To prove the suitability in charged switchyard condition, practical demonstration shall be conducted before acceptance.
- vii. Necessary training may be accorded to personnel to make use of the kit for locating PD sources inside the GIS
- viii. Calibration: The UHF Couplers have to be first calibrated as per CIGRE procedure TF 15/330305 as part of factory acceptance tests to guarantee detection sensitivity of 5pC or better. The GIS of same design shall be used as test specimen during the coupler calibration. The pulse injection level determined through above factory calibration tests shall only be used as reference for site sensitivity checks during commissioning of PDM system. The data sheet/ frequency response characteristics shall be submitted for reference.
- ix. Pulse generator for UHF sensor sensitivity test shall also be supplied as a standard accessory.

5.7.15.5 SF6 topping system.

SF6 topping system shall be provided for 220 kV GIS for filling/ topping up SF6 gas to panel under energized condition manually.

- 5.7.16 DC Control supply change over scheme for the EHV GIS shall be as per hardware datasheet B269-999-16-50-0119 attached with the tender document.
- 5.7.17 Contractor shall finalise the make of 66kV GIS switchboard meeting the criteria indicated in attached Experience Record Proforma (ERP), B269-999-16-50-ERP-0020. Completely filled in ERP sheet along with all supporting documents shall be furnished along with bid.
- 5.7.18 At all 220kV & 66kV feeders (incomer & outgoing) including spares, local breaker back up protection (LBB) shall be considered. Control logic shall be prepared accordingly.
- 5.7.19 Regarding the busbar differential protection envisaged in 220kV GIS & 66kV GIS, contractor shall note the following:
 - a. Redundant & completely independent scheme shall be provided for main & check zone low impedance distributed differential protection with complete redundancy at both central as well as feeder CT input level for each of the main & check zone protection scheme. Redundancy of bus differential scheme to be ensured with two independent sets central unit each having independent main & check zone protection along with dedicated independent CT input modules for each feeder.
 - b. Bus differential scheme shall have dedicated power supply from same bus section.

5.8 HV ISOLATING BREAKER PANELS

- 5.8.1 33 kV, 1600Amps, 40kA (3Sec) indoor GIS Isolating Breaker Panel (2 nos.) shall be as per EIL standard specification, 6-51-0065. 6.6 kV, 800 Amps, 40 kA (1 Sec) AIS Isolating Breaker Panel (1 no.) shall be as per EIL standard specification 6-51-0001. The switchboard shall be complete with metering, protection & control facility as per data sheet attached with tender. 33kV IBP shall have separate panel for incoming and outgoing cables. Tag number of various equipment shall be as follows.

Tag Number	Item	Hardware Datasheet
HV-63161	33 kV, 1600Amps, 40kA (3Sec) Isolating Breaker Panel	B269-999-16-50-0073
HV-63162	33 kV, 1600Amps, 40kA (3Sec) Isolating Breaker Panel	B269-999-16-50-0073

HV-100211	6.6 kV, 800 Amps, 40 kA (1 Sec) Isolating Breaker Panel	B269-999-16-50-0074
HV-100212	6.6 kV, 800 Amps, 40 kA (1 Sec) Isolating Breaker Panel	B269-999-16-50-0074

- 5.8.2 The switchgear shall be qualified as classification IAC for rated fault current for 0.2 sec. for both 33kV and 6.6kV, according to IEC 62271-200 with regard to its mechanical strength in the event of an internal arc. The test performance shall be in conformity with accessibility type AFLR. The test shall be executed for all separate compartments within the functional unit containing HV equipment, i.e., bus-bar compartment, circuit breaker compartment and cable compartment.
- 5.8.2.1 In case contractor has considered pressure relief flap/gas duct above switchboard for release of gases due to internal arc, suitable absorbers in the switchboard shall be provided to prevent the release of harmful gases in the switchgear hall. Alternatively duct including all accessories/supporting arrangement/sealing material/bends/ installation material etc. shall be provided for taking the gas outside of substation to a safe location.. . Substation equipment layout shall be furnished during detailed engineering stage by contractor indicating duct location. This requirement is applicable for 6.6kV switchboard & all isolating breaker panels (6.6kV & 33kV).
- 5.8.3 Vendor to note that all HV switchboards shall have Loss of service continuity category as LSC2B with partition class PM as per IEC-62271-200.
- 5.8.4 Separate earthing carriage/ truck shall be supplied for the IBPs. One set of earthing truck for incoming and outgoing cable side earthing shall be provided for IBPs. Two numbers of Lifting trucks and accessories (if applicable) shall be provided for IBPs for withdrawal of cassette mounted circuit breakers.
- 5.8.5 The validity requirements for the type test reports for HV switchboards , breakers etc. shall be as below :-

S. No	Type Test	Equipment	Validity
1	Short Circuit Withstand Capacity	Panel	Up to 5 years from the final bid opening date or design change which is earlier
2	Temperature Rise	Panel and breaker	Up to 5 years from the final bid opening date or design change which is earlier
3	Impulse and power frequency withstand	Panel	Till any design change
4	Internal Arc Fault	Panel	Till any design change
5	Degree of protection for panels	Panel	Till any design change
6	Breaker short circuit duty cycle test	Breaker	Till any design change

- 5.8.6 In case the valid type tests on the offered design of Equipment is not available, all type tests shall be conducted by the successful vendor on the offered design after order finalization without any extra cost and delivery impact
- 5.8.7 Surge arrestor shall be provided at both incoming and outgoing of Isolating Breaker Panels. Sizing calculation of surge arrestors shall be furnished during drawing review stage.
- 5.8.8 IBPs shall be with single tier circuit breaker arrangement and shall be provided with Online temperature monitoring system.
- 5.8.9 IBPs outgoing and incoming cabling compartment shall be provided with unique castle key rear door interlock such that breaker gets tripped/ does not gets closed, if rear door (through

rear door limit switch) of that IBP is opened. In addition to that IBP rear door shall be interlocked with upstream switchboard breaker off contact, so that it shall not be possible to open the rear door, until upstream switchboard breaker is off. Rear door can be opened only when the breaker is switched off and racked out

- 5.8.10 Electrical interlock shall be provided for rear door of IBPs. Further, a mechanical interlock such as a trapped key interlock mechanism that does not permit opening of back cover until cable side earthing of outgoing breakers has been done.
- 5.8.11 Pressure relief ducts above switchboard for release of gases due to internal arc duct shall be considered as per manufacturer's recommendation and type tested design. In case pressure relief ducts are terminated inside switchgear hall, these shall be directed away/ upwards from person standing in the vicinity and shall be provided with absorber at both ends.
- 5.8.12 In each VCB panel, vendor shall ensure that two separate shutters have been provided, one for bus-side and one for cable side.
- 5.8.13 Vendor to note that an indication that defines 'ON', 'OFF', and 'in service position' shall be provided at the back side of all Isolating Breaker panel. Further, additionally, R-, Y-, B- Phase healthy indication shall also be provided.
- 5.8.14 Incoming and outgoing power cables to and from isolating breaker panels shall be as follows:
 - **For 6.6kV IBP** : 1 Run 3C x 300 Sq.mm. 6.6 kV (UE), XLPE Insulated, Armoured, and FRLS Aluminium Cables separately for incoming from upstream feeder and to downstream 6.6/0.433kV distribution transformer.
 - **For 33kV IBP**: 4 Run 1C x 630 Sq.mm./phase 33 kV (U), XLPE Insulated, Armoured, and FRLS Copper Cables separately for incoming from upstream 220/33kV power transformer and to downstream plant feeder.
- 5.8.15 The 6.6kV IBP will receive power from upstream 6.6 kV switchboard. Receiving end 87F relay for both the IBPs shall be also free issued to CONTRACTOR as part of this tender. Testing and commissioning of the receiving end relays is also included in CONTRACTOR scope. Optical fiber cable along with HDPE duct (Green conduit with white strip) shall be provided by others, however end termination of OFC including all accessories for receiving end shall be in the scope of this tender.
- 5.8.16 The 33kV IBP will receive power from step down power transformer and shall fed to downstream switchboard installed in client's PNCP Plant. Receiving end 87F relay for both the IBPs to be installed in downstream 33kV switchboard shall be also supplied by CONTRACTOR as part of this tender. Testing and commissioning of the receiving end relays is also included in CONTRACTOR scope. Optical fiber cable along with HDPE duct (Green conduit with white strip) and end termination of OFC including all accessories for receiving end shall be provided by others.

5.9 HV SWITCHBOARD

- 5.9.1 All requirements shall be considered while sizing the switchboards and feeders, as required, including feeder for free-issues material based on final approved single line diagram, shall be provided with no cost and time implication to owner. 20% spare capacity shall be considered for sizing of Switchboard.
- 5.9.2 HV Switchboard shall be provided with two incomers and two bus coupler. Second bus coupler shall be without any kind of numerical relay and shall be provided with Electro-mechanical type Trip circuit supervision relay. Status of second bus coupler shall be used in interlock of Auto changeover logic, which shall be implemented in the first bus coupler with numerical relay. There shall not be any feeder in between two bus couplers.
- 5.9.3 All HV Switchgear shall be provided with online wireless temperature monitoring facility. The passive sensor should be wireless, battery less, dielectrically safe, robust to high voltage, high

electromagnetic field, and harsh environment. It should take direct measurement on critical point. This facility shall be interfaced with ECS.

- 5.9.4 All feeders of HV Switchboard shall be provided with thermography window at rear side.
- 5.9.5 Transformer + Feeder differential relay (87T+F) of same make/ model as installed in the Upstream 66kV Switchboard at SS-100 shall be free-issued to CONTRACTOR for installation and wiring in 6.6kV Switchboard incomer panels. Testing and commissioning of loose supply relay is included in scope of CONTRACTOR.
- 5.9.6 CONTRACTOR shall supply (loose supply) Feeder differential relay (87F) of same make/ model as installed in the 2 Nos. 6.6kV Outgoing plant feeder for Owner's use for installation and wiring in downstream 6.6kV Switchboard incomer panels. Installation, Testing and commissioning of loose supply relays shall be done by others.
- 5.9.7 Auto changeover between incomers and bus coupler for 6.6 kV system shall be provided. Additionally manual change over through synchro-check relay with momentary paralleling shall also be provided. All necessary hardware shall be included to achieve auto, independent and manual operation of incomers and bus coupler.
- 5.9.8 Only major relays, meters and controls are indicated in the hardware data sheets. 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 by the CONTRACTOR. All logic shall be implemented in the relay itself and not externally. Provision of adequate I/O count in the relays shall be ensured.
- 5.9.9 All relays, metering and control components shall be mounted on the panel front only. Dummy panel and rear extension, as required, for bus trunking / cable terminations shall be provided.
- 5.9.10 Microprocessor based Fast bus transfer system shall be provided between Incomer-1, bus coupler-1 and incomer-2.
- 5.9.11 Auto/Manual Changeover with fast bus transfer scheme for switchboard with two incomers and one bus-coupler breakers shall comply with the logic described briefly as follows. Safety interlocks as deemed necessary shall however be considered during detailed engineering.

Auto/Manual Fast Bus Transfer

The auto/ manual fast bus transfer scheme is described in brief as follows:

Facility to be provided

- a) Auto fast bus changeover between the two incomers and one bus-coupler shall be in such a way that two incomer breakers are 'ON' at a time and bus-coupler breaker is normally open.
- b) Bus-coupler breaker is made 'ON' automatically in case the incoming supply at incomer breaker no. 1 or 2 fails in following modes:
 - i. Fast Transfer
 - ii. Delayed In phase transfer
 - iii. Residual voltage transfer (slow changeovers)
- c) Interlocks shall be continuously checked not limited to the following
 - i. Transfer system healthiness
 - ii. Breaker in service
 - iii. Breaker status & breaker contact integrity
 - iv. Master trip relay lockout condition (86)
 - v. Breaker coil healthiness and breaker configuration
 - vi. PT in service and PT MCB condition
 - vii. Other source voltage healthiness

- d) Blocking of auto transfer (i.e., closing of bus-coupler) if any incomer breaker trips due to a fault.
- e) Tripping of incomer on under voltage shall be blocked, if both the incomers simultaneously experience an under voltage.
- f) The auto-change over shall be blocked during load shedding.

Normal operating condition

Incomer no. 1 and 2 breakers are 'ON'. Bus-coupler breaker is 'OFF'.

Fast Transfer

The bus voltage and incoming source voltage shall be monitored on a continuous basis for magnitude and phase angle and it shall be ensured that the same are within the specified limit values at the moment of initiation to ensure that transfer operation is carried out under conditions conducive to fast bus transfer as per high speed sync-check supervision. The open and close commands to the circuit breaker from the high speed transfer device shall be issued synchronously.

In-Phase Transfer

If the synchronized conditions are not present the fast transfer shall be blocked. The supply breaker feeding to the bus opened and the bus-coupler is closed in the first minimum of the difference of healthy and bus bar voltage. The transfer system is able to determine the course of the difference voltage and the point in time of the 1st phase coincidence (first slip cycle synchronization). In order to compensate for the installation specific processing time like system response time, circuit breaker opening time etc. the close command is issued accordingly before the actual first minimum difference voltage occurs.

Residual voltage transfer

When the criteria for a fast transfer operation are not met and in phase transfer is not feasible, the closing of breaker in fast transfer and in phase transfer is not possible, the residual voltage transfer shall be utilized. The closing of the bus coupler shall take place when the voltage of the bus bar has subsided to a preset, permissible safe value (20-30% of rated voltage).

Manual transfer

- a) It is possible to trip incomer no. 1 or 2 after closing the bus-coupler to facilitate maintenance as required.
- b) When supply is again available at incomer breaker after auto changeover has already taken place, it is possible to restore the system to normal operating condition by operating selector switch (meant for tripping incomer no. 1 or 2 or bus-coupler) and by setting auto/manual switch in 'Manual' mode.
- c) In manual transfer the closing circuit shall be checked through contacts of check synchronizing function during momentary paralleling.
- d) In manual transfer after momentary paralleling if desired breaker does not trip after preset time delay, breaker last closed shall trip.

Independent mode

In addition to the transfer modes, all the incomer and bus-coupler breaker shall be desired to operate independently (ON-OFF operation) on independent mode for dead bus charging & other maintenance requirement of switchboard. Paralleling of sources shall not be permitted in this mode.

Auto-Manual-independent (A-I-M) selector switch shall be provided in the switchboard for selection of different modes for operation.

Number of binary and analog inputs / outputs shall be adequate for the required system configuration.

FBT (Fast bus transfer) RELAY shall be physically located in Bus coupler panel or in any panel placed in the panel line-up only. All signal interchange between FBT relay & other panels shall be through inter-panel wiring only.

- 5.9.12 CT and PT burden mentioned in data sheets are indicative. CONTRACTOR shall provide the same as required including the burden for transducers provided at transducer panel. CONTRACTOR may consider 1.5 VA per phase per transducer for CT burden and 1.5 VA per phase per transducer for PT burden for analogue input for ECS interface.
- 5.9.13 DC and AC control supply scheme for HV switchboards shall be in line with hardware data sheet attached for HV switchboards.
- 5.9.14 All HV motor feeders schematics shall have provision for auto start and auto re-acceleration with feature to inhibit irrespective of process/licensor's requirement.
- 5.9.15 All HV switchboards shall have provision for positive LOTO implementation. Photographs of LOTO provision in each type of panels shall be submitted during drawing review for approval.
- 5.9.16 All requirements as specified above including ECS interface, shall be applicable for switchboard. Line PT and protection & metering requirements shall be as per Design data sheets and 6.6 kV hardware data sheets as applicable.
- 5.9.17 For interfacing with DCS system, separate Standalone Marshalling panel shall be provided in Substation. Hardwired signals (with minimum requirement specified below) from various feeders of a bus section required for DCS interface shall be wired and terminated in the standalone marshalling panel.
 - i) Breaker/Contactor 'ON' indication
 - ii) Breaker/Contactor 'OFF' indication
 - iii) Local/Remote selection indication
 - iv) Process Trip indication
 - v) Process Start command
 - vi) Process Stop command
 - vii) Process Start permissive command
 - viii) Ammeter (0-1A/4-20mA)
 - ix) Ready to Start signal from feeder
- 5.9.18 Terminals for DCS input & DCS output shall be segregated & separate terminal block shall be provided. While wiring these signals from respective feeder module to marshalling, it shall be ensured that separate cables are used for status & commands & same shall be segregated.
- 5.9.19 Current rating for interface contacts shall be 2A, 110V DC.
- 5.9.20 All the signals available in Numerical relays shall be made available in Laptop & HMI through serial communication.
- 5.9.21 All signals as per ECS data sheet shall be provided for interface with the Electrical control system.
- 5.9.22 Number of analogue / digital IOs shall be worked out by the CONTRACTOR as per the ECS I/Os list attached with the bid package
- 5.9.23 All trip contact should be preferably "NO" contact. Separate NO contact of each such trip should be routed to relay also for event logging or redundant tripping.
- 5.9.24 All the CT connection should be through ring type reliable connection/terminations only.

- 5.9.25 There shall be one common control supply switch for all control supply of feeder. Separate fuses for following branch circuit shall be provided:
- Spring charging circuit
 - Closing circuit
 - Tripping circuit and contactor multiplier circuit & digital input circuit
 - Indication circuit
 - Numerical relay supply (incoming of numerical relay supply fuse shall be tapped before the "control supply switch").
- 5.9.26 Separate control supply switch shall be provided for differential protection relays.
- 5.9.27 Control supply of each BUS PT of HV switchboard shall have independent control supply switch and sets of fuses tapped from Main DC bus.
- 5.9.28 Installation of surge arrestors to be done after the CTs towards cable termination side.
- 5.9.29 Hard contacts of the breaker shall be used for providing interlocks in the schemes mainly for auto change over, tripping, feedback, closing and process interlocks. In the absence of sufficient hard contacts, latched contactors/ relays to be used for contact multiplication.
- 5.9.30 Critical contacts used for providing process interlocks should be direct hard contacts and these shall not be taken from the multiplying contactors / auxiliary relays, if feasible.
- 5.9.31 Wherever two NO contacts available in Emergency push button & LCS STOP PB of all breaker fed HV Motors, one NO contact shall be wired to trip breaker directly & other shall be wired to binary input of numerical motor protection relay.
- 5.9.32 All rear panel doors of HV panels shall have handle for ease of maintenance.
- 5.9.33 The validity requirements for the type test reports for HV switchboards , breakers etc. shall be as below :-

S. No	Type Test	Equipment	Validity
7	Short Circuit Withstand Capacity	Panel	Up to 5 years from the final bid opening date or design change which is earlier
8	Temperature Rise	Panel and breaker	Up to 5 years from the final bid opening date or design change which is earlier
9	Impulse and power frequency withstand	Panel	Till any design change
10	Internal Arc Fault	Panel	Till any design change
11	Degree of protection for panels	Panel	Till any design change
12	Breaker short circuit duty cycle test	Breaker	Till any design change

In case the valid type tests on the offered design of Equipment is not available, all type tests shall be conducted by the successful vendor on the offered design after order finalization without any extra cost and delivery impact.

- 5.9.34 Contractor shall furnish details of type test certificate in attached format for Type test certificates Doc no. B269-999-16-50-DS-1030 during detailed engineering for review.

5.10 NEUTRAL GROUNDING RESISTOR

- 5.10.1 Neutral grounding resistor shall be supplied as per the EIL specification, 6-51-0043 & attached data sheet.

5.11 EHV CABLE (66KV)

- 5.11.1 66kV cable shall be supplied as per the EIL specification, 6-51-0067 & attached data sheet. Bonding scheme & associated hardware, jointing kit, termination kit, earthing cable etc. as required shall be decided & supplied by contractor.
- 5.11.2 Termination of owner's supplied & laid 66kV cable at outgoing terminal of 66kV GIS switchboard at MRSS-100 is included in contractor's scope. Accordingly, termination kit shall be supplied & commissioned by contractor.
- 5.11.3 Supply, laying & termination of 66kV cable on primary side of 66/6.9kV transformer to be supplied by contractor is included in contractor's scope.

5.12 HV CAPACITOR BANK

- 5.12.1 HV Capacitor shall be as per the enclosed HV capacitor datasheet and EIL standard specification 6-51-0020 attached with the tender.
- 5.12.2 Capacitor banks along with APFCR shall be indoor panel mounted type, installed in switchgear hall. Dry type series reactor, RVT installed inside panel shall be provided with the capacitor banks.
- 5.12.3 Capacitor bank and associated equipment shall be sized to maintain min. 0.95 power factor at the primary of 66/6.9kV transformers.

5.13 MV SWITCHBOARD

- 5.13.1 Refer enclosed hardware data sheets for the details of relay and metering facilities to be provided for each feeder. Only major relays, meters and controls are indicated in the data sheets. 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 by the contractor. All relays, metering and control components shall be mounted on the panel front only. All logic shall be implemented in the relay itself and not externally. Adequate I/O count shall be ensured.
- 5.13.2 The Contractor shall be solely responsible to coordinate the relay characteristics with relay supplier for the proper selection of all CTs with special care to select class PS CTs. The VA burden, knee-point voltage, CT resistance and magnetizing current shall be calculated by the contractor for Owner/ Consultant's review before proceeding with manufacturing.
- 5.13.3 Dummy panels and rear extensions, as required, for cable terminations, mounting of relays, meters, control components etc. shall be supplied as required and dummy/adopter panel for beam shall be considered for as per site requirements. Rear cable chamber provided for the switchboard shall be of height similar to other vertical panels.
- 5.13.4 All MV switchboards in contractor scope shall be of the same make.
- 5.13.5 Limiting maximum rating of PMCC/EP MCC shall be 4000A and fault level limited to 65kA for 1 sec.
- 5.13.6 The rating of MCC & ASB shall be limited to maximum 1250A.
- 5.13.7 All Incomers, Bus couplers and ACB power/motor feeders in MV Switchgear (PCC/PMCC/EP MCC) shall be provided with online wireless temperature monitoring facility. The passive sensor should be wireless, battery less, dielectrically safe, robust to high voltage, high electromagnetic field, and harsh environment. It should take direct measurement on critical point. This facility shall be interfaced with ECS.
- 5.13.8 For PCC/PMCC/EP MCC internal arc protection system shall be provided to sense internal arc and to isolate the fault.
- 5.13.9 For MV Switchboards rated up to 4000A, forced cooling for any of the components e.g. bus bars, air circuit breakers etc. is not acceptable. To achieve the continuous current rating under

site conditions at design ambient temperature inside the panel / cubicle, the required de-rating as / if applicable shall be considered by switchboard vendor.

- 5.13.10 MV switchboards shall be provided with facility to conduct test & disconnected operations with door closed position only.
- 5.13.11 All switchboards shall be provided with two incomer and one bus coupler. However, PMCC shall have third incomer for integrating solar photovoltaic system. No. of outgoing feeders shall be decided based on system requirement, spare feeders and feeders for Owner's use as defined elsewhere. However, feeders, as required, based on final approved single line diagram, shall be provided with no cost and time implication to owner. 20% spare outgoing feeder or minimum one of each type, whichever is higher shall be provided in each switchboard.
- 5.13.12 Air circuit breaker/Isolator provided in incomers of PMCC /EPMCC /MCC /ASB /LDB /ELDB shall be of 4-pole type. Isolating links shall be provided in the neutral circuit of all the TPN outgoing feeders
- 5.13.13 All the switchgears shall have rating at least equal to the maximum demand plus a provision for 10% future load growth and 20% spare capacity (i.e. Max. Demand x 1.1 x 1.2). Incomers of switchgear shall be designed to cater to the complete load including 10% margin for future load growth and 20% spare capacity as specified above. Service breaking capacities for all breakers shall be equal to or higher than the maximum value of the short circuit at the point of installation.

5.13.14 Changeover scheme for three incomers and one bus-coupler

PMCC shall be provided with Auto/ Manual Changeover facility. Auto/Manual Changeover scheme for switchboard with two incomers and one bus-coupler breakers shall comply with the logic described briefly as follows. Third Incomer of PMCC (i.e. Incomer from Solar PV system) shall be connected to the bus having emergency supply. Safety interlocks as deemed necessary shall however be considered during detailed engineering.

5.13.14.1 Auto Changeover

- i) Auto changeover between the two incomers and one bus-coupler shall be in such a way that the two-incomer breakers are 'ON' at a time and bus-coupler breaker is normally open.
- ii) Bus-coupler breaker is made 'ON' automatically in case the incoming supply at either of the incomer breaker fails and the respective breaker trips on under voltage.
- iii) Blocking of auto transfer (i.e., closing of bus-coupler) if any incomer breaker trips due to a fault or in case of standby earth fault (51G). Trip due to 64R, 63TX shall allow the transfer.
- iv) Tripping of incomer on under voltage shall be blocked, if both the incomers simultaneously experience an under voltage.

5.13.14.2 Manual Changeover

- i) Both the Incomer breakers are 'ON'. Bus-coupler breaker is 'OFF' Manual closing of bus-coupler with momentary paralleling (interlocked with check synchronizing relay) of the incoming supplies to facilitate taking out any of the incomer breakers for maintenance.
- ii) Trip any of the incomer breakers (pre-selected) after closing of any of the Incomer or coupler to avoid continuous paralleling of incomers.

5.13.14.3 Initiation of auto changeover:

- i) When the incoming supply to any of the breakers fails, the respective incomer is tripped through under voltage relays and a timer. The time delay is in the range of 0.5

to 5 sec. Breaker trip on under voltage is blocked in case of power failure on both the incomers.

- ii) The voltage on healthy bus section has been above the set value of normal voltage for a specified duration (settable through an off delay timer of range 0.5 to 5 sec) and the incomer breaker of healthy bus is closed in service position.
- iii) Bus-coupler is open and in-service position.
- iv) Auto / Manual switch is set for 'AUTO' operation.

5.13.14.4 Closing of bus coupler breaker under auto operation:

- i) One of the incomer breakers has tripped on under voltage.
- ii) The residual voltage on the bus that has lost supply is less than 40% of normal voltage.
- iii) Incoming voltage of healthy incomer has been above 80% of normal voltage for a specific duration (Through timer 0.5 sec to 5.0 sec)
- iv) Auto/ Manual switch is set for 'AUTO' operation.

5.13.14.5 Manual transfer after auto changeover:

- i) When supply is again available at incomer breaker after auto changeover has already taken place, it is possible to restore the system to normal operating condition by operating selector switch (meant for tripping incomer no. 1 or 2 or bus-coupler) and by setting auto/ manual switch in 'Manual' mode.
- ii) In manual transfer the closing circuit shall be interlocked through check synchronizing relay.

5.13.15 For interfacing with OWNER system, separate Standalone Marshalling panel shall be provided in Substation. Hardwired signals (with minimum requirement specified below) from various feeders required for ECS / DCS interface shall be wired and terminated in the standalone marshalling panel.

- i) Breaker/Contactor 'ON' indication
- ii) Breaker/Contactor 'OFF' indication
- iii) Local/Remote selection indication
- iv) Process Trip indication
- v) Process Start command
- vi) Process Stop command
- vii) Process Start permissive command
- viii) Ammeter (0-1A/4-20mA)
- ix) Ready to Start signal from feeder

5.13.16 Number of analogue / digital IOs shall be worked out by the Contractor as per the ECS I/Os list attached with the tender.

5.13.17 Terminals for DCS& ECS, input & output shall be segregated & separate terminal block shall be provided. While wiring these signals from respective feeder module to marshalling, it shall be ensured that separate cables are used for status & commands & same shall be segregated

5.13.18 Current rating for interface contacts shall be 2A, 110V DC or 240V AC.

5.13.19 Indicating lamps shall employ LEDs. LEDs provided for indication shall be cluster type with adequate brightness and minimum 2Nos LEDs chips per light. LEDs shall be connected in parallel and each LED chip having diameter not less than 3mm.

- 5.13.20 All feeders shall have physical lock out provision to facilitate the “lock out tag out” (LOTO) procedure for ensuring safe operation
- 5.13.21 Two numbers ACB breaker handling trolleys shall be provided for the substation.
- 5.13.22 Earth fault relay operated through CBCT provided in PMCC & LDB feeders shall be mounted on draw-out part of the switchboard and shall be suitable for operation at 110V DC or 240V AC supply as available in the respective switchboard.
- 5.13.23 Timer provided in LDB shall be astronomical type smart timer i.e. to take care of weather condition & shall be programmable for full year.
- 5.13.24 For motor feeder rated up to 55kW, following shall be provided :
- R-C circuit shall be provided across the power contactor for all DOL motor starter feeders in PMCC.
 - Low burden auxiliary contactors shall be provided in all DOL motor starter feeders for receiving start/ stop commands from field.
- 5.13.25 All trip contact should be preferably “NO” contact. Separate NO contact of each such trip should be routed to relay also for event logging or redundant tripping.
- 5.13.26 All the CT connection should be through ring type reliable connection/terminations only.
- 5.13.27 There shall be one common control supply switch for all control supply of feeder. Separate fuses for following branch circuit shall be provided:
- Spring charging circuit
 - Closing circuit
 - Tripping circuit, contactor multiplier circuit & digital input circuit
 - Indication circuit
 - Numerical relay supply (incoming of numerical relay supply fuse shall be tapped before the “control supply switch”).
- 5.13.28 Separate control supply switch shall be provided for differential protection relays.
- 5.13.29 Control supply of each BUS PT of PCC/EPCC/PMCC/EPMCC shall have independent control supply switch and sets of fuses tapped from Main DC bus.
- 5.13.30 Hard contacts of the breaker shall be used for providing interlocks in the schemes mainly for auto change over, tripping, feedback, closing and process interlocks. In the absence of sufficient hard contacts, latched contactors/ relays to be used for contact multiplication.
- 5.13.31 Critical contacts used for providing process interlocks should be direct hard contacts and these shall not be taken from the multiplying contactors / auxiliary relays, if feasible.
- 5.13.32 Wherever two NO contacts available in Emergency push button & LCS STOP PB of all breaker fed MV Motors, one NO contact shall be wired to trip breaker directly & other shall be wired to binary input of numeric motor protection relay.
- 5.13.33 All rear panel doors of MV panels shall have handle for ease of maintenance
- 5.13.34 Rear cable chamber provided for the switchboard shall be of height similar to other vertical panels and shall have handle for ease of maintenance.
- 5.13.35 All the offered switchboards and breakers shall be type tested. Copies of valid type test certificates for the following tests conducted on identical design of offered equipments required as per data sheets attached with tender specifications shall be furnished post order. The validity requirements for the type test reports for MV switchboards , breakers etc. shall be as below :-

S. No	Type Test	Equipment	Validity
1	Short Circuit Withstand Capacity	Panel and breaker	Up to 5 years from the final bid opening date or design change which is earlier
2	Temperature Rise	Panel and breaker	Up to 5 years from the final bid opening date or design change which is earlier
3	Internal Arc Fault	Panel	Till any design change
4	Degree of protection for panels	Panel	Till any design change
5	Breaker short circuit duty cycle test	Breaker	Till any design change

5.13.36 CONTRACTOR to conduct heat run test on each rating of MV switchboard at vendor's works as part of scope of this tender and no extra payment for the same shall be provided.

5.13.37 For owner supplied items, feeders at 415 V shall be provided by the CONTRACTOR in the PMCC switchboard supplied by them. Number of feeders required for Owner's use are listed below.

S. No.	Description	PMCC	EPMCC	LDB	ELDB	Total Load*
1.	FVNR 30	4	2			PMCC- 60KVA EPMCC – 30KVA
2.	FVNR 100	3	2			PMCC- 125KVA EPMCC – 90KVA
3.	O/G Breaker Feeder with Numerical Relay – 800 Amps	3	6			PMCC-800KVA EPMCC-1200kVA
4.	SFU – 63 Amps with CBCT and ELR, Contactor	4	2			PMCC- 200KVA EPMCC- 100KVA
5.	SFU – 160 Amps with CBCT and ELR, Contactor	3	2			PMCC- 100kVA EPMCC- 100KVA
6.	SFU – 1 x 160 Amps + 4 x 63 Amps with CBCT and ELR, Contactor & timer			2 + 2 (Indoor+ Outdoor)	2 + 2 (Indoor+ Outdoor)	LDB- 25KVA ELDB- 10KVA

* Total Load of 1310 KVA of owner's load shall be considered in Normal distribution transformer sizing. Total load of 1530KVA of Owner's load shall be considered by Contractor for emergency distribution transformer sizing.

5.14 RELAY AND CONTROL PANEL

5.14.1 Relay and control panel shall be as per EIL specification for Relay and control panels/desks, single line diagram and data sheets.

- 5.14.2 Panel shall be free standing, floor mounting, simplex panel with swing frame and protective full glass door in front.
- 5.14.3 Relay and Control panel shall be fed from separate dedicated 415V AC supply feeders, from Auxiliary switch board.
- 5.14.4 Closing and tripping coil of each breaker shall have a dedicated DC feeder.
- 5.14.5 The measuring instruments for Import/ Export purpose shall be taut-band type.
- 5.14.6 The captions to be engraved for various feeders / annunciators shall be finalised during detail engineering. Same shall meet the technical specification of C&R Panels as per HVPNL.
- 5.14.7 Semaphore indicator shall be used for isolator and earth switch, while for breakers, Discrepancy switches shall be used.
- 5.14.8 Testing facility for meters and relays shall be provided. For this purpose, necessary test blocks and test plugs shall be provided.
- 5.14.9 A digital clock suitable for DC supply shall be provided in a suitable position on the complete relay panel assembly.
- 5.14.10 Requirement of ICTs, stabilizing resistance and metrosil shall be decided by the contractor. Calculations to be furnished. For transformer feeders, stabilizing resistor shall be provided in residual earth fault connections to avoid spurious tripping during charging of transformer.
- 5.14.11 Synchronizing panel shall be provided as part of Relay and control panel. Synchronizing facility shall be provided to carry out the synchronizing for the 220 kV & 66kV GIS Incomers, Bus couplers, Bus-sectionalizer and tie breakers. Synchronization shall be from ECS as well as from this panel. Following operations shall be possible from Synchronization panel:
 - 5.14.11.1 Closing of all incomer breakers, bus couplers, bus Sectionalizer breakers, tie breakers (in service position) on dead bus condition (bus coupler/ bus sectionalising breakers dead bus closing to be checked on either side of the breaker).
 - 5.14.11.2 Synchronizing and closing of selected incomer breakers (in service position) and bus couplers/ bus sectionalising breakers/tie breaker (in service position) through check synchronizing.
 - 5.14.11.3 Required interlocks for safe operation shall be provided.
- 5.14.12 All signals as per ECS data sheet shall be provided for interface with the Electrical control system.
- 5.14.13 Number of analogue / digital IOs shall be worked out by the Contractor as per the ECS I/Os list attached with the bid package
- 5.14.14 Power quality meter, disturbance recorder & event logger, Main and back up distance relay, fibre optic transmission system for voice and data communication, cyber security requirements, etc. shall be complied as per requirement of CEA guidelines for grid connectivity and CEA guidelines for communication system. Specific requirement of HVPNL for power quality meters and other equipment listed above shall also be complied by the CONTRACTOR.
- 5.14.15 CONTRACTOR to note that relays, meters and other instruments used in HVPNL feeders shall be as per HVPNL specifications & requirements.
- 5.15 NUMERICAL RELAYS AND SUBSTATION AUTOMATION SYSTEM**
 - 5.15.1 Numerical relays shall be used in 220 kV GIS, 66k kV GIS, 33 kV, 6.6 kV and 415 V switchgear.
 - 5.15.2 All numerical relays shall be digital (microprocessor based) & communicable type as per EIL Standard Specification 6-51-0055 and datasheet for Numerical relay attached with tender.

- 5.15.3 All relays to the extent possible shall be sourced from same make. All the numerical relays of each switchboard shall be suitable for communication on IEC-61850 protocol and shall be connected serially/LAN topology to Ethernet Switches.
- 5.15.4 All protective relays and meters shall be provided with test terminal blocks for secondary injection testing.
- 5.15.5 All numerical relays shall comply with the prevalent emission and immunity levels.
- 5.15.6 All relays, metering and control components shall be mounted on the panel front only. All panels, relays and components shall be suitable for use in corrosive, humid, sulphurous environment. All relays shall be suitable for flush mounting, and fitted with dust-tight covers. The relay shall have a provision for testing using an external power supply without disconnecting the permanent wiring.
- 5.15.7 Hardwired lockout relay (86), Hand reset (VAJH) type shall be provided. PQ8 relay is not acceptable.
- 5.15.8 Distance Relay (21), Differential relays (87), restricted E/F (64R) relay as asked for in the data sheet shall be separate relay and shall not be combined with the main protection relay.
- 5.15.9 As per technical specification of CR Panel with SAS of HVPNL, distance protection schemes on each 220 kV incoming line feeder C&R panel shall be of different make in view of fact that both the distance protection scheme (Main-I & Main-II) should have different measuring techniques.
- 5.15.10 Feeder overload alarm scheme is also to be provided for incoming 220kV lines. The feeder overload alarm relay in built with numerical distance protection relay or over current and earth fault protection relay is acceptable provided it meets HVPNL requirements.
- 5.15.11 The requirement of numerical relays and integration shall be in compliance with the requirement given in attached data sheet, and specification. Even though data sheets define the requirement in terms of discreet relays (electromechanical type) but numerical relay comprising all required functions shall be provided. Under voltage and Overvoltage relay along with associated timers shall be part of the numerical relay.
- 5.15.12 Numerical relays provided for motor feeders shall use in-built under voltage relay and timer for delayed tripping on bus under voltage.
- 5.15.13 Minimum 4 nos. inputs (DI) and 4 nos. outputs (DO) as spare shall be provided in each numerical relay.
- 5.15.14 Provision of manual bypass of 87B shall be provided in Numerical relays
- 5.15.15 Relay logic shall be ensured to not provide trip in case of DC failure & restoration
- 5.15.16 Scheme of switchboard shall be engineered to achieve the control logic, as required, through relay logic.
- 5.15.17 All relays shall be integrated to ECS for monitoring and control. Provision shall be provided for monitoring & control at HMI also. The relays shall be integrated based on basic system architecture attached with the tender.
- 5.15.18 Conformal coating shall be done for all electronic equipments as per grade 3C3 (Harsh environment) of IEC 60721-3-3. Alternatively, it shall comply with ANSI/ ISA S71.04 class G3 or IEC 60068-2-60 for mixed flow gas test or ASTM B845. Certification for batch of supplied items shall be submitted by vendor for the same.
- 5.15.19 All relays shall have communication port for direct access of data through laptop. One laptop common for all relays shall be provided for the following purposes:
- 5.15.19.1 Retrieving data from numerical relays.
- 5.15.19.2 Uploading settings & I/O configuration.

5.15.19.3 Retrieving & viewing disturbance recorder data

- 5.15.20 The Numerical relays shall be provided with suitable hardware, software and communication ports for communication with minimum three different client sources simultaneously.
- 5.15.21 The redundancy in communication hardware shall be provided as per the data sheet attached. In ring topology, the communication shall have no disruption due to loop open circuit or failure of communication port. Also the switch off of DC supply to any or more relay should not affect the communication to rest of the relay. Moreover the ring should not be shared between the switchboards. For LAN where star couplers are used, the communication from star coupler to Ethernet switches shall be dual redundant. Relays of different switchboard should not be connected to the same star coupler. Similar to ring architecture, the failure of one star coupler or failure of communication port or processor should not affect the communication of other star coupler to Ethernet switches.
- 5.15.22 **Refer Specification for Numerical Relays (Doc no. 6-51-0055)**, 20% spare ports shall be provided in each Ethernet switch provided in switchboard and in SAS.
- 5.15.23 All the data as available in the relay including the status of DI should be considered to be communicated to HMI. The data required for final configuration shall be finalized during engineering. Similarly whether specified or not, serial interface shall have no limitation for data transfer to ECS. However data as required for ECS interface shall be decided during engineering.
- 5.15.24 GPS antenna and hardware shall be provided for time synchronization. The resolution of time synchronization shall be ± 1 millisecond or better throughout the entire system. Suitable ports shall be provided in the GPS for hook up of Owner's switchboard numerical relays for future use.
- 5.15.25 Substation Automation System for switchgears shall be provided. It shall include Ethernet switches, laptop, HMI (Engineering cum operator workstation) and software to be installed for interfacing with Numerical relays over IEC-61850. Following substation automation system shall be in the scope of contractor.

SAS Tag Number	For Equipment	Remarks
SAS-100921	220 kV GIS	
SAS-100922	66 kV GIS	
SAS-100923	6.6 kV IBP and 415V Switchboard	Separate Ethernet Switch in each IBP and MV switchboards shall be provided
SAS-100924	220kV IBP, 33kV GIS, 415V, DC, AC UPS	For new gantry substation
Existing	220 kV GIS Extension Bays	Extension of existing system for incorporation new bays to be done.
Existing	33 kV IBPs	Extension of existing system for incorporation new bays to be done.

- 5.15.26 Redundant upper level Ethernet switch shall be provided for each SAS system in wall mounted cabinet.
- 5.15.27 Supply, laying and termination of all interconnecting cables from switch boards to Ethernet switches including cable termination kits and accessories in each substation is in CONTRACTOR's scope. FO cable for connection between switchgear and Ethernet switch shall be supplied and laid in HDPE duct (HDPE ducts shall be black conduit with blue strip for Relay LAN) which is also to be supplied and installed by CONTRACTOR.

- 5.15.28 DC System, UPS etc. shall be interfaced with SAS (Substation Automation System) on MODBUS TCP/IP.
- 5.15.29 Two Laptops are envisaged for the EHV, HV & MV switchboards in the project hence software as required for interface with Numerical relays of EHV switchboard and HV/MV switchboard shall be loaded by the switchboard Vendors in the Laptop provided. Following Laptops shall be in the scope of contractor.
- 5.15.29.1 Laptop for 220 kV GIS & 66kV GIS switchboards. Software if required for interface with GIS SF6 Analyser, PD Monitoring system, etc. shall be loaded in the Laptop provided
- 5.15.29.2 Laptop for 33 kV IBP, 6.6 kV IBP and 415V Switchboards. Software required for interface with Numerical relays of 33 kV, 6.6 kV & 415V switchboards shall be loaded in the Laptop provided.
- 5.15.30 Laptop with Windows-10 or latest tested & compatible windows version and other required licensed software, hardware, accessories (serial data cables, VGA Cables, HDMI Cables, and USB Cables etc.) and materials shall be supplied as defined in the tender. The communication port on laptop shall match as that provided on the front of numerical relay. System configuration shall be latest proven model and upgradable. The minimum configuration for this project shall be Intel i7 processor, 1 TB HDD, 4 GB RAM, DVD R/W Multi Drive, 15" LED screen, 4 nos. USB Ports (minimum), Ethernet Port, RS-232 Serial Ports, HDMI Port, etc. Further, laptop shall have compatible ports and compatible hardware for interfacing with transformer gas analysis, GIS SG6 analyser, PD Monitoring, etc. systems.
- 5.15.31 Laptop provided with SAS shall have functionalities specified under clause 6.4.1, 6.4.5 and 6.4.6 of 6-51-0055 attached with tender.
- 5.15.32 HMI with Windows-10 or latest tested & compatible windows version and other required licensed software, hardware, accessories (serial data cables, VGA Cables, HDMI Cables, and USB Cables etc.) and materials shall be supplied as defined in the tender. System configuration shall be latest proven model and upgradable. The minimum configuration for this project shall be Intel i7 processor, 1 TB HDD, 4 GB RAM, DVD R/W Multi Drive, 21" LED screen, 4 nos. USB Ports (minimum), Ethernet Port, RS-232 Serial Ports, HDMI Port, etc.
- 5.15.33 Laser printer shall be provided configured for line by line printing
- 5.15.34 Software for substation automation along with integrating hardware as required shall be supplied as a part of Laptop. Functionality minimum but not limited to the following shall be carried out. Customized software for substation application shall be supplied in non-returnable CD/DVD/USB Drive. Contractor to submit function design specification and screenshots of the various screen for Owner's review.
- Relay parameterization
 - Control
 - Disturbance record
 - Data logging
 - Annunciation
 - Event/ status monitoring (including DI& DO of relays)
 - Feeder status monitoring
 - Event recording, motor starting transients, fault analysis etc.
 - Analogue signal monitoring and metering
 - Self-supervision
 - Single Line Diagram
 - View of historical data and generating trends
 - Preparation of maintenance schedule
- 5.15.35 HMI shall be provided for disturbance recorder and power quality analyzer. The Power quality meter shall share the recorded data with the electricity regulatory commission. Power quality meters shall have facility to measure and meter the harmonics complying with provision of IEC

61000-3-4 Class A. In addition to harmonics, power quality meter shall have provision to monitor voltage sag, swell, flicker, disruptions, etc. Facility for waveform analysis shall also be provided.

5.15.36 For communication with HVPNL, Fiber optic transmission system shall be provided as per HVPNL requirement. All components e.g. FODP, Multiplexer (of both type, SDH & PDH), Digital protection coupler, media converters, connecting cables, equipment for SCADA interface, gateway for protocol conversion to IEC 104 protocol and components required for firewall, as per HVPNL specification shall be provided by CONTRACTOR and approval has to be taken on system architecture and equipment specifications/ datasheet from HVPNL before placing any order.

5.15.37 **FACTORY ACCEPTANCE TEST**

FAT shall be conducted for project simulation. FAT procedure shall be prepared and submitted for Owner's review. The methodology shall be mutually agreed to verify the system simulation and intended specification of tender document. All graphics and navigation between different pages shall be configured to Owner's satisfaction and successful commissioning.

5.15.38 **SITE ACCEPTANCE TEST**

SAT shall be conduct to verify the actual simulation and shall be verified for required functionality and the scan time. Any modification as required to meet the tender document requirement and customization modification due to Owner's site engineer in charge shall be carried out with no commercial implication.

5.15.39 For system architecture, refer system architecture drawing attached with tender.

5.16 **DC SYSTEM**

5.16.1 The DC system shall be as per EIL standard specification 6-51-0019 and DC System datasheet attached with tender. Battery shall be Medium Discharge type. Minimum temperature for battery sizing shall be 5°C.

5.16.2 DC system configuration shall be as per sketch attached with the Design Basis.

5.16.3 110V DC system complete with Ni - Cd battery bank, battery charger & DCDB supplied for Switchgear protection and control shall be provided with 2 x 50% battery banks.

5.16.4 220V DC system complete with Ni - Cd battery bank, battery charger & DCDB supplied for critical lighting shall be provided with 2 x 50% battery banks.

5.16.5 25% spare capacity shall be considered while sizing the battery and battery charger. 20% spare feeders of each type and rating shall be provided in DCDB.

5.16.6 3 Pole switch shall be provided for battery isolation purpose. Battery Isolator shall not be located inside battery room.

5.16.7 Battery charger shall be SMPS based.

5.16.8 DC Earth fault monitoring relay shall be provided on the battery charger.

5.16.9 DCDB shall be provided with voltmeter & selector switches which have facility to check DC positive to negative, positive to earth & negative to earth voltage. Annunciation for same shall be provided and indicated to ECS also

5.16.10 Busbar to be provided on TOP in DCDB.

5.16.11 ECS Interface for each DC System shall be provided as per ECS I/O list.

5.16.12 Battery charger output interlocking system shall not be MCCB based.

5.16.13 All inter-cell & inter row links shall be of copper with lead coating. Aluminium links are not acceptable.

- 5.16.14 Online battery bank monitoring system shall be provided for 110V DC System battery banks. Provision for individual cell temperature, cell voltage & cell impedance shall be monitored and common alarm shall be provided for each category. Battery monitoring system shall have connectivity with ECS system and remote alarm facilities.
- 5.16.15 For the following loads, completely independent redundant feeders from different bus sections of the DCDB shall be provided to the respective loads :
- 5.16.15.1 220kV GIS / CRP
- 5.16.15.2 66kV GIS / CRP
- 5.16.15.3 415V PCC/PMCC
- 5.16.15.4 Substation Automation System Panels
- 5.16.15.5 Nitrogen Injection Fire Protection System panel
- 5.16.15.6 Isolators for outdoor switchyard
- 5.16.15.7 Any other equipment based on reliability point of view & client requirement.
- 5.16.16 Specification for online cell booster shall be as under
1. Mains Voltage : 415V, +/-10%, 3phase
 2. Efficiency : > 90%
 3. Mains frequency : 50Hz
 4. Max. Battery voltage can be charged : 24V
 5. Charging current (max.) : 200A
 6. Characteristics : Constant Current and Constant Voltage to be followed while charging
 7. Battery capacity : 20AH to 1000AH
 8. Chargeable cells : Ni-Cd / 1-16 cells
 9. Enclosure Protection : IP21
 10. Weight : should be portable (weight less than 25 kg)
 11. Ripple Content : 0.5% (max)
 12. Protection : a) output Short Circuit
b) Output polarity reversal protection
c) cell over charging
d) output Over Load
e) Voltage free output clamp
 13. Maintenance : Maintenance Free
 14. Setting Parameter : it shall having facility of setting
a) Type of Batteries/ charging characteristic
b) Battery capacity
c) No. Of battery cells
 15. Display Parameter : LCD display indicating following
a) Charging voltage
b) Charging Current
c) Input AH (AH charged)
d) Status of charged

- e) Fault indication (error code)
16. CE Marking : This unit meets the essential requirements of the low voltage & electromagnetic compatibility directives
17. Other Features : a) It shall be based on latest microprocessor controlled high frequency switching technology.
b) It shall act following function:
i) AS A SICK CELL CHARGER: For ON LINE charging. No need to isolate the cell.
ii) AS A BATTERY CHARGER: To charge any voltage of the battery 2V to 48V (selectable)
iii) AS A RECONDITIONER: for reconditioning of VRLA cells to keep cells in a fully charged condition till they are installed.
iv) AS A TESTING EQUIPMENT: For type testing, bulk testing or acceptance testing of a cell or a Battery. While charging, AH capacity fed to the cell or a battery shall be continuously monitored and recorded.

- 5.16.17 Battery charger for DC System shall be installed in Air-Conditioned area but it shall be suitable for operation in non-air-conditioned area also. Battery backup time shall be 120 minutes for both DC system.
- 5.16.18 Both DC system shall be kept in Substation switchgear hall. Ni-Cd Batteries for DC system shall be installed in a separate battery room. Both the DC system shall be of same make.
- 5.16.19 Diode droppers for battery charger shall be provided to limit the load voltage to nominal voltage.
- 5.16.20 Battery stand shall be in Double row double tier execution.
- 5.16.21 All cable glands and lugs are in scope of vendor.
- 5.16.22 Current feedback of each battery bank shall be provided to both the rectifiers so that in case of failure of one rectifier, another rectifier can control/ regulate the charging current of both battery banks.
- 5.16.23 The height of DCDB panel shall be same as that of battery charger.
- 5.16.24 Clearance between gland plates to terminating point shall be minimum 300mm in all the electrical equipment
- 5.16.25 Each of battery banks is to be located in a common battery room. CONTRACTOR to furnish number of air changes required to make the battery room safe i.e. non-hazardous. CONTRACTOR to furnish the proposed layout of battery rack in battery room maintaining 750 mm minimum clearance on all sides of battery rack.
- 5.16.26 All electrical equipment installed in battery room must be flameproof type suitable for gas group IIC.
- 5.16.27 DISCHARGE DUTY REQUIREMENTS FOR OWNER'S LOAD:
Load as per below mentioned table shall be considered for Owner's switchgear control supply and critical lighting in respective DC system to be located in Main GIS Substation MRSS-100 in P25 area.

DC System	Nominal DC voltage	Duty cycle		
		First 1 min.	Next 58 min.	Last 1 min.
DC System for switchgear control	110V	60 Amps	40 Amps	50 Amps
DC System for Critical Lighting	110V	15 Amps	15 Amps	15 Amps

5.16.28 FEEDER REQUIREMENTS FOR DCDBs:

DC System	Rating of each outgoing feeders	Number of Outgoing feeders
DC System for switchgear control	Upto 63 Amps	10 Feeders
DC System for Critical Lighting	Upto 32 Amps	6 Feeders

This feeder requirement is over and above the requirement of feeders for items free issued by owner and does not include any spare feeders. Same to be located in Main GIS Substation in P25 area.

5.16.29 Following clause-wise modifications / additions to standard specifications shall be applicable on Specification for Battery Charger (EIL Spec. 6-51-0019):

5.16.29.1 Note-2 on Page 13 & 14 of specification

Addition: "Battery isolator (MCCB/Switch Fuse) shall be provided with three pole version to ensure positive isolation of all the three connections of battery".

5.16.29.2 Cl. no. 5.2.1.8 Battery Charger:

Addition : "Perforated sheet/Wire Mesh shall not be provided at the bottom of the charger as over a period of time these gets corroded / damaged resulting in easy access of vermin's. Heat transfer system inside the charger shall be designed considering this aspect"

5.16.29.3 Cl. no. 5.2.2.7 Printed Circuit Board :

Addition: "Battery charger PCB electronic cards shall have conformal coating as per grade 3C3 (harsh environment) of IEC 60721-3-3 and certification for batch of supplied items shall be submitted by vendor for the same.

5.16.29.4 Cl. no. 5.3.1 Construction of Chargers / Distribution Board

Modification: "Each Battery Charger and DC distribution board shall be housed in a separate free standing cubicle with minimum IP-41 degree of protection, with common items for charger-1 & 2 housed in a separate vertical panel....."

5.17 UPS SYSTEM

- 5.17.1 UPS system shall be as per EIL Specification 6-51-0017 and UPS system datasheet attached with the tender.
- 5.17.2 UPS system configuration shall be Double Parallel redundant with Individual bypass as per sketch attached with the Design Basis. Bypass shall have static or servo controlled voltage stabilizer.
- 5.17.3 230V AC UPS system complete with 2x 100% Ni - Cd battery bank & ACDB shall be provided for Control supply of Thyristor Control Panel, VFD, ECS, LAN system etc.
- 5.17.4 20% spare capacity shall be considered while sizing the battery and UPS. 20% spare feeders of each type and rating shall be provided in ACDB.

- 5.17.5 3 Pole switch shall be provided for battery isolation purpose. Battery Isolator shall not be located inside battery room.
- 5.17.6 UPS system shall be provided with additional separate earth bus for earthing of Isolation transformer. This earth bus shall be separate from earth bus provided for body earthing.
- 5.17.7 Online battery bank monitoring system shall be provided for 110V AC UPS System battery banks. Provision for individual cell temperature, cell voltage & cell impedance shall be monitored and common alarm shall be provided for each category. Battery monitoring system shall have connectivity with ECS system and remote alarm facilities.
- 5.17.8 ECS Interface for each UPS System shall be provided as per ECS I/O list.
- 5.17.9 Outgoing feeders with isolation transformer shall be provided with HRC type switch fuse on primary side and semi-conducting type fuse along with switch on secondary side. Outgoing feeders without isolation transformer shall be provided with semi-conducting type fuse.
- 5.17.10 Wherever, isolation transformers are required to be earthed to maintain output voltage in grounded condition, earth bus shall have punched holes for earthing of isolation transformers.
- 5.17.11 DC to DC convertor between UPS charger and battery bank is not acceptable i.e. battery bank float voltage shall be equal to charger float voltage.
- 5.17.12 All inter-cell & inter row links shall be of copper with lead coating. Aluminum links are not acceptable.
- 5.17.13 Disturbance recorder shall have at least two analogue channels with sampling rate of 1ms or better for monitoring of both UPS output at one place. Disturbance recorder shall have minimum features:
- Capacity to record at least 5 disturbances of 3 second each -
 - Disturbances shall triggered based on settable under voltage level. -
 - Option of settable pre - & post time
 - Shall have facility to take the data to laptop through USB/ suitable communication port.
 - Disturbance should be stored in "first in first out" mode without any manual intervention.
- 5.17.14 Busbar to be provided on TOP in ACDB.
- 5.17.15 Specification for online cell booster shall be as specified in 5.16.16.
- 5.17.16 For the following loads, completely independent redundant feeders from different bus sections of the ACDB shall be provided to the respective loads :
- 5.17.16.1 LAN System Racks
- 5.17.16.2 Substation Automation System Panels
- 5.17.16.3 ECS System Panels
- 5.17.16.4 Any other equipment based on reliability point of view & client requirement.
- 5.17.17 FEEDER REQUIREMENTS FOR UPS ACDB:

UPS System	Rating of each outgoing feeders	Number of Outgoing feeders
For ECS System	Upto 5kVA	10 Feeders
For EPABX	Upto 500VA	4 Nos.

This feeder requirement is over and above the requirement of feeders for items free issued by owner and does not include any spare feeders. Same to be located in Main GIS Substation MRSS-100 in P25 area.

5.18 FIRE DETECTION AND ALARM SYSTEM

- 5.18.1 Fire alarm system shall be engineered in line with the specifications attached with the bid document for all areas within battery limit including buildings.
- 5.18.2 Fire Alarm devices (i.e. DGFAP, detectors, MCP, hooters, HAB, exit sign, input module/control module) shall be supplied by Owner as free issue items (FIM) and quantities of same are as mentioned elsewhere in the tender. In case quantity required by CONTRACTOR is more than the indicated FIM, contractor shall supply the additional quantity without any time & cost implication. The make of these additional equipment/devices shall be of identical make, type & model no. as that of the free-issued equipment/devices.
- 5.18.3 Fire alarm system as required for unit/area including buildings within package battery limit shall be engineered by CONTRACTOR. CONTRACTOR will prepare the fire alarm layout for the building. Owner will free issue the FA devices as per the final approved layout within the limits as mentioned elsewhere in the tender.
- 5.18.4 Installation of all Free Issued Materials for Fire Alarm System and cabling including supply & laying of cables up to DGFAP for all field equipment in line with approved calculations shall be done by contractor. Installation shall be carried out as per installation details/ instruction details/ precautions provided by FA system manufacturer, approved Fire Alarm layouts, specification attached, approved sizing calculations and block diagram.
- 5.18.5 Interface cabling with air-conditioning system, NIFPS, HVWS and other systems shall be provided by contractor as applicable.
- 5.18.6 Testing and commissioning, of the Owner supplied fire alarm system will be done by others (Fire Alarm Vendor). However, contractor shall extend all necessary help and manpower to Fire Alarm vendor for executing works such as cable connection, disconnection and reconnection, detector removal, re-installation required during testing and commissioning of the system.
- 5.18.7 FAJB (Metallic), as required shall be in scope of CONTRACTOR. Fire alarm cabling inside building shall be done using armoured cables. Unarmoured cable will be used as a special case in concealed conduits only subject to Owner's approval.
- 5.18.8 Tinned copper cable lugs for termination of 1.5 sq.mm. multi stranded fire alarm cables in all indoor and outdoor equipments including panels, detectors, BGU, hooters, relay modules, exit signs, JB's, etc. shall be considered by CONTRACTOR. Cable glands with PVC shrouds for all indoor and outdoor equipments including panels, detectors, BGU, hooters, relay modules, exit signs, JB's, etc. shall also be considered by the CONTRACTOR.
- 5.18.9 All hardware used for installation and cable tags shall be of SS 304 grade.
- 5.18.10 CONTRACTOR to furnish the details of control voltage of various systems like NIFPS system & HVAC system for designing of tripping contact by FA system manufacturer. CONTRACTOR to furnish tripping philosophy for HVAC system including tripping of VAM package and AHU package during engineering stage.
- 5.18.11 Maximum number of Fire Alarm system equipments considered in OWNER's scope of supply for installation in MRSS-100 by contractor, shall be as listed below. Any requirement over and above the listed quantities shall be in contractor's scope. The make of these additional equipment/devices shall be of identical make, type & model no. as that of the free-issued equipment/devices. Make & model no. of free-issued fire alarm equipment and fire alarm cable sizes shall be informed to the Contractor during detail engineering
- Data gathering cum fire alarm panel (DGFAP) – 1 no.
 - Intelligent addressable multi sensor detector – 375 Nos.
 - Intrinsic safe intelligent addressable heat detector – 18 Nos.
 - Linear Beam detectors – 12 Nos.

- Manual call point (MCP) safe area type – 12 Nos.
- Electronic hooters addressable – 7 Nos.
- Exit signs addressable (Single faced) – 8 Nos.
- Exit signs addressable (Double faced) – 4 Nos.
- Hooter Acknowledgement Box – 4 Nos.
- Relay Module – 6 Nos.
- Input module – 16 Nos.
- Fault Isolator Module – 25 Nos.

5.18.12 For Substation cum control room to be located in the existing refinery area, supply installation, testing and commissioning of all system components such as DGFAP, detectors, MCPs, Hooters, hooter acknowledgement boxes, exit signs, Control & input relay modules etc. shall be in the scope of contractor. Make of these new components shall be same as the existing system. Also contractor shall be responsible for integration of this fire alarm system with the existing FA system in nearby substation-63. Modification & updation of graphics in Main Fire station in existing refinery for the vendor supplied system shall also be in contractor's scope.

5.19 PLANT COMMUNICATION SYSTEM

- 5.19.1 Plant communication system shall be engineered in line with the specifications attached with the bid document for all areas within battery limit including buildings.
- 5.19.2 Plant communication devices (i.e. Master call station, Operator Call station, Field Call Station, Loudspeaker, beacon lamp, etc.) shall be supplied by Owner as free issue items (FIM) and quantities of same are as mentioned elsewhere in the tender. In case quantity required by CONTRACTOR is more than the indicated FIM, contractor shall supply the additional quantity without any time & cost implication. The make of these additional equipment/devices shall be of identical make, type & model no. as that of the free-issued equipment/devices.
- 5.19.3 Plant communication system as required for unit/area including buildings within package battery limit shall be engineered by CONTRACTOR. CONTRACTOR will prepare the plant communication layout for the building. Owner will free issue the devices as per the final approved layout within the limits as mentioned elsewhere in the tender
- 5.19.4 Installation of all Free Issued Materials for Plant Communication System, PAJB and cabling including supply of PAJB and supply & laying of cables up to PAJB for all field equipment in line with approved layouts shall be done by contractor. Installation shall be carried out as per installation details/ instruction details/ precautions provided by Plant Communication system manufacturer, approved layouts, specification attached, approved sizing calculations and block diagram.
- 5.19.5 Testing and commissioning of the Plant Communication system will be done by Owner/others (Plant Communication Vendor). However, contractor shall extend all necessary help and manpower to Plant communication vendor for executing works such as cable connection, disconnection and reconnection required during testing and commissioning of the system.
- 5.19.6 Weatherproof Junction box (Metallic), shall be considered in 220 kV GIS substation building suitable for 1 runs of 50P cable, for receiving incoming cable from Owner's PA System Exchange. Termination and glanding of incoming cable in PAJB is in scope of CONTRACTOR. Contractor to note that minimum 5P cable shall be considered for each FCS and OCS/MCS.
- 5.19.7 Plant Communication cabling from PAJB onwards to the MCS, OCS, FCS, amplifier, loudspeaker, etc. shall be done by CONTRACTOR. Cabling inside building shall be done in concealed conduits using un-armored cables. Tinned copper cable lugs shall be considered for termination of multi stranded cables in all equipments. Cable glands with PVC shrouds for all equipments shall also be considered by the CONTRACTOR
- 5.19.8 All hardware used for installation and cable tags shall be of SS 304 grade.

5.19.9 Maximum number of Communication system equipments considered in OWNER's scope of supply shall be as listed below. Any additional requirement over and above the listed quantities shall be in contractor's scope. The make of these additional equipment's shall be of identical make, type & model no. as that of the free-issued equipment's. Make & model no. of free-issued plant communication equipment's and PA communication cable size shall be informed to the Contractor during detail engineering.

- Master Call Station – 1 Nos.
- Operator Call Station – 2 Nos.
- Field call station & weatherproof loudspeakers 25W (FCS + Ext loudspeaker) – 6 Nos.

5.19.10 Supply, installation, testing & commissioning of plant communication system for new gantry area comprising of substation & outdoor switchyard within (95x95) mtr. Area in existing PR is included in contractor's scope. Make & model of PA system equipment shall be same as of existing equipment (make: Industronic). Further the new system shall be integrated with existing PA system at 220kV existing GIS substation. Following PA equipment shall be provided by the contractor as minimum along with associated cabling:

- Operator all station with 16 no. keys: 1 No.
- Field call station & weatherproof loud speakers (25W): 1 No.
- PAJB: 1 No.

Scope of work also includes software modification in existing PA system to include PA system devices supplied by contractor.

5.20 TELEPHONE SYSTEM

- 5.20.1 Telephone system equipments as specified in scope of work shall be supplied, installed, tested and commissioned as per the specifications of this package.
- 5.20.2 Indoor Telephone Distribution Junction Box (TDJB) suitable for minimum 25 telephones shall be made out of 2.03 mm (14 gauge) sheet steel with Krone type terminals and with hinged lockable door. TDJB shall be provided with one anti-rust coat of primer and two finished coats of epoxy paint.
- 5.20.3 CONTRACTOR to note that incoming cables upto TDJB inside 220 kV GIS substation building shall be supplied and laid by others. However, termination and glanding of cables in TDJB JB is in scope of CONTRACTOR.
- 5.20.4 CONTRACTOR shall supply, install, test and commission flush mounting, plug - in type sockets for telephones including supply of sheet boxes with covers.
- 5.20.5 CONTRACTOR scope includes wiring from TDJB onwards to telephone sockets in concealed conduit.
- 5.20.6 Analog push button telephone handset to be supplied shall have the following functionalities :
- Redial / flash buttons.
 - Ringer volume control.
 - Hands free dialling.
 - Two way speaker phone.
 - Desktop/wall mountable.
 - Caller ID facility.
 - Minimum 99 incoming and 10 outgoing no. storage.
 - Display of real time and date.
 - Programmable flash.
 - Alphanumeric 16 Digit Backlit LCD display without any battery or adopted in put power and shall display date, time, caller number & name at a time.
 - Minimum 50 Names phone book.
 - Should have Music on hold.
 - Adjustable ringing tone.

- Telephone set should work on both tone & pulse mode.
- Dual mode FSK / DTMF system compatible with auto detection
- Telephone set & Ringer should be compatible with Openscape 4000 V8 type of system
- Telephone Sets should be supplied with battery, rosette, line cord & coil cord.

5.21 LAN SYSTEM

- 5.21.1 CONTRACTOR scope includes supply, installation, testing and commissioning of LAN system comprising of CAT 6A modular UTP jack including all connected material (i.e. face plate, surface mounted box, patch cord, etc.), circuit wiring from Ethernet switch rack to CAT 6A UTP Jack using CAT 6A LSZH UTP cables, CAT 6A modular patch cord.
- 5.21.2 CONTRACTOR to note that minimum three 5A convenience outlets with switch shall be provided along with each LAN UTP Jack.
- 5.21.3 CONTRACTOR to note that connection of LAN system with refinery LAN shall be done by others

5.22 MOTORS

- 5.22.1 MV Motors, if required, shall be energy efficient IE3 type as per IS 12615 and shall meet the requirements as per EIL standard specification 6-51-0064 and datasheet for MV motors attached with tender.
- 5.22.2 Motors installed outdoors shall have canopy (2 mm thick G.I. sheet steel) for additional weather protection.
- 5.22.3 The cable entries of all Terminal Boxes of motors, before dispatch from motor manufacturer works, shall be fitted with suitably sized IP-55 Metallic Sealing Plugs to prevent water entry/ingress in motor windings through openings meant for cable entry in terminal boxes at construction site till the time motors are erected and cable terminations are done. Weatherproof nickel plated brass cable glands shall be supplied loose.
- 5.22.4 In addition to packing requirements specified in EIL standard specification of motors, Vendor to do plastic wrapping for shipping from works to site.
- 5.22.5 All motors shall have provision for double earthing.
- 5.22.6 All glands supplied with motors shall be of thread type 'ET'.

5.23 LOCAL CONTROL STATION

- 5.23.1 Weatherproof control stations (IP-65) for all motors, emergency stop push buttons for transformers, motors and emergency push buttons as required for plant operation and safety etc. shall be provided by the contractor.
- 5.23.2 Each motor shall have a separate push button station for motor start/stop in addition to local/remote, Auto/manual selector switch as per operation requirements. LCS for motors rated 5.5 kW and above shall be provided with ammeter.
- 5.23.3 Dual pushbutton to be provided in the transformer bay shall be wired in series and connected to the trip circuit of the upstream breaker such that pressing of both simultaneous shall trip the transformer circuit breaker. All contact of these push buttons shall be used as close permissive for the transformer circuit breaker. Additionally push buttons shall also be provided with covers and pushbutton shall be stay put type.
- 5.23.4 Each pushbutton provided in LCS shall have two elements / contacts.
- 5.23.5 Local control stations installed in outdoor area shall have GI canopy for additional weather protection.
- 5.23.6 Local control stations stop push button for transformer shall have 3 NO + 3 NC contacts instead of 2 NO + 2NC specified in EIL standard specification 6-51-0006.

5.23.7 Local Push Button station at each entry of substation floor shall be provided and same shall be wired to LDB for control of normal lighting of switchgear/GIS hall & cable cellar.

5.24 CABLEING

5.24.1 All HV & MV Power cables shall comply with the EIL standard specification 6-51-0051 and datasheet attached with tender.

5.24.2 Power cables used shall be with 3.5/ 4 cores, except for motors, which shall be 3C. The conductor size shall be minimum 4mm². Colour of outer sheath of cables shall be BLACK.

5.24.3 The conductor material for MV power cables shall be copper up to 16 mm² / Aluminium above 16 mm². However in case of cables related to DC system and UPS system all cables from Battery charger & DCDB onwards and from UPS & ACDB onwards shall be with copper conductors irrespective of cable size.

5.24.4 All MV control cables, plant communication cables, telephone system cables and fire alarm cables shall comply with the EIL standard specification 6-51-0052 and datasheet attached with tender. Control cables shall be 2.5 mm², multi stranded copper conductor, twisted pair and overall shielded, XLPE insulated type. Note that type of core insulation for these cables shall be Type A as per IS 5831 and material of Inner sheath shall be ST1.

5.24.5 All cable tags used for cable identification shall be of stainless steel grade SS 304.

5.24.6 For fire alarm system, power cables shall be 2.5 mm², copper conductor, XLPE Insulated armoured with FRLS outer sheath and cables for connecting various fire alarm devices shall be 1.5 mm², copper conductor, twisted pair XLPE Insulated, armoured with FRLS outer sheath. Fire alarm cables shall be multi-stranded type. Colour of outer sheath of fire alarm cables shall be RED. However, power cables for fire alarm shall be BLACK in colour.

5.24.7 For plant communication system, 0.9 mm dia twisted pair solid copper conductor XLPE insulated cables for interconnections between MCS / OCS / FCS & exchange and 1.5 sq. mm twisted pair multi stranded copper cable for connection to the loudspeakers shall be provided. Colour of outer sheath of plant communication cables shall be GREY.

5.24.8 For telephone system, cable from TDJB onwards to telephone sockets shall be 660 V grade, 0.63mm dia. annealed tinned copper conductor and PVC insulated. Colour of outer sheath of telephone cables shall be GREY.

5.24.9 All cables shall be supplied in non-returnable steel drums.

5.24.10 FIBRE OPTIC CABLES

5.24.10.1 Fibre optic cable shall be supplied along with HDPE duct.

5.24.10.2 The fibre-optic cable shall be of single mode type only with a minimum of 2 spare fibers in each cable. Procedure of data transmission, error control and recovery shall be as per acceptable standards.

5.24.10.3 All lengths shall be joint free single continuous lengths. Coating and the colour of the fiber shall not react with the surrounding jelly. Outer sheath shall be flame retardant low smoke (FRLS) type.

5.24.10.4 Fiber-optic data cable shall be suitable for water-submergence duty and high temperature withstand as per the routing requirements in the plant. All lengths shall be joint-free continuous lengths.

5.24.10.5 Optical fibers shall be coated with UV cured double acrylate resin. It should not have any reaction with cladding or core material.

5.24.10.6 The coatings shall be in various colours in order to facilitate fiber identification. Fiber colours shall correspond to latest revision of IEC publication 60793-2 and 60304. The colours shall correspond reasonably with standard colours and shall readily be identifiable and shall be durable. The colours should have good colour fast properties also in the presence of other

materials during the lifetime of cable. The coating and the colour shall not react with the surrounding jelly.

- 5.24.10.7 The fiber optic cable shall be protected against damages from termite, rodent, fire, chemicals (such as oil & natural gas, LPG and other petroleum/ petrochemical products), moisture and water over the life time of the cable.
- 5.24.10.8 Moisture barrier – Polymer coated aluminium tape placed longitudinally over the cable core. The tape shall form a close fit around the cable core with a sealed overlap of 6mm minimum. The thickness of each polymer layer shall be 0.04 mm minimum. The thickness of fully annealed aluminium foil shall be 0.15 mm minimum.
- 5.24.10.9 The armouring of the optical fiber cable shall be of corrugated steel (electrolytically chrome plated low carbon steel) tape both side coated with ethylene acrylic copolymer, applied longitudinally with minimum overlap of 6mm. The thickness of the steel tape shall be 0.15 mm minimum. The thickness of each polymer layer shall be minimum 0.04 mm minimum.
- 5.24.10.10 The cable shall have sufficient strength to withstand a load of value $T = 9.81 \times W$ newton, where W = mass of 1 km in kg. The load shall not produce total strain exceeding 0.25% in the fiber.
- 5.24.10.11 The termination enclosures of the optical fiber cable should be dust tight (No dust ingress) and protected against immersion in water (suitable for continuous immersion in water) and should be complete with all accessories including splice cassettes splice protection and all other accessories including accessories for electrical continuity of metallic layers of optical fiber cable and OFC preparation kit along with instruction sheet.
- 5.24.10.12 All fibres (including spare fibers) of a cable shall be terminated in the termination enclosure by pigtails. Subsequent connection shall be by patch chords. Supply and erection of termination enclosure, pigtail, patch chord etc. is in vendor's scope. OTDR analysis/report shall form part of the testing activities of the OFC network.
- 5.24.10.13 Vendor shall furnish past track record for the selected make of the fiber optic cable, preferably for the past EIL projects during drawing review stage.
- 5.24.10.14 HDPE duct shall be permanently solid lubricated/ with spiral groove, UV-protected, fire retardant (Class V2 as per UL-94 and with limited oxygen index of 21 or higher as per ASTM D2863), of 40 mm outer diameter (+5.0/-0.0 mm) minimum thickness 3.7 mm, suitable to withstand load of 6 kg/m².
- 5.24.10.15 All HDPE ducts shall be supplied along with accessories such as push fit coupler, bend and elbow, end plug, simple plug, sonic head, etc. required for blowing cable into HDPE duct by compressed air technology.

5.25 CABLING SYSTEM

- 5.25.1 Cable tray support along with cable trays inside substation cable cellars shall be provided by CONTRACTOR. Cable tray shall be provided on both side of vertical supports in multi-tier arrangement with minimum 6 cable trays uniformly spaced at 300 mm, on each vertical support along the complete length of substation. Vertical support shall be provided for complete height of cable cellar, fixed at cable cellar floor and roof. Span between two consecutive supports shall not exceed 3000 mm.
- 5.25.2 Dedicated cable route shall be provided for 220 kV & 66kV cables. Only 1 trefoil of 220 kV and 2 trefoil of 66kV cable is permitted in each tray. Sufficient space, minimum 500 mm for 220kV cables and 400mm for 66kV cable shall be provided between various tiers for laying cables. For 220 kV&66kV Cables, trays and supports shall be provided to withstand minimum 250 kg/ meter of uniform weight for cables laid in trefoil arrangement. Sufficient space shall be provided between trays for laying of cables.

- 5.25.3 Supporting structure shall be provided for raising cable trays from cable cellar to switchgear hall for termination in GIS. Cutout provided for raising 220 kV & 66kV cables in switchgear hall for termination shall be closed by chequered plates.
- 5.25.4 Cable tray supports shall be suitable for 750 mm wide cable trays. Engineering for sizing of cable trays based on number and size of cables shall be done by CONTRACTOR.
- 5.25.5 All cable trays as required as per CONTRACTOR scope, shall be GI type with SS hardware and shall be provided by CONTRACTOR. Coupling and connection hardware of cable trays shall be of stainless steel grade SS 304.
- 5.25.6 GI pipes for cable protection above ground, floor sleeves, supports wherever necessary, cable markers, identification tags, GI saddles, saddle bars and associated accessories, all other galvanized hardware like nuts, bolts, washers, grouting bolts as necessary, shall also be provided
- 5.25.7 Modification in requirements specified above, to suit site condition shall be finalized during detail engineering, which shall be taken care by the contractor without any impact on cost and time to Owner/ EIL
- 5.25.8 Wherever trenches/trays within battery limit have interface with the trays and trenches outside battery limit, the details shall be finalized during detailed engineering. Trenches and trays shall be provided up to the battery limits as per the final approved layouts without any impact on cost and time to owner
- 5.25.9 It shall be CONTRACTOR's responsibility to co-ordinate the cable trench/ tray routing from the package battery limit area, control room and substation building etc. with other agencies involved. Trenches and trays shall be provided up to the battery limits as per the final approved layouts without any impact on cost and time to owner.
- 5.25.10 In cable trays/trenches 20% spare space shall be provided. 40% spare shall be considered in Electrical Road Crossings.
- 5.25.11 Lugs to be supplied by the CONTRACTOR shall meet the following requirements for all terminations for the equipments in the scope of CONTRACTOR.
- Aluminum conductor cable termination on Aluminum bus bar/ terminals (like switchboards) - Aluminum lugs
 - Aluminum conductor cable termination on Copper bus bar/ terminals (like motor) - Bimetallic lugs having Al barrel & tinned Cu palm
 - Copper conductor cable termination on Aluminum bus bar - Bimetallic lugs having tinned Cu barrel & Al palm
 - Copper conductor cable termination on copper bus bar/ terminals - Tinned copper lugs.
 - Lugs provided for termination of HV & MV cables at switchgear end shall be of long barrel type.
- 5.25.12 Glands to be supplied by the CONTRACTOR shall be of nickel-plated brass for all cabling & termination for the equipment in the scope of CONTRACTOR. The cable glands shall be single compression type for indoor equipments & double compression type for outdoor equipments.
- 5.25.13 MV Control cable shall be of Multi-stranded conductor, twisted pair individual & overall shielded, XLPE insulated type.
- 5.25.14 The Cable outer sheath Color for various twisted pair cables shall be as follows:

MV Control Cables	Black base color
MV Communication Cables	Gray base color
MV Fire Alarm Cables	Red base color

MV Fire Safe Cables

White base color

5.26 EARTHING AND LIGHTNING PROTECTION

- 5.26.1 Earthing system of the entire package shall be designed to meet the statutory requirements and shall be included in contractor's scope including interconnection with owner's earth grid and earthing of all equipment.
- 5.26.2 Earth Resistivity Value shall be measured by CONTRACTOR at minimum five locations before earthing system design calculation.
- 5.26.3 Contractor shall measure the earth resistivity of soil as per Wenner's four electrode method. For determining the earth resistivity, five test locations shall be chosen to cover the whole site as per the site-Engineer-in-charge. This number shall be increased if the test results obtained shows a significant difference. The tests shall be conducted during the dry season
- 5.26.4 Earthing system shall conform to following standards:
 - 5.26.4.1 IEEE-80 Guide for safety in AC substation grounding.
 - 5.26.4.2 IS-3043, Code of practice for earthing.
 - 5.26.4.3 CBIP Tech. report for Earthing System for HV, EHV and UHV Substations.
 - 5.26.4.4 CEA Regulations as amended from time to time and the relevant regulations of the Electricity Supply Authority concerned.
 - 5.26.4.5 The earthing work shall also conform to EIL specification for Installation of earthing system.
- 5.26.5 Lightning protection shall comply with the requirements of IS/ IEC 62305. Contractor to furnish calculation for lightning protection of building. Lightning protection of building and switchyard area shall be separate and shall be designed for LPS 2 as a minimum. Lightning strip size shall be minimum 25 x 3 mm.
- 5.26.6 Cross-section of earthing conductor shall be designed to prevent fusing of conductor and deterioration of joint under most adverse conditions of fault. The same shall be determined as per IS: 3043, and to meet the regulations of CEA Regulations. MS rod shall be used for the buried earth grid in outdoor switchyard. For earthing conductor sizing, duration of earth fault current duration to be considered, shall be minimum one second.
- 5.26.7 The entire installation shall be done in accordance with standards mentioned herein. The contractor shall carry out any changes desired by the electrical inspector or the owner, in order to make the installation conform to CEA Regulations at no extra cost.
- 5.26.8 Earthing system shall be designed to have a low impedance to ground and a current carrying capacity consistent with the fault current. The earth loop impedance to ground shall not be in excess of 1.0 Ω . The main earth loop shall be laid at a depth of minimum 500 mm below grade level. Earth resistance of individual electrode to general mass of earth shall not exceed requirements given in OISD-STD-137.
- 5.26.9 Test disconnect facilities shall be provided for the earth pits to check their earth resistance periodically.
- 5.26.10 The method of earthing has to be considered from the view point of touch and step potentials in the area extended 1 meter outside the substation battery limit and in outdoor switchyard area, so as to ensure that the area in the vicinity of the substation and the switchyard equipments is safe from the viewpoint of touch potential under fault conditions.
- 5.26.11 The attainable and permissible values of the step and touch potential in the design of the earthing grid in substation shall be calculated as per IEEE 80, and it shall be ensured that the attainable step and touch potential are less than permissible step and touch potential. For step

and touch potential, current distribution factor shall be considered as 1 and duration of rated fault current shall be 1 second.

- 5.26.12 Contractor shall provide earth grid up to battery limit of the package including provision of earth plate near the battery limit for interconnection of the unit earth grid with the Owner's main plant grid. CONTRACTOR shall extend & connect the plant earthing grid to main earthing grid, at minimum two points.
- 5.26.13 All earthing hardware (i.e. nut, bolts, etc.) for earth pits, earth plate connection cable trays earthing, etc. shall be of stainless steel grade SS 304.
- 5.26.14 Contractor to note that separate dedicated earth electrodes shall be provided for lightning protection.
- 5.26.15 **Equipotential Earth mat.**
- 5.26.15.1 When a fault current flows through the earthing connections into the soil, the enclosures, linked to the earthing circuits, will be at the same potential as the earthing mat conductors but this potential is generally different from that on the soil surface.
- 5.26.15.2 In order to ensure the security of personnel, it is necessary to install an equipotential mat linked to the general earthing mat in the zones where metal enclosures and fixed accessories are accessible from the floor.
- 5.26.15.3 It is also necessary to provide an equipotential earthing mat in the zones where an emergency mechanical operation or a locking system is accessible from the floor. It is therefore possible to extend the equipotential mat to allow the operator to carry out his maneuvers.
- 5.26.15.4 In order to ensure a good equipotential surface, each element of the equipotential mat must be connected to the general earthing network by the manufacturer.
- 5.26.15.5 This mat will be placed on the floor, all around the switchgears. It is not required in front of the control cubicles.
- 5.26.15.6 If it is an oxidizing material, it should be hot dip galvanized.
- 5.26.15.7 The manufacturer must design, specify, and provide this equipotential earth mat. The location of the equipotential mat should be defined by the supplier for all the GIS and at places where:
- The enclosures are accessible for the floor.
 - Manual operation of apparatus or locking system is located.
- 5.26.15.8 Equipotential earth mat drawings along with design calculations shall be submitted for approval by the CONTRACTOR along with general arrangement drawings.
- 5.26.16 All earth pits for earthing and lightning protection shall be maintenance free chemical earth pit with Cu bonded high tensile low carbon steel core electrode.
- 5.26.17 Earth connections shall be welded at joints, anti-corrosive paint or bitumen and jute covering shall be applied for welded portion.
- 5.26.18 Separate clean earth system shall be provided for Numerical relays, SAS& ECS in Substation.
- 5.26.19 Material of connection of equipments to earth plate shall be as per the equipment earthing schedule enclosed with the tender document.
- 5.26.20 Minimum size of the main earth grid shall be 100 x 12 for Substation. However, Earthing sizing calculation shall be furnished by Contractor for the final GI earth strip selected.
- 5.26.21 Adequate number of earth plates for taking branch connections shall be provided.

5.27 LIGHTING SYSTEM

- 5.27.1 Normal lighting, Emergency lighting and DC Critical lighting shall be provided as per Electrical Design Philosophy.

- 5.27.2 All lighting fixtures shall be LED type, supplied complete with associated LED lamp and driver
- 5.27.3 25% of total fixtures shall be fed from emergency lighting panel for illumination, in case of failure of normal power supply.
- 5.27.4 During normal operation, both emergency and normal lighting shall be fed by normal power source. On failure of normal supply, emergency lighting load shall be transferred to emergency power supply source. Critical (DC) lighting shall be normally kept 'OFF' and during failure of AC power; DC system shall feed the critical lighting system.
- 5.27.5 All lighting fixtures shall be suitable for the area in which they are installed. All hardware of the lighting fixtures like nuts, bolts, mounting brackets for ceiling & column mounting and adaptors for installation on poles shall be with MOC of SS304.
- 5.27.6 For fixture mounted on pole dedicated standalone junction box shall be provided at bottom for loop-in loop-out.
- 5.27.7 Lighting & Power panels shall be standardized to have 6, 12 or 18 single phase outgoing feeders. The panel shall be provided with 30% spare outgoing
- 5.27.8 All lighting poles shall be hot dipped galvanized type with SS hardware.
- 5.27.9 DC critical lighting shall be provided at exit, escape route inside the building/plant area and other strategic locations in package battery limit.
- 5.27.10 All lighting fixtures shall also have independent earth terminal outside the enclosure.
- 5.27.11 Cable from lighting panel onwards to the outdoor lighting fixtures shall be 3Cx2.5mm², Copper conductor, and armored FRLS cable.
- 5.27.12 It is vendor's responsibility to ensure that adequate lighting is maintained within package battery limit with minimum lux level specified as per clause 7.4.12 of 6-51-0099. The same will be measured and demonstrated at site. In case additional lighting fixtures and associated circuit/cabling is required, the same will be provided by vendor without any time/cost implication to owner.
- 5.27.13 415/ 415V Dry type lighting transformer shall be supplied with vector group as Dyn1

5.28 SPECIAL REQUIREMENTS FOR LEDs FIXTURES

5.28.1 TECHNICAL REQUIREMENTS OF LED:

- 5.28.1.1 LED efficacy shall be greater than > 140Lumen/Watt @ 350mA drive current. In respect of LEDs of higher power ratings, drive current greater than 350mA can be accepted if the LED's LM 80 / IS: 16105 test reports support the same.
- 5.28.1.2 LED type shall be SMD (surface mounted device) type LED for all applications. COB type to be considered only for applications such as High bays, Flood Lights & Flameproof Light Fittings.
- 5.28.1.3 Approved makes for different LED technology/types shall be as follows:

LED Technology/ Type	Approved Make
SMD	Nichia, Osram, Lumileds (Erstwhile Philips Lumileds), CREE
C.O.B	Citizen, Bridgelux
Domestic/Decorative Luminaires	Everlight Taiwan, Edison Taiwan, Samsung Korea, Osram Germany along with makes approved for SMD

- 5.28.1.4 Test Report for Ambient Temperature of 55 / 85 / 105 °C at rated and maximum current shall be submitted for SMD type LED. For COB type LED, as soldering temperature is not applicable for COB technology, LM 80 test report shall be submitted.
- 5.28.1.5 TM 21 life projection calculations along with LM80 for all three ambient temperature of 55 / 85 / 105°C as per applicable standard shall be submitted to substantiate that life of LED Chip shall be more than 50000 Hrs for both commercial and Industrial range and 25000 Hrs for LED Bulb, domestic and decorative Range.
- 5.28.1.6 Reported life Span of LEDs used in the Luminaire shall be greater than 50,000 Hrs at the soldering point temperature of 85°C and at the luminaire driving current.
- 5.28.1.7 The LEDs shall comply with Ptioto biological Safety norms as per IEC 62471 / EN62471 / IS: 16108 and should fall in the exempt group for indoor luminaires and in exempt or low risk group for outdoor LED luminaires.
- 5.28.1.8 View angle : Typical 120°
- 5.28.1.9 The colour temperature of the proposed white colour LED shall be from 5700K (i.e. 5665K±355K) to 6500K for indoor type luminaire Step 5 or Step 3 McAdam ,as per ANSI standard C78.377A, & 5700K (i.e. 5665K±355K). For outdoor type luminaires, Step 7 McAdam, as per ANSI standard C78.377A, will be accepted on account of colour consistency.
- 5.28.1.10 The Colour Rendering Index (CRI): CRI should include all colour range from R1 to R15, shall be > 80 for Indoor luminaire and > 70 for Outdoor luminaire.

5.28.2 TECHNICAL REQUIREMENTS FOR LED DRIVER

- 5.28.2.1 Min. efficiency of driver: The minimum efficiency of LED driver shall be 85% for driver power output rating ≤40W and 87% for driver power output rating > 40W.
- 5.28.2.2 Power factor of complete fitting shall be greater than 0.90.
- 5.28.2.3 In-built high voltage cutoff shall be ≥ 290Volt.
- 5.28.2.4 Driver Surge Protection standard: Surge Protection for minimum 2kV for indoor and minimum 3kV for Outdoor LED systems shall be provided. However, if a site is prone to lightning and surge, 10kV surge protection shall be required. In case of outdoor luminaires, the Surge Protection Device (SPD) should be series type with fail safe.
- 5.28.2.5 Total Harmonic Distortion (THD): Less than 10 % for full load for more than 20 W and less than 20% for less than 20W. Not applicable for Domestic/Decorative LED fixtures.
- 5.28.2.6 Isolated driver shall be used. Short circuit protection /Open load protection shall be provided
- 5.28.2.7 For driver power output rating > 50W, potted driver shall be provided.
- 5.28.2.8 The power supply shall be connected to the LED PCBs through proper connectors.
- 5.28.2.9 EMI/ EMC compliance: The driver shall comply to the following EMI/ EMC standards:
- CISPR 15/ 18:6873 (CE, RE, CDN) or compliance to equivalent EN standard.
 - IEC: 61347 (reference standards are listed as follows)
- 5.28.2.10 Driver shall comply with the safety requirements laid down in IEC: 61347 - 2 - 13/ EN: 61347 - 2 - 13/ IS: 15885 - 2 - 13.

5.28.3 TECHNICAL REQUIREMENTS OF ELECTRONIC COMPONENTS USED IN LED LUMINAIRE

The circuit boards and electronic components to be used in the luminaire should be of rating/ type so as to provide reliable functioning. Following shall be ensured during procurement:

- 5.28.3.1 MCPCB is to be used for SMD technology for LED wattage in excess of 0.5. The minimum thickness should be 1.0 mm for indoor and 1.6 mm for outdoor type luminaire. However, the same is not applicable for COB.

- 5.28.3.2 FR4 grade PCBs of min. thickness of 1.6 mm shall be used in driver circuits. The same is not applicable for COB.
- 5.28.4 TECHNICAL REQUIREMENTS OF LED LUMINAIRE
- 5.28.4.1 The luminaire shall have LM-79 / IS: 16106 test report from a NABL accredited laboratory.
- 5.28.4.2 The min. system lumen efficacy of the luminaire shall be 95 lm/W (for luminaire system wattage ≤ 15 W) and 100lm/W for wattage > 15 W.
- 5.28.4.3 Following shall be required in terms of secondary lens/ optics:
- Outdoor industrial luminaire like well glass, flat glass may not have secondary lens/optics.
 - For other Industrial and outdoor fixtures, luminaire must have secondary lens/optics of type PMMA/Borosilicate glass/Polycarbonate.
- 5.28.4.4 Color temperature: 5700K (5665 $\pm$ 355K, as per ANSI standard C78.377A)
- 5.28.4.5 Housing of luminaire: Housing of outdoor and/or FLP shall be Pressure die-cast LM6/ADC12/LM24. For indoor, non-weather proof items like CRCAIPC/Aluminium Extrusion housing can be used.
- 5.28.4.6 Cover type: For outdoor type fittings, cover type shall be Toughened glass or UV stabilized polycarbonate whereas, for indoor and non-weather proof items, UV stabilized Poly Carbonate can be used.
- 5.28.4.7 Minimum Ingress Protection Required for LED Flood Light / Outdoor Industrial is IP 65.
- 5.28.4.8 Impact Resistance: For outdoor fittings minimum impact resistance shall be IK-05 and not applicable for indoor fixtures.
- 5.28.4.9 Temperature rise test: When the luminaire has stabilized thermally, soldering point temperature shall be ≤ 85 °C for SMO type but for COB type the temperature rise test shall not be applicable.
- 5.28.4.10 Temperature rise (above ambient) of heat sink should generally remain within 20°C - relaxation on this account can be granted as long as the soldering point temperature limit of 85°C is not violated and there is no unacceptable outcome.
- 5.28.4.11 BIS Registration: The luminaire shall have BIS approval for surface mounted luminaire as applicable.
- 5.28.4.12 Flameproof tight fittings shall be certified for use in hazardous area as per area classification and the flameproof certificate shall be submitted by the vendor. Explosion proof certificate from PESO shall be submitted before or along with supply of such light fittings.
- 5.28.5 TESTING OF LED LUMINAIRE
- 5.28.5.1 Following acceptance tests shall be carried out / type test & routine test certificates from NABL accredited Labs shall be provided as per relevant standards.
- Visual and dimensional checks
 - Resistance to humidity test
 - Insulation resistance (IR) test
 - High Voltage test
 - Over-voltage protection
 - Surge protection
 - Total harmonic distortion (THD) test
 - Reverse polarity test
 - Temperature rise test

- Ingress protection test

5.28.5.2 Type test report/ certificate as per relevant standards on selected sample including endurance test as per IS10322 & Safety test for Drivers as per IS15885 from NABL accredited lab shall be submitted.

5.28.6 MISCELLANEOUS REQUIREMENTS

5.28.6.1 For LED fixture, integral junction box shall be provided with 3 nos. cable entries for loop-in, loop-out and associated wiring to fixture. Alternatively 2 nos. cable entries for loop-in and loop-out shall be provided with internal wiring for driver and lamp.

5.28.6.2 All lighting fixtures shall be supplied complete with associated LED lamp and driver.

5.28.6.3 All lighting fixtures shall be supplied with fixture mounting nuts and bolts of stainless steel SS-304. Fixture mounting bolts & nuts for mounting the light fittings on already installed clamps/brackets. However, Clamps/brackets mounting bolts & nuts are excluded from vendor's scope.

5.28.6.4 Flameproof LED type lighting fixtures shall fulfill the following requirements:

- LED lamps and Drivers shall be provided with min. 5 years warranty period.
- Lighting fixtures reserved for use in 240 Volt AC Emergency Circuit shall have additional RED Circular ring marking for identification purpose for hazardous area identification. This detail shall be furnished to successful vendor during detailed engineering.
- Vendor shall indicate the following parameters as a minimum in fixture drawings:
 - Fixture Wattage and LED Wattage
 - Actual Consumption of Fixture
 - Driver Consumption
 - Fixture Life time
 - Luminous Efficacy of fixture
 - Lumen Output of Fixture
 - Tolerance for Voltage and wattage rating
 - Power factor of Fixture
 - Beam Angle of Lighting Fixture
 - Weight of Fixture
 - LED LAMP and Driver Warranty Period
 - Driver Surge Protection
 - Compliance to IEC-61347-2-13 for LED Driver
 - BIS Certification no. for Driver
 - Driver Make and Model No.
 - LED Make and Model no.
 - LED type i.e. COB (Chip on Board) or Multichip etc.
 - Quantity of Fixtures
 - No. of Cable entries for Fixture along with quantity of FLP Cable glands and FLP Stopper plug.
 - PESO/CIMFR/BIS License certificates numbers along with dates.
- IES files of all LED lighting fixtures finalized during detail engineering shall be furnished for owner/EIL records.

5.29 FIXED TYPE SPACE HEATER PDB

- 5.29.1 PDB shall be installed in safe area and shall be suitable for safe area. Ingress protection shall be IP-41.
- 5.29.2 PDB shall be single front, and fixed type, free standing floor mounted type. PDB shall be minimum 415V, 200 Amp, 50Hz, TPN, 25 kA (1 sec.) with two number SFU incomers mechanically interlocked with each other.
- 5.29.3 The switchboard shall be non-compartmentalized type instead of compartmentalized specified in 6-51-0012. However, other requirements of 6-51-0012 shall be complied with.
- 5.29.4 The number of outgoing 240V AC, SPN feeders in the PDB for Owner's use shall be as follows:

Rating	Nos
16A Double Pole MCB	6
32A Double Pole MCB	6
63A Double Pole MCB	6

- 5.29.5 Incomer feeder shall be provided with voltmeter and ammeter. All indicating lamps shall be LED type.
- 5.29.6 Terminals for outgoing feeder's upto 16A shall be suitable for 10 Sq.mm. cable. Terminals for upto 32A and 63A feeders shall be suitable for 25 mm² cable. Supply of lugs and nickel-plated brass cable glands for all cabling & termination in the scope of vendor inclusive of cable glands for incoming cable to PDB. The cable glands shall be single compression type.

5.30 SOLAR ROOFTOP PHOTO VOLTAIC SYSTEM

- 5.30.1 Contractor shall provide grid connected solar power plant units at roof top of main substation MRSS-100 in P25 area & new gantry substation at existing PR area, on substation switchgear room and transformer bays and feed the generated solar power to the electrical system of the complex. The solar power shall be generated at 415V, TPN, 50 Hz which can support loads at 0.8 pf.
- 5.30.2 The scope of work for contractor includes design, manufacture, supply, erection, testing and commissioning of grid connect interactive solar PV power plants without batteries on substation building roof. Solar power unit shall be connected to the nearest 415V MV switchboard for export of solar power. The solar power systems shall remain synchronized with the grid supply for generation of solar power.
- 5.30.3 Each photovoltaic solar panel shall be divided into small sub arrays to feed into Power Conditioning Units (PCU). The series parallel connection of sub arrays shall be done through panel junction boxes, Array junction boxes and main junction boxes. The AC output of the PCUs shall be collected at the MV switchboard. The detailed scheme for power evacuation shall be worked out by the contractor.
- 5.30.4 PV panels shall be installed on the complete building terrace area which includes roof top of substation switchgear room and transformer & capacitor bays except for personnel movement area and area for other facilities installed on the roof top. Minimum 1 KWp solar panels shall be located in each 12 m² area.
- 5.30.5 The minimum guaranteed supply of energy from the solar power systems shall be 1400 KWh/year for 1 KWp PV panel. The contractor/manufacture shall furnish the undertaking for guaranteed supply of energy for the solar power systems provided by them.
- 5.30.6 Contractor shall engage the services of a separate specialist agency/manufacture for execution of solar power plants including design, engineering, sizing, selection & procurement

of equipment/material, installation, testing and commissioning of solar power plants. The agency shall be an established manufacturer/supplier of complete SPV power system and shall have adequate experience for carrying out similar SPV based solar power plants. The agency should have designed, supplied, installed and commissioned SPV power plants of cumulative installed capacity of 250 kWp or above, out of which at least one plant should be of 100 kWp capacity operating satisfactorily for more than one year. The agency shall be approved by PMC/Owner during detail engineering based on details furnished by contractor.

- 5.30.7 The PV solar panels shall be located on roof tops of substation switchgear room and transformer & capacitor bays away from the shadow area. The direction of solar panels shall be as per manufacturer recommendation. The PCU shall be located within the building in Air conditioned room.
- 5.30.8 Complete cabling including supply, laying and termination of cables, cable trays, material, hardware etc. within SPV power plant units and from power plant units to MV switchboards for export of solar power is in contractor scope.
- 5.30.9 For further requirements/details refer Specification for Solar PV System attached with the tender.

5.31 REQUIREMENT FOR AIR CONDITIONING

- 5.31.1 Vendor scope shall include sizing, design, engineering, manufacturing, supply, installation, testing and commissioning, packing and delivery at site of all the electrical equipments including supply of all commissioning spares, special tools and tackles as per the specifications and the datasheets attached or referred. The major electrical equipments for the package includes
 - 5.31.1.1 All MV motors
 - 5.31.1.2 Power distribution board - PDB (As per EIL specification 6-51-0012) for all motors and other load of the package, separate for each building (PDB shall be installed in AC Plant/ Package room, AHU room, as required).
 - 5.31.1.3 Supply, laying and termination of all power and control cabling for all package loads.
 - 5.31.1.4 Cable trays, as required for laying the cables for the motors/ loads.
 - 5.31.1.5 Local control panels/ local push button stations (as required).
 - 5.31.1.6 Earthing material as required for earthing for package equipments.
 - 5.31.1.7 Any other equipment not specifically mentioned above but required for normal operation of the package equipments.
- 5.31.2 PDB shall be single front, compartmentalized, and fixed type. PDB shall be suitable for 415V, 50Hz, TPN, 50 kA (1 sec.) with single bus, two SFU incomers (4 Pole) provided with manual transfer facility and mechanical interlocking between incomers.
- 5.31.3 The number of feeders in the PDB shall be as per the electrical loads of the respective building, where PDB is located. PDB for AC Plant room in shall also include feeders for downstream PDBs located in each AHU Room
- 5.31.4 All PDBs shall be suitable for TOP Cable entry. Minimum clear space of 1000mm shall be maintained in front of PDBs.
- 5.31.5 Incomer feeder shall be provided with voltmeter and ammeter. Incomer SFU shall be 4 Pole type. All motor & other feeders shall be provided with hardware as per the respective datasheets for same attached with the tender, however same shall be in fixed execution. Field ammeter shall be provided in LCS for motors above 55 kW.
- 5.31.6 Providing required interlocking between main PDB & sub PDB of A/C system of a particular building shall be in vendor scope.

- 5.31.7 For Air-conditioning, all blowers shall trip and all “Fire Dampers” shall automatically close on receipt of “Fail-safe FIRE signal” i.e. normally closed but open on Fire condition contact. CONTRACTOR shall take care of this contact in fire alarm system of building. Further distribution of fire signal to each vendor’s sub PDB in AHU room (for air-conditioning system) shall be in vendor’s scope.
- 5.31.8 All indicating lamps shall be LED type. LED for Space heater ‘ON’ indication shall be provided for all feeders.
- 5.31.9 20% spare outgoing feeder or minimum one of each type, whichever is higher shall be provided for each PDB
- 5.31.10 Control transformer shall be provided for each outgoing feeder module.
- 5.31.11 Required number of earth plate shall be provided within AC room, AHU room, and pressurization room. Further connection of individual equipments with earthing system shall be done by contractor. For earthing of various equipments upto earth plate, earthing schedule attached with the tender shall be followed
- 5.31.12 All the Electrical work of this package shall be carried-out as per EIL Standard Spec no. 6-51-0093 for package units.
- 5.31.13 Co-ordination required for lighting and fire alarm installation works for areas with false ceiling and/ or air-conditioning ducts is in scope of vendor.

5.32 REQUIREMENT FOR EOT CRANE

- 5.32.1 One EOT Crane for GIS hall of suitable capacity shall be provided for erection & maintenance of largest GIS component/assembly. The crane shall consist of all special requirements & lifting assemblies for erection & maintenance of GIS equipment.
- 5.32.2 The capacity of the crane shall be sized to lift the heaviest GIS switchgear component.
- 5.32.3 The Crane shall be used for the erection and maintenance of the GIS switchgear component and all parts installed in the GIS switchgear room. On completion of erection of the switchgear, the CONTRACTOR shall completely service the crane before the handing over to client.
- 5.32.4 For detailed specifications of EOT crane, refer elsewhere in the tender document.

5.33 FIRE PROOFING SYSTEM

- 5.33.1 The fire-proof sealing system and fire protection coating system are required to prevent the spreading of fire from one place to another (or one zone to another) through the openings in wall / floor, along cables laid in trays / racks and through openings below floor-mounted Electrical Switchgear, MCC, Distribution Boards, Junction boxes, Cabinets and Panels. The systems shall be installed in the specified locations in consultation with the purchaser’s engineer after all cables have been laid and terminated.
- 5.33.2 For further requirements/details refer Specification for Fire Proof Sealing System attached with the tender.

5.34 SYNCHRONISATION, CONTROL AND ANNUNCIATION PANEL (SCAP)

- 5.34.1 For the 220kV system covered under the scope of this tender hard wired control, metering and annunciation shall be provided on SCAP which shall be located in Main Substation MRSS-100 in P25 Area and same shall be of mosaic panel type. SCAP shall carry out the control, monitoring and annunciation functions including those of future incomers, which shall include but not be limited to the following
- 5.34.1.1 Control functions
- Control of all breakers (incomers, bus couplers, outgoing).
 - Tap changer control of Grid transformers
 - Auto/Manual synchronization of all incomers and bus couplers.

- ON/OFF control of all incomers, outgoing feeders and bus couplers including outdoor IBPs in outdoor switchyard.
- Manual Synchronization subsystem complete with running and incoming voltmeters, frequency meters, ON/OFF switch, check synchronizing and guard relays, switches, lamps and any other hardware as required.
- Manual Changeover of incomers & bus couplers.

5.34.1.2 Monitoring functions

- Voltage of incomers and buses.
- Current of each phase of incomers and bus couplers/section breakers
- Frequency of each incomer
- Power factor of each incomer
- MW, MVAR & MVA of each incomer and outgoing feeder.
- MWH, MVARH of each incomer
- Voltage and frequency recorder for each bus.
- Any other function, which is not mentioned but is essential for operation and safety of equipment and personnel.

5.34.1.3 Audio-visual annunciation Functions

Audio-visual annunciation shall be provided for monitoring the equipment, transformers, switchboard and other electrical equipment as a minimum, but shall not be limited to the following:

- Annunciation of Fault status of Breakers
- Operating and fault status of all protective relays and trip alarm of incomers, buscouplers, etc.
- Complete trip and non-trip alarm annunciation for all transformers including alarm of OLTC.
- Annunciation of all protective relays and trip alarms of all major electrical equipment in the substation
- Hooter and clock.

5.34.1.4 Status on mimic diagram

- ON/OFF/TRIP indications of all breakers
- Semaphore indicators for all circuit breakers, isolators and earth switches

5.34.1.5 Control And Operation Philosophy

- a) Switchboard shall have one local/remote control selector switch. When the switch is selected in local mode, the control will be done from GIS control cubicle.
 - It shall be possible to close any incomer and bus coupler/section breaker of GIS in test condition.
 - It shall be possible to close any of the outgoing breakers of GIS in service condition.
 - When selector switch is selected in remote mode, control shall be transferred to hard wired synchronizing panel (SCAP).
- b) Hard wired synchronizing panel (SCAP) shall be provided with the following selector switches for operation and control:
 - SW-1 3-position selector switch (SCAP/ OFF/ECS)
 - SW-2 4 position selector switches for each breaker to be synchronised (OFF/Dead bus/Manual synchronizing/Auto synchronizing)

- Incomers selector switches shall be provided on SCAP for selecting the incomers to be sync checked and closed.
- Contractor, based on the requirements of synchronizing scheme finalized shall decide quantities of these selector switches.
- Following operations shall be possible from SCAP:
 - Closing of all incomer breakers (in service position) and bus couplers/section breakers (in service position) on dead bus condition (bus coupler/ section breakers dead bus closing to be checked on either side).
 - Synchronizing and closing of selected incomer breakers (in service position) and bus couplers/ section breakers (in service position) through check synchronizing & auto synchroniser.
- Required interlocks for safe operation shall be provided.

5.35 ECS INTERFACE

- 5.35.1 All signals as per ECS IO List sheet attached elsewhere shall be provided in respective equipment for interface with the Electrical control system.
- 5.35.2 Number of analogue / digital IOs for ECS interface shall be worked out by the CONTRACTOR as per the ECS I/Os list attached.
- 5.35.3 CONTRACTOR to note that:
- 5.35.3.1 Acquisition of input/output (I/O) signals as hardwired or software:
- All numerical relays shall be connected to a substation automation system. ECS shall communicate with the substation automation system to acquire relay and metering status I/O signals of the relays. These I/O signals have been indicated as “relay and metering LAN” in the typical I/O list.
 - All other I/Os shall be acquired hardwired and have been indicated as “hardwired” in the typical I/O list.
 - In case any of these data cannot be acquired over the relay LAN, these signals have to be provided as hardwired. For requirement of numerical relays, refer Electrical part of contract document.
- 5.35.3.2 The I/O list is indicative only. Any other I/O required to meet the contract requirements shall be identified and provided by CONTRACTOR
- 5.35.3.3 Guidelines for ECS I/O Interface Design

Analogue Input Signals Signal transducers for hard-wired analogue inputs shall have accuracy class 0.1 for the range 0-120%. All transducers shall be externally-powered types. External power supply shall be 230V AC UPS.

For all measurements for I, V, MW, MVAR, Hz, obtained on the relay and metering LAN, maximum possible accuracy shall be ensured

Digital Input Signals

Alarm (D)

Alarm is a signal which requires operator to be alerted such as VT circuit MCB (closed, open), relays 86 & 95 (operated, reset), auto-changeover (blocked, not blocked), DC control supply (healthy, failed), line voltage (unhealthy, healthy), bus voltage (unhealthy, healthy), motor trip from process, under-voltage trip. This shall be hardwired / on relay LAN as specified.

For hardwired signal, potential free contacts of rating 1 A, 110V DC or 240 V AC, make to alarm (NO) preferred. CONTRACTOR shall specifically indicate if NC contact is being provided in place of NO

	contact.
	Generally a hardwired alarm point is put under "sequence of event" monitoring
Status (S)	For hardwired signal, potential free contacts of rating 1 A, 110V DC or 240 V AC, make to alarm (NO) required
Digital Output Signals	
Command (C)	Hardwired through potential free changeover type contact of interposing relay, contact rating 5 A, 240 V AC and/or 4 A, 110V DC. Coil rating shall be 24 V DC

6 MISCELLANEOUS REQUIREMENTS

- 6.1 Equipment numbering scheme for equipment located in Substation shall be as per Design Basis document. Numbering scheme for other equipments shall be decided during detailed engineering.
- 6.2 Power system study shall be carried out in latest version of ETAP software. Contractor shall furnish the native file of ETAP after carrying out the preliminary study (stage-1), intermediate study (stage-2) & final study (stage-3). Following study shall be done by contractor & report shall be submitted to EIL/owner for review/approval:
 - a. Load flow
 - b. Short circuit
 - c. Motor startup studies (Largest HV and MV motor shall be intimated during detail engineering.
 - d. Transient stability
 - e. Harmonic study
 - f. Relay co-ordination
 - g. Insulation co-ordination (*)
 - h. Transformer inrush current (*)

(*) If the study is not part of ETAP, contractor shall utilize other reputed industry proven software to conduct these studies. Operating & contingency conditions for carrying out power system study shall be informed during detailed engineering.
- 6.3 Wherever switchboards are provided with online temperature monitoring system, thermography window in cable chamber is not required.
- 6.4 CONTRACTOR shall furnish complete relay coordination and relay settings for the complete package including coordination with other EPCC CONTRACTOR/owner, relay settings for the upstream feeders.
- 6.5 Paint shade for indoor electrical equipment shall be RAL 7032, & for outdoor electrical equipment shall be RAL 7031.
- 6.6 Suitability of cable terminal boxes/chambers for the respective cables sizes / runs as per the approved cable schedule shall be ensured by the CONTRACTOR.
- 6.7 All nuts, bolts, washers, spring washers, grouting bolts, anchor fasteners, etc. necessary for completion of job wherever used shall be of stainless steel SS304. External hardware for lighting fixture, junction boxes, 230V receptacles, and lighting panel shall be of stainless steel grade SS304.
- 6.8 All lugs to be supplied shall be heavy duty, long barrel, crimping type and made of tinned copper. Sector shaped/circular barrel lugs shall be provided for making connections for cables having sector shaped/circular geometry of conductors respectively.

- 6.9 Cable tag shall be stainless steel with cable tag engraved. All spare holes at feeder end shall be sealed using metallic plate and GI hardware.
- 6.10 Cable glands shall be of nickel-plated brass. Cable glands shall be single compression type for indoor equipments & double compression type for outdoor equipments.
- 6.11 CONTRACTOR to note that 3D modelling of substation building and equipments shall be done by contractor in line modelling specification attached with tender. PDF/ Hard Copy of GA drawings of Owner's equipments to be installed in the substation shall be provided to CONTRACTOR during detail engineering
- 6.12 Wherever single core cables are to be terminated in switchboard, aluminum gland plates shall be provided.
- 6.13 All Emergency Stop/Stop pushbuttons on LCS/LCP/Switchboard shall be provided with protective covers to avoid accidental operation.
- 6.14 Contractor shall include painting and marking of all buses, individual incomers, all outgoing feeders etc. with detail such as Tag no., feeder rating, sending end source reference etc. for all switchboards.
- 6.15 All switchboards, panels, etc. shall be provided with LED indications and adequate no. of LEDs shall be provided to give required illumination.
- 6.16 All ACB fed motor feeders (>55kW), schematics shall have provision for auto start and auto re-acceleration with feature to inhibit irrespective of process/licensor's requirement. Reacceleration scheme for contactor fed motors (<=55kW) shall be provided by Contractor for all those drives requiring reacceleration as per Process requirements.
- 6.17 For owner supplied items, feeders at 415V/230V AC/ 110V DC/ 230V AC UPS voltage shall be provided by the contractor in the respective switchboard supplied by them. The details for same shall be provided during detailed engineering.
- 6.18 All the critical inputs must be wired in SAS/ECS for proper monitoring.
- 6.19 Armoured cables with double compression glands shall be used inside Battery Rooms along with FLP fittings/equipments.
- 6.20 Contractor / vendor shall comply with the requirements as per Ministry of Power (GoI)'s various orders regarding testing of all equipment, components & parts imported for use in the power supply system for cyber security to check for any kind of embedded malware/Trojans/cyber threat and for adherence to Indian Standards. Necessary testing of their equipment/ components at designated labs & obtaining test certificates in line with MOP orders shall be done by contractor/vendor
- 6.21 Color of HDPE duct for various application shall be as under :

Sr. No.	Application	Colour
1.	Fire Alarm System Data highway OFC cables	Fire Red
2.	Substation Automation system	Black with blue strips
3.	ECS System OFC Cables	Black with red strip for main data highway. Black with blue strip for redundant data highway.
4.	HDPE conduit for LAN line OFC	YELLOW conduit with BLACK strip
5.	HDPE conduit for Feeder differential protection System	GREEN conduit with WHITE strip

6.22 ADDITIONS / DELETIONS / MODIFICATIONS TO STANDARD SPECIFICATION

6.22.1 Specification for Earthing Installation (6-51-0084 Rev.4)

6.22.1.1 The last sentence of clause no.5.1 of 6-51-0084 stands modified as below:

“The Earth electrodes shall be so located such that inter distance/ mutual separation between two electrodes shall not be less than twice the driven depth, however in areas where there is physical limitation to meet the above separation, the mutual spacing can be reduced to a value not less than the driven depth of each electrode”.

6.22.2 Specification for Medium and High Voltage cables & accessories (6-51-0051 Rev.8)

6.22.2.1 Clause No. 5.1.6 (b) shall be read as below:

“Temperature index as per ASTM-D-2863 i.e. to determine at what temperature normal oxygen content of 21% in air will support combustion of FRLS sheath will remain as 250°C”.

6.22.2.2 Refer Cl. 6.3.1 and note that standard cable drum lengths for below mentioned cable sizes stands revised as mentioned below:

- Multi core power cables up to 50 sq.mm. – 2000 m
- Control cable of size up to 7x2.5 sq.mm. – 2000 m

6.22.2.3 The following point is added at the end of specification:

“For screen sizing calculations, final temperature to be considered shall be 200 °C under adiabatic conditions”.

6.22.3 Specification for Communication and Fire Alarm Cables (6-51-0052 Rev. 6)

The following clauses of 6-51-0052 stands modified as below:

6.22.3.1 Cl. 4.3.2 – For XLPE insulated PA/FA/Telephone/Paired Control Cables, insulation thickness (nominal values) shall be as per IS-7098 (Part-1).

6.22.3.2 Cl. No. 6.3 (d) - Temperature index as per ASTM-D-2863 i.e. to determine at what temperature normal oxygen content of 21% in air will support combustion of FRLS sheath shall remain as 250°C.

6.22.3.3 Cl. No. 7.3 – Standard cable drum lengths for below mentioned cable sizes stands revised as mentioned below:

- PA/FA/Signal cable having size up to 6 pair 1.5 & 2.5 sq.mm. – 2000 m
- PA/FA/Signal cable having size up to 10 pair 0.9 mm dia. – 2000 m

6.22.4 Specification for Uninterrupted Power Supply System (6-51-0017 Rev. 7)

6.22.4.1 The following is added at the end of Cl. No. 5.3.9 of specification:

“The efficiency of DC-DC Converter / Buck Boost Amplifier shall be considered in battery sizing calculations as well as rectifier sizing calculations and capacity of battery and rectifier shall be accordingly sized”.

6.22.5 Specification for Battery Charger (6-51-0019 Rev. 6)

6.22.5.1 The following is added at the end of Note-2 on Page 13 & 14 of specification:

“Battery isolator (MCCB/Switch Fuse) shall be provided with three pole version to ensure positive isolation of all the three connections of battery”.

6.22.6 Electrical Installation Standards 7-51-0201 Rev. 5, 7-51-0202 Rev. 5, 7-51-0221 Rev. 5 & 7-51-0233 Rev. 0

50 Dia. GI Pipe and 100 Dia. GI Pipe mentioned wherever in the standards shall be read as 50 NB (Medium Grade) GI Pipe and 100 NB (Medium Grade) GI Pipe respectively.

- 6.23 CONTRACTOR shall provide separate RCBO & MCB or separate ELCB & MCB for each lighting outgoing circuit at local lighting distribution panel. Common RCBO/ELCB + MCB unit is not acceptable. ELCB/RCBO shall be rated for 30mA in field and 300mA in indoors.
- 6.24 For wiring just above the false ceiling, METSEC channel shall be used. For wiring on true ceiling black enameled surface conduits shall be used.
- 6.25 All Copper Control cables shall be twisted paired (individual shielded and overall shielded) only. Minimum 10% spare pair or minimum 1 spare pair shall be provided.
- 6.26 All Multi-Function Meter (MFM) in HV & MV switchboards shall be communicable type. Complete data of MFM shall be accessible in the SAS (through switchboard level Ethernet switches) & associated SAS Laptop/ HMI. The protocol for communication shall be over RS-485 or fibre optic cable, preferably with IEC protocol. Accordingly, protocol convertors/gateways at suitable locations as required shall be provided by CONTRACTOR for data integration on IEC 61850 protocol from Master Ethernet switch to Owner's ECS system.

7 SPARES

- 7.1 Commissioning spares for all electrical equipments are included in Package Contractor's scope of supply and shall be included in the base price.
- 7.2 Mandatory Electrical spares as per document No. B269-999-16-50-SL-0020, are included in vendor's scope of supply.
- 7.3 Unit rates for two years recommended O&M spares along with list of recommended spares for each equipment provided as a part of this package, shall be provided by CONTRACTOR along with offer
- 7.4 Recommended list of maintenance spares for two years operation shall include the following as a minimum for motors. Vendor shall ensure to quote for the same.
- Bearing for DE/NDE-one set
 - Terminal box cover with screws
 - Fan
 - Terminal block

8 INSTALLATION, FIELD TESTING & COMMISSIONING AT SITE

- 8.1 Contractor shall carry out the installation, field testing and commissioning of all items including installation in field, testing and commissioning of free issue items in accordance with Consultant installation standard & standard specification attached with tender.
- 8.2 Contractor shall coordinate with manufacturers of other equipment wherever required and shall freely and readily supply all technical information for this purpose as and when called for.
- 8.3 Contractor shall comply with the requirements of Mechanical Completion as described in relevant section of Bid document.
- 8.4 Obtaining clearance for energizing the complete electrical facilities covered under this tender and approval of installation / drawings from central electrical inspector and any other concerned approving authority e.g. CCOE (PESO), OISD etc. shall be in the scope of the contractor.
- 8.5 Contractor shall also avail OEM (Original Equipment Manufacturer) services for testing and commissioning of equipment as listed elsewhere in the tender. However for other equipment, contractor shall ensure services of manufacturers' representatives for supervision of installation, testing and commissioning.
- 8.6 Testing and commissioning of all free issue relays for installation in Owner's sending/receiving end switchboard feeders, relay setting for all these feeders at site including supply, installation and testing of application software as required for numerical relays and Owner's laptop/ HMI

(of 220 kV, 66kV and 33kV / 6.6 kV / 415V) are included in the scope of vendor. Relay manufacturer shall be solely responsible for numerical relays integration, relay setting etc. for the complete switchboards.

- 8.7 Splicing of FO cable and taking over from cable laying contractor and glanding of same shall be in the scope of CONTRACTOR. OTDR test shall be done mandatorily after taking over from cable laying contractor.
- 8.8 Structural steel support shall be fabricated of rolled MS sections after shot blasting, welding, bolting, riveting, supply of necessary anchor bolts and grouting etc. including supply of paint and applying one coat of anti-rust primer and two finished coats of approved synthetic enamel paint (suitable for highly corrosive environment) as per painting specification attached with tender.
- 8.9 Cable support structure below the GIS shall NOT be fixed to the floor/ wall, instead shall be connected to GIS structure, to avoid this structure coming off the fixing during the short circuit.
- 8.10 Chequered plate shall be painted in accordance with painting specification 6-79-0020 enclosed elsewhere in the bid package.
- 8.11 HV cables being free issued by owner shall be made available at OWNER's warehouse. Transportation of cables from warehouse to site, laying and termination of cables including supply of all cable laying accessories, cable joints, cable termination kits, etc. is in scope of contractor.
- 8.12 Painting/ marking/ numbering of all buses of switchboards and each incoming/ outgoing feeder with details of tag number, feeder rating in front and rear of panel and all other equipments viz. transformers, lighting fixtures, FA devices, junction boxes, motors, welding receptacles, convenience receptacles, local control stations, etc. shall be done as per requirement of Engineer-in-charge at site.

9 INSPECTION AND TESTING AT MANUFACTURER'S WORKS

- 9.1 All major electrical equipment and material shall be subject to inspection by owner/ Consultant or authorized representative at manufacturers' works. Contractor/Vendor/ Sub-Vendor shall furnish all necessary information concerning the supply to owner/ Consultant.
- 9.2 During fabrication, all the equipment shall be subject to inspection by owner/Consultant or by an agency authorized by the owner to assess the progress of work as well as to ascertain that only quality raw material is used.
- 9.3 Type, routine and acceptance tests to be conducted on all equipment shall include all tests as specified in standard specifications & data sheets enclosed with the package.
- 9.4 Contractor shall ensure that the electrical equipment procured have type test certificates.
- 9.5 All routine and acceptance tests as specified by the applicable standards shall be carried out by the contractor/vendor/sub-vendor and these tests shall be witnessed by owner/ Consultant or an agency authorized by owner/ Consultant Any other test and quality assurance requirements as defined elsewhere in the package shall also be complied.
- 9.6 All the equipment offered shall have valid type test certificates of recognized testing house such as CPRI, CMRI, PTB, BASEEFA, UL or equivalent.
- 9.7 Wherever, EIL Inspection and test plan is not available for electrical equipments e.g. Solar rooftop photovoltaic system, etc., CONTRACTOR/ Supplier shall develop QAPs using the specific requirements of Inspection and testing as covered in the tender. The QAPs are required to be reviewed and approved by EIL/Owner.

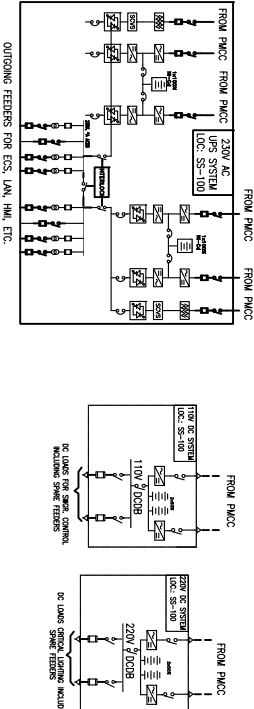
10 STATUTORY APPROVAL OF WORKS

- 10.1 The contractor shall obtain approvals from the concerned electrical inspectorate for installation drawings and engineering of the electrical system and equipment covered under the contractor's scope. Any modification or additional requirements of the electrical inspectorate shall have to be carried out by the contractor at his own cost without affecting time schedule. Arranging for any other approvals required for the complex, from agencies such as CCOE, CEA etc. are included in the contractor's scope. For electrical equipment to be installed in hazardous area, statutory approval certificates shall be furnished by the contractor. Any additional testing, if required, shall be carried out by the contractor without affecting project time schedule at no extra cost to Owner.
- 10.2 The inspection and acceptance of the work as above shall not absolve the Contractor from any of his responsibilities under this package. Obtaining clearance for energizing the complete electrical facilities covered under this tender, and approval of installation and drawings from the Chief Electrical Inspectorate/CEA/HVPLN/Power Supply Company shall be the responsibility of the contractor.

11 MAKES OF EQUIPMENT AND COMPONENTS

- 11.1 List of approved vendors for Electrical equipment/components is as mentioned elsewhere in the Master Vendor List, attached with the tender.
- 11.2 All electrical equipment shall be brand new with state of art technology and proven track record. No prototype shall be offered. The make and type of equipment, if not specified in this bid document, shall be subject to approval of owner/ Consultant.
- 11.3 Additional makes of imported items shall be subject to Owner/Consultant's approval during detailed engineering.
- 11.4 Vendor may procure material from any of the listed vendors. However current validity and range of approval as per Consultant enlistment letter, workload, stability and solvency need to be verified by the vendor before placement of order.
- 11.5 Vendor shall ensure the availability of spare parts and maintenance support services for the offered equipment at least for 10 years from the date of supply. Vendor/ sub-vendor shall give a notice of at least one year to the end user of equipment and PMC before phasing out the products/spares to enable the end user for placement of order for spares and services.

LOC : EXISTING REFINERY AREA

[illegible]

	EM/PM CIRCUIT BREAKER		RECTIFIER/CHARGER
	AIR CIRCUIT BREAKER		INVERTER
	NEUTRAL GROUNDING RESISTOR		STATIC SWITCH
	TRANSFORMER		BATTERIES
	GAS/AIR INSULATED BUSDUCT		CONTACTOR
	BUSBAR		DRAWOUT FEATURE
	FUSE		CABLE CLAMP TERMINATION
	ON LOAD ISOLATOR/FEEDER DUTY SWITCH		MOTOR PROTECTION RELAY
	VACUUM CIRCUIT BREAKER		SYNCHRONOUS TIME
	EARTH LEAKAGE CIRCUIT BREAKER		

FL	INTERLOCK
AM	AUTO/MANUAL
	PUSH BUTTON STATION WITH AMMETER
B	PUSH BUTTON STATION
	POTENTIAL TRANSFORMER
C	CAPACITOR BANK
	TRANSFORMER TAP (BREAK GLASS TYPE)
	CURRENT TRANSFORMER
	MULTI FUNCTION METER
	CBCT
	EARTH LEAKAGE RELAY
	3 POSITION MOTORISED ISOLATOR FOR GIS
	2 POSITION MOTORISED ISOLATOR FOR GIS
	HIGH SPEED EARTH SWITCH

**पुणेकरांची
सुविधा निमित्त
पुणेकरांची
सुविधा निमित्त**

**PIONEERS
NDA LIMITED**

(A Govt. of India Undertaking)

INDIAN OIL CORPORATION LTD

PANIPAT REFINERY EXPANSION PROJECT(P-25)

OVERALL SINGLE LINE DIAGRAM

NTS	B	2	6	9	9	9	9	1	6	5	0	0	0	2	0	0	D

3-1641-0500 REV.2 AO-1189 x 841

Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE	
Unit	COMMON		Location	Job No.	B269	Unit No. 999
PURCHASER'S DATA						
A.	Site Conditions					
1.	Maximum Ambient Temperature		°C	50		
2.	Minimum Ambient Temperature		°C	5		
3.	Design Ambient Temperature		°C	45		
4.	Relative Humidity		%	90		
5.	Altitude Above MSL		mm	1000		
6.	Environment		Hot, Humid & Corrosive			
B.	Operating Conditions					
1.	Voltage		kV	6.6 +/- 10 %		
2.	Frequency		Hz	50 +/- 3 %		
3.	No of phases		Three			
4.	System fault level		kA	40		
5.	System earthing		Resistance Earthing			
6.	Auxiliary supply					
	AC		V	240 +/- 5 %		
	DC		V	110 +15% /- 10 %		
C.	Electrical Data					
1.	Busbar current rating (inside panel at design temp.)			As per Job Specification		
2.	1 sec. Short Circuit withstand capacity		kA	40		
3.	System Breaking capacity		kA	40		
	% D.C. Component			As per IEC		
4.	System making capacity		kA(peak)	100		
5.	Type of Circuit Breaker		VCB			
	Shunt Trip Coil-1 :		V	110 DC		
	Shunt Trip Coil-2 :		V	230V AC (Refer Note-2)		
6.	Duty Cycle of C.B.		O-3min-CO-3min-CO			
7.	Suitability for Cap. Switching		Required			
8.	Surge supressor for all Feeders		Yes			
9.	Provision of earthing					
	Earthing truck		Required			
	Earthing switch		Not Required			
D.	Miscellaneous					
1.	Interface with ECS			Required		
2.	Incoming Power Entry			Cable/Bus Duct		
3.	Cable Entry			Bottom		
4.	Separate bolted removable gland palte for cable entry			Reqd.(Gland Plate Drilled at side)		
5.	Cable glands and lugs for cable termination			Refer Job Specification		
6.	Paint shade			RAL-7032		
7.	Windows at the rear side of panels for thermography			Not Required		
MANUFACTURER'S DATA						
A.	Switchboards					
1.	Make					
B	13-SEP-2021	ISSUED WITH MR/TENDER	V V S N MURTY	ANIL KUMAR GARHWAL	HARISH KUMAR	
A	27-APR-2020	ISSUED WITH MR/TENDER	JAYENDRA L CHAUHAN	HARISH KUMAR	HARISH KUMAR	
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By	

Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE	
Unit	COMMON	Location	Job No.	B269	Unit No.	999
2.	Type designation					
3.	Degree of protection					
4.	Max. overall weight of C.B. panel	Kg				
5.	Overall dimensions of C.B. panel					
	Width	mm				
	Depth	mm				
	Height	mm				
6.	Overall dimensions of dummy /gland palte for cable entry					
	Width	mm				
	Depth	mm				
	Height	mm				
7.	Overall weight and dimensions of largest shipping section					
	Weight	Kg				
	Width	mm				
	Depth	mm				
	Height	mm				
8.	Overall dimensions of each swbd. including all dummy/adaptor/rear extension panels					
	Width	mm				
	Depth	mm				
	Height	mm				
9.	Recommended clearances					
	Front	mm				
	Rear	mm				
	Above	mm				
10.	Shock loading on foundation					
11.	Max. size/no. of cables that can be terminated inside the panel					
	without rear extension panel					
	with rear extension panel					
	size of rear extension panel					
12.	Clearance in air					
	Phase to Phase (min.)	mm				
	Phase to Earth (min.)	mm				
13.	Busbar current rating at design ambient temperature	A				
14.	Busbar (separately for each swbd)					
	(a).Horizontal main busbar size (No. of flats x size of each flat)					
	(b).Horizontal main busbar size as tested at CPRI for full short ckt					
	withstand as per specification requirement (No. of flats x size of each flat)					
	(c).Vertical dropper size (No. of flats x size of each flat)					
15.	Horizontal main busbar/Vertical busbar material					
16.	Insulating material (Busbar supports)					
17.	Earth busbar size					
18.	Earth busbar material					
19.	1 min. power frequency withstand voltage (rms	kV				
	Over voltage factor for PTs					
20.	Impuse withsatnd voltage (peak)	kV				
B	13-SEP-2021	ISSUED WITH MR/TENDER	V V S N MURTY	ANIL KUMAR GARHWAL	HARISH KUMAR	
A	27-APR-2020	ISSUED WITH MR/TENDER	JAYENDRA L CHAUHAN	HARISH KUMAR	HARISH KUMAR	
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By	

Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE	
Unit	COMMON	Location		Job No.	B269	Unit No. 999
	Wave shape of impulse voltage					
21.	1 sec. short ckt. Withstand capacity		kA			
22.	Peak dynamic withstand capacity		kA			
23.	Safety Features					
	(a).Heat shrinkable sleeves, rated to withstand the system line to line voltage for one min., provided on busbar					
	(b).Removable FRP shrouds for all busbar joints and tap-off connections provided					
	(c).Arc propagation barrier in busbar compartment provided					
	(d).Breaker service, test and drawn-out position provided					
	(e).Distinct overall lockable door for breaker compartment provided					
	(f).Automatic safety shutter provided					
	(g).Independent pressure release flaps provided for all HV compartments					
	(h).Wire mesh for all louvered openings provided					
	(i).Suitable interlocks to prevent faulty operation as per Cl. 4.4.10 of spec. 6-51-0001 provided					
	B. Circuit Breaker					
1.	Type					
	2nd shunt trip coil for VFD feeders					
2.	Make					
3.	Type Designation					
4.	Circuit Breaker mounting in panel					
5.	No. of poles/phase					
6.	Current rating (in free air)		A			
7.	Current rating inside the panel at specified design temperature		A			
8.	Short time rating (1sec.)		kA			
9.	Symmetrical breaking capacity		kA			
9.1	% D.C. Component					
10.	Peak making current		kA			
11.	1 min. dry withstand voltage (power frequency)		kV			
12.	Duty Cycle					
13.	Total opening time		m sec.			
14.	Total closing time		m sec.			
15.	Power required for opening		W/VA			
16.	Power required for closing		W/VA			
17.	Power required for spring charging motor		W/VA			
18.	Breaker is trip free					
19.	Closing mechanism					
20.	Provision of manual spring charging provided					
21.	Mechanical Trip PB provided					
B	13-SEP-2021	ISSUED WITH MR/TENDER	V V S N MURTY	ANIL KUMAR GARHWAL	HARISH KUMAR	
A	27-APR-2020	ISSUED WITH MR/TENDER	JAYENDRA L CHAUHAN	HARISH KUMAR	HARISH KUMAR	
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By	

Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE
Unit	COMMON	Location		Job No.	B269
				Unit No.	999
22.	Mech. On/Off indicator provided				
23.	Operation counter provided				
24.	Time taken for spring charging	sec.			
25.	No. of aux. contacts and their current ratings				
26.	Interrupter				
	(a).Make				
	(b).Pressure switch for monitoring of SF6 gas pressure provided				
	(c).Re-filling arrangement of SF6				
27.	LOTO (Lock-Out Tag-Out) Provision for mechanical locking arrangement				
28.	Suppressor				
	Type designation				
	Make				
27.	Derating reqd. for Cap. Switching				
29.	Earthing System				
30.	Copies of following test certificates enclosed				
	For each type of offered circuit breaker panel with breake				
	(a).Short Circuit tests (Peak and 1 sec.withstand)				
	(b).Heat run test				
	(c).Internal arc test				
	(d).Impulse and power freq. withstand				
	For each type of offered circuit breaker (in panel)				
	(a).Short Circuit test duties				

Eil Notes

- Vendor shall furnish the dimensions of various types/ratings of swbds., CB panels and dummy/adaptor panels separately.
- For all HV Circuit Breakers feeding HV VFDs, two nos. trip coil shall be provided. 1no. trip coil shall operate on 110V DC supply and other trip coil shall operate on 230V AC UPS supply.
- All offered switchboards shall have IAC rating of AFLR 40 kA for 0.2 Sec.
- Variation/ Clarification against the standard specification for HV switchboards 6-51-0001, shall be as per the MoU agreed with EIL by respective HV switchboard manufacturer. No further deviations to tender requirements shall be entertained.

B	13-SEP-2021	ISSUED WITH MR/TENDER	V V S N MURTY	ANIL KUMAR GARHWAL	HARISH KUMAR
A	27-APR-2020	ISSUED WITH MR/TENDER	JAYENDRA L CHAUHAN	HARISH KUMAR	HARISH KUMAR
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE
Unit	COMMON	Location		Job No.	B269
				Unit No.	999

PURCHASER'S DATA					
A. Site Conditions					
1. Maximum Ambient Temperature	°C	50			
2. Minimum Ambient Temperature	°C	5			
3. Design Ambient Temperature	°C	45			
4. Relative Humidity	%	90			
5. Altitude Above MSL	m	1000			
6. Environment	Hot, Humid & Corrosive				
B. Operating Condition					
1. Voltage	6.6 kV ± 10 % TP				
2. Frequency	50 Hz ± 3 %				
3. No. of Phases	Three				
4. System Fault level	kA	40			
5. System earthing	Resistance earthed				
6. Auxillary supply AC	240 V ± 10 %				
C. Busduct Details					
1. Rated Voltage	6.6 kV ± 10 %				
2. Current Rating	A	Refer Job Specification			
3. Short circuit rating	kA	Refer Job Specification			
4. Type	TP Phase segregated				
5. Location	Outdoor/Indoor				
6. Wall frame assembly with seal off bushings and bus conductors	Required				
7. Paint shade of enclosure	RAL 7031 Outdoor, RAL 7032 Indoor				
8. Space heater and breather with silica gel in bus duct	Required				
9. Supporting arrangement of busduct	Required				
MANUFACTURER'S DATA					
1. Make					
2. Current rating					
3. Short circuit rating					
4. Type					
5. Degree of protection					
6. canopy of outdoor busduct					
7. Busbar details					
a. Busbar Material					
b. Busbar size (No. of flats x size of each flat)	mm ²				
c. Busbar size as tested at CPRI for full short ckt withstand(No. of flats x size of each flat)	mm ²				
d. Busbar insulator					
i. Type					
ii. Tracking index					
e. Clearance					
i. Phase to phase	mm				
ii. Phase to earth	mm				
f. Flexibles	Size/Qty				
g. Earth bus material/size					

B	08-SEP-2021	ISSUED WITH MR/TENDER	V V S N MURTY	ANIL KUMAR GARHWAL	HARISH KUMAR
A	12-MAY-2020	ISSUED WITH MR/TENDER	JAYENDRA L CHAUHAN	HARISH KUMAR	HARISH KUMAR
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

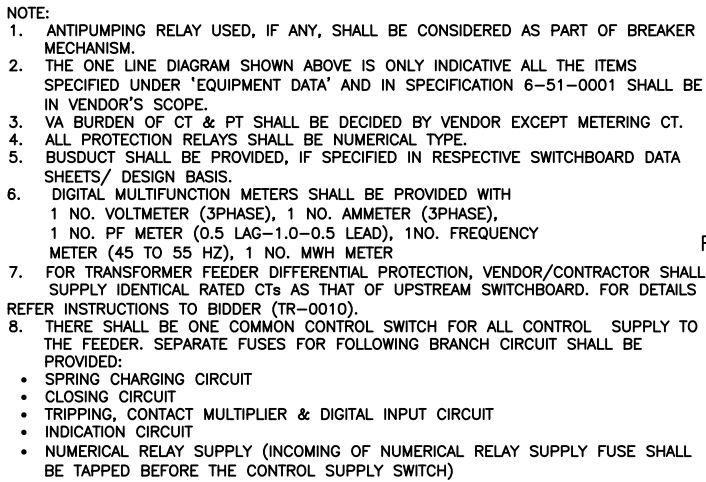
Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE
Unit	COMMON	Location		Job No.	B269
				Unit No.	999
h.	Heat shrinkable sleeves rated to withstand the system line to line voltage for 1 min provided				
i.	Removable FRP shrouds for all busbars joints provided				
8.	Space heater provided				
9.	Overall dimensions(LxBxH)				
10.	Weight of each section of busduct				
11.	Type test certificates				
	Short ckt(Peak & 1 sec withstand)				
	Temperature rise				
	Voltage withstandability				

Eil Notes

- Bus duct offered shall be of proven design and shall have been successfully type tested.Type test certificates for an exactly identical design of offered bus duct shall be furnished by bidders.
- Rubber bellows shall not used for alignment /adjustments.

B	08-SEP-2021	ISSUED WITH MR/TENDER	V V S N MURTY	ANIL KUMAR GARHWAL	HARISH KUMAR
A	12-MAY-2020	ISSUED WITH MR/TENDER	JAYENDRA L CHAUHAN	HARISH KUMAR	HARISH KUMAR
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

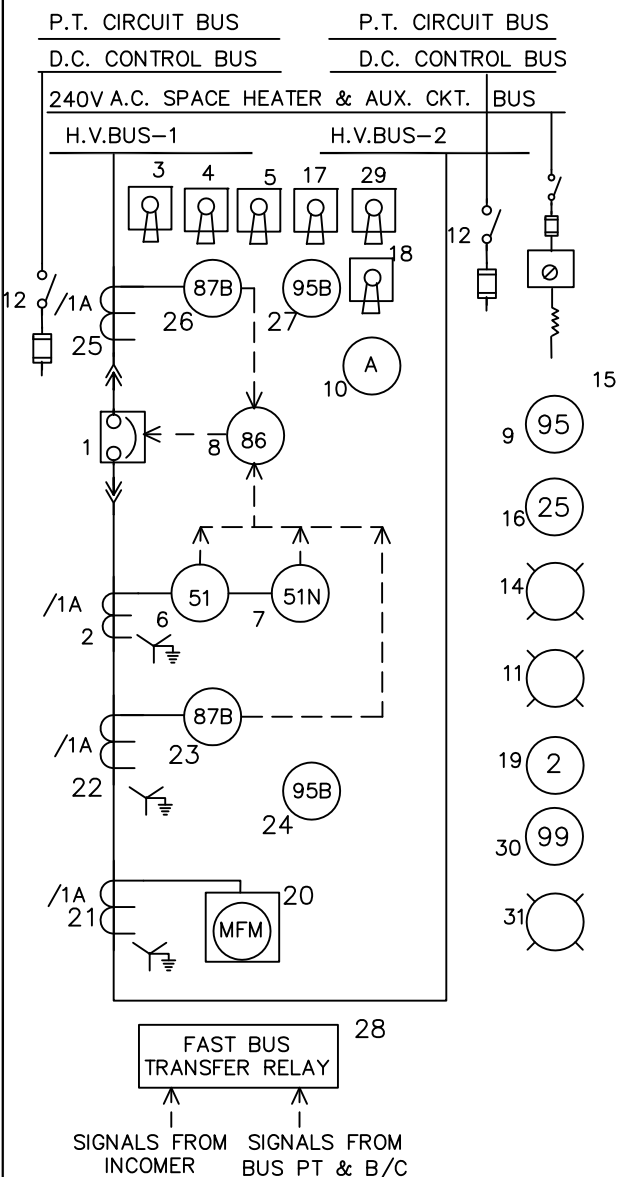
PROJECT: PANIPAT REFINERY EXPANSION(P-25) CLIENT: M/S IOCL	REV.	DATE	PURPOSE	BY	CHKD	APPD.
	A	05.05.2020	ISSUED WITH MR/TENDER	JLC	HK	HK
	B	13.09.2021	ISSUED WITH MR/TENDER	SNM	AKG/RSR	HK



EQUIPMENT DATA			
ITEM NO.	NEMA NO.	QTY.	DESCRIPTION
1	52	1	CIRCUIT BREAKER
2	—	3	TRANSF. DIFF. C.T. CI.—PS
3	—	3	METERING/PROTECTION C.T. CI.—5P10
4A	—	3	PROTECTION C.T. FOR REF PROT. CI.—PS
4B	—	3	PROTECTION C.T. FOR 87B PROT. CI.—PS
5	52 C/S	1	BKR. CONTROL SW. CLOSE—NEUTRAL—TRIP (LOCKABLE WITH SPRING RETURN TO NEUTRAL)
6	51	2	IDMTL O/C RELAY (50—200%)
7	51N	1	IDMTL E/F RELAY (10—40%)
8a	64R	1	INST. E/F RELAY (WITH STABILISING RESISTOR) (10—40%)
8b	51G	1	IDMTL O/C RELAY (20—80%)
9	—	3	METERING CT CLASS 1.0, 15VA
10	86	1	TRIPPING RELAY (ELECTRO MECHANICAL)
11	95	1	TRIP CKT. SUPERVISION RELAY
12	95B	1	
	—	3	Y/Y CONNECTED, CI.—1, P.T. WITH $\frac{110V}{\sqrt{3}}$ SECONDARY WITH PRIMARY FUSE
13	27U	3	U/V RELAY (40—80%)
14	2	1	TIME DELAY ON PICK UP TIMER 0.5—5.0 SEC.
14a	2	1	TIME DELAY ON DROP—OFF TIMER 0.5—5.0 SEC.
15	—	1	VOLTMETER (3PHASE)
16	—	1	AMMETER (3PHASE)
17	—	1	PF METER 0.5LAG—1.0—0.5LEAD
18	—	1	FREQUENCY METER 45 TO 55Hz
19	—	1	MWH METER
20	—	AS REQD.	AUX. RELAY
21	—	1	CUBICLE LAMP WITH SWITCH & FUSE
22	—	1	D.P. SWITCH 10A WITH FUSE FOR D.C. CONTROL SUPPLY
23	—	AS REQD.	CLUSTER LED TYPE INDICATING LAMP
24	—	1	4 POLE MCB 10A.
25	—	1	PANEL SPACE HEATER WITH SWITCH, FUSE AND THERMOSTAT.
26	—	1	UPSTREAM BREAKER TRIP SWITCH (2 POSITION)(STAYPUT & LOCKABLE)
27	—	3	CLUSTER LED TYPE IND. LAMP (TRAFO. TROUBLE, UP STREAM BREAKER ON/OFF)
28	87T+F	1	TRAFO. DIFFERENTIAL RELAY WITH STABILISING RESISTOR AND METROSIL(NOTE—7)
29	—	1	MVAH METER
30	—	1	MVAR METER
31	—	1	MVA METER
32	—	1	MWH METER
33	25	1	SYNCH. CHECK RELAY
34	—	1	DIGITAL MUTLIFUNCTION METER
35	—	1	LOCAL/ECS SELECTOR SWITCH

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PROJECT: PANIPAT REFINERY EXPANSION(P-25)	REV	DATE	PURPOSE	BY	CHKD	APPD
CLIENT: M/S IOCL	A	05.05.2020	ISSUED WITH MR/TENDER	JLC	HK	HK
	B	13.09.2021	ISSUED WITH MR/TENDER	SNM	AKG/RSR	HK



- R1 PART OF NUMERICAL RELAY-1
R2 PART OF NUMERICAL RELAY-2
R3 PART OF NUMERICAL RELAY-3
R4 PART OF NUMERICAL RELAY-4

- NOTE:
1. ANTIPUMPING RELAY USED, IF ANY, SHALL BE CONSIDERED AS PART OF BREAKER MECHANISM.
 2. THE ONE LINE DIAGRAM SHOWN ABOVE IS ONLY INDICATIVE. ALL THE ITEMS SPECIFIED UNDER "EQUIPMENT DATA" AND IN SPECIFICATION 6-51-0001 SHALL BE IN VENDOR'S SCOPE.
 3. A-I-M AND TRIP A-T-B SELECTOR SWITCHES SHALL BE PROVIDED IF AUTO TRANSFER REQUIREMENT IS SPECIFIED IN RESPECTIVE SWITCHBOARD DATASHEET.
 4. ALL PROTECTION RELAY SHALL BE NUMERICAL TYPE
 5. VA BURDEN OF CT SHALL BE DECIDED BY VENDOR.
 6. DIGITAL MULTIFUNCTION METERS SHALL BE PROVIDED WITH 1 NO. AMMETER (3PHASE).
 7. MANUAL BYPASS FEATURE SHALL BE PROVIDED FOR BUS DIFFERENTIAL FOR BOTH BUS SECTIONS INDEPENDENTLY.
 8. THERE SHALL BE ONE COMMON CONTROL SWITCH FOR ALL CONTROL SUPPLY FEEDER. SEPARATE FUSES FOR FOLLOWING BRANCH CIRCUIT SHALL BE PROVIDED:
 - SPRING CHARGING CIRCUIT
 - CLOSING CIRCUIT
 - TRIPPING, CONTACT MULTIPLIER & DIGITAL INPUT CIRCUIT
 - INDICATION CIRCUIT
 - NUMERICAL RELAY SUPPLY (INCOMING OF NUMERICAL RELAY SUPPLY FUSE SHALL BE TAPPED BEFORE THE CONTROL SUPPLY SWITCH)

EQUIPMENT DATA			
ITEM NO	NEMA NO.	QTY.	DESCRIPTION
1	52	1	CIRCUIT BREAKER
2	-	3	METERING / PROTECTION C.T. CI.-1/5P10
3	-	1	BREAKER CONTROL SWITCH CLOSE-NEUTRAL TRIP (SPRING RETURN TO NEUTRAL)
4	-	1	AUTO-IND-MANUAL SELECTOR SWITCH (STAYPUT & LOCKABLE)
5	-	1	3 POSITION SW. FOR TRIP BKR.-A/TRIP TIE/ TRIP BKR.-B (STAYPUT & LOCKABLE)
6	51	2	IDMTL O/C RELAY (50-200%) OR APPD. EQUIV.
7	51N	1	IDMTL E/F RELAY (10-40%)
8	86	1	TRIPPING RELAY (ELECTRO MECHANICAL)
9	95	1	TRIP CKT. SUPERVISION RELAY
10	95B	1	AMMETER (3 PHASE)
11	-	1	CUBICLE LAMP WITH SWITCH AND FUSE
12	-	2	DP SWITCH 10A WITH FUSE FOR D.C. CONTROL SUPPLY (NOTE-8)
13	-	AS REQD.	AUX. RELAY
14	-	AS REQD.	CLUSTER LED TYPE INDICATING LAMP
15	-	1	PANEL SPACE HEATER WITH SWITCH FUSE & THERMOSTAT
16	25	1	SYNCH.CHECK RELAY
17	-	1	32A/63A DC CONTROL SUPPLY CHANGEOVER SWITCH(4 POSITION)
18	-	1	32A AC CONTROL SUPPLY CHANGEOVER SWITCH (4 POSITION)
19	2	AS REQD.	ON/OFF DELAY TIMER
20	-	1	DIGITAL MULTIFUNCTION METER
21	-	3	METERING CT CLASS 1.0
22	-	3	PROTECTION C.T. FOR 87B PROT. CI.-PS
23	87B	1	HIGH IMPEDANCE BUSBAR DIFF. PROTECTION RELAY ALONG WITH CT SUPERVISION RELAY FOR COMPLETE BUS SECTION (NOTE-7)
24	95B	1	BUS WIRE SUPERVISION RELAY FOR COMPLETE BUS SECTION
25	-	3	PROTECTION C.T. FOR 87B PROT. CI.-PS
26	87B	1	HIGH IMPEDANCE BUSBAR DIFF. PROTECTION RELAY ALONG WITH CT SUPERVISION RELAY FOR COMPLETE BUS SECTION (NOTE-7)
27	95B	1	BUS WIRE SUPERVISION RELAY FOR COMPLETE BUS SECTION
28	-	1	FAST BUS TRANSFER RELAY ALONG WITH ALL OTHER ACCESSORIES AS REQUIRED
29	-	1	LOCAL/ECS SELECTOR SWITCH
30	-	1	CLOSING CIRCUIT SUPERVISION
31	-	1	CLOSING CKT. HEALTHY INDICATION LAMP LAMP(LED TYPE)



ENGINEERS INDIA LIMITED
NEW DELHI

TECHNICAL AMENDMENT NO. 01

6.6KV SWITCHBOARD HARDWARE DATASHEET FOR BUSCOUPLER WITH FAST BUS TRANSFER

DATA SHEET

REV

B269-999-16-50-DS-0005

SHT 1 OF 103

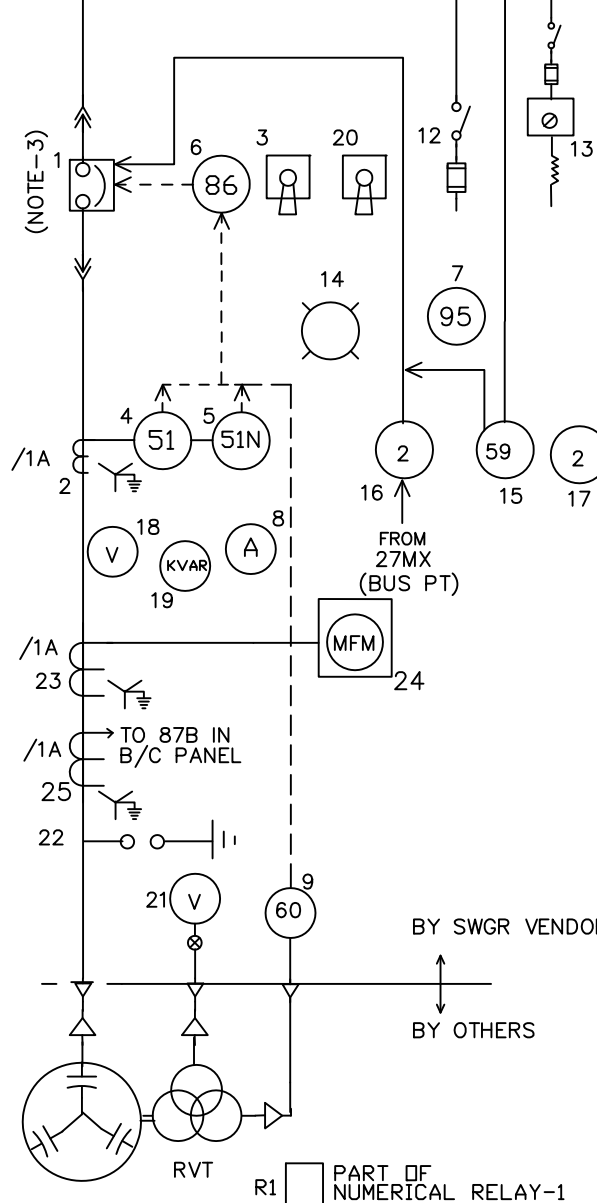
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REV	DATE	PURPOSE	BY	CHKD	APPD
A	05.05.2020	ISSUED WITH MR/TENDER	JLC	HK	HK
B	13.09.2021	ISSUED WITH MR/TENDER	SNM	AKG/RSR	HK

PROJECT: PANIPAT REFINERY EXPANSION(P-25)
CLIENT: M/S IOCL

PT CIRCUIT BUS
DC CONTROL BUS
240V A.C. SPACE HEATER & AUX. CKT. BUS
HV BUS



EQUIPMENT DATA			
ITEM NO.	NEMA NO.	QTY.	DESCRIPTION
1	52	1	CIRCUIT BREAKER
2	-	3	METERING / PROTECTION CT CL.-1/5P10
3	-	1	BREAKER CONTROL SW. CLOSE-NEUTRAL-TRIP (SPRING RETURN TO NEUTRAL)
4	51	2	IDMTL O/C RELAY (50-200%)
5	51N	1	IDMTL E/F RELAY (10-40%)
6	86	1	TRIPPING RELAY (VAJH TYPE)
7	95	1	TRIP CKT. SUPERVISION RELAY
8	-	1	AMMETER (3 PHASE)
9	60	1	NEUTRAL DISPLACEMENT RELAY
10	-	AS REQD	AUX. RELAY
11	-	1	CUBICLE LAMP (CFL) WITH SWITCH AND FUSE
12	-	1	DP SWITCH 10A WITH FUSE FOR DC CONTROL SUPPLY
13	-	1	PANEL SPACE HEATER WITH SWITCH FUSE AND THERMOSTAT
14	-	AS REQD	CLUSTER LED TYPE INDICATING LAMP
15	59	1	DEFINITE TIME OVER VOLTAGE RELAY (105-170%, 0-5 SEC.)
16	2	1	TIMER ON DELAY TYPE (0.5-5 SEC)
17	2	1	ON DELAY TIMER (0-600SEC) FOR CLOSING INTERLOCK
18	-	1	VOLTMETER (3 PHASE)
19	-	1	KVAR METER
20	-	1	LOCAL/ECS SELECTOR SWITCH
21	-	1	VOLTMETER WITH SELECTOR SWITCH 3-WAY AND OFF.
22	-	1SET	METAL OXIDE TYPE SURGE SUPPRESSOR
23	-	3	METERING CT CLASS 1.0, 15VA
24	-	1	DIGITAL MUTLIFUNCTION METER
25	-	3	PROTECTION C.T. FOR 87B PROT. CL.-PS

- NOTES:
1. ANTIPUMPING RELAY USED, IF ANY, SHALL BE CONSIDERED AS PART OF BREAKER MECHANISM.
 2. THE ONE LINE DIAGRAM SHOWN ABOVE IS ONLY INDICATIVE . ALL THE ITEMS SPECIFIED UNDER "EQUIPMENT DATA" AND IN SPECIFICATION 6-51-0001 SHALL BE IN VENDOR'S SCOPE.
 3. CIRCUIT BREAKER SHALL BE SUITABLE FOR CAPACITOR SWITCHING DUTY.
 4. ALL PROTECTION RELAYS SHALL BE NUMERICAL TYPE.
 5. METERING AS SHOWN SHALL BE PART OF NUMERICAL RELAY.
 6. VA BURDEN OF CT SHALL BE DECIDED BY VENDOR EXCEPT METERING CT.
 7. DIGITAL MULTIFUNCTION METERS SHALL BE PROVIDED WITH 1 NO. AMMETER (3PHASE), 1 NO. MVAR METER, 1 NO. VOLTMETER (3PHASE).
 8. THERE SHALL BE ONE COMMON CONTROL SWITCH FOR ALL CONTROL SUPPLY TO THE FEEDER. SEPARATE FUSES FOR FOLLOWING BRANCH CIRCUIT SHALL BE PROVIDED:
 - SPRING CHARGING CIRCUIT
 - CLOSING CIRCUIT
 - TRIPPING, CONTACT MULTIPLIER & DIGITAL INPUT CIRCUIT
 - INDICATION CIRCUIT
 - NUMERICAL RELAY SUPPLY (INCOMING OF NUMERICAL RELAY SUPPLY FUSE SHALL BE TAPPED BEFORE THE CONTROL SUPPLY SWITCH)
 - CONTACTS FOR VOLTAGE/CURRENT FOR INTERFACE WITH APFC SHALL BE PROVIDE:
 - INCOMER: LPT VOLTAGE AND CURRENT
 - BUSCOUPLER: BPT VOLTAGE AND CURRENT



ENGINEERS INDIA LIMITED
NEW DELHI

TECHNICAL AMENDMENT NO. 01

6.6KV SWITCHBOARD
HARDWARE DATASHEET FOR
CAPACITOR FEEDER

DATA SHEET

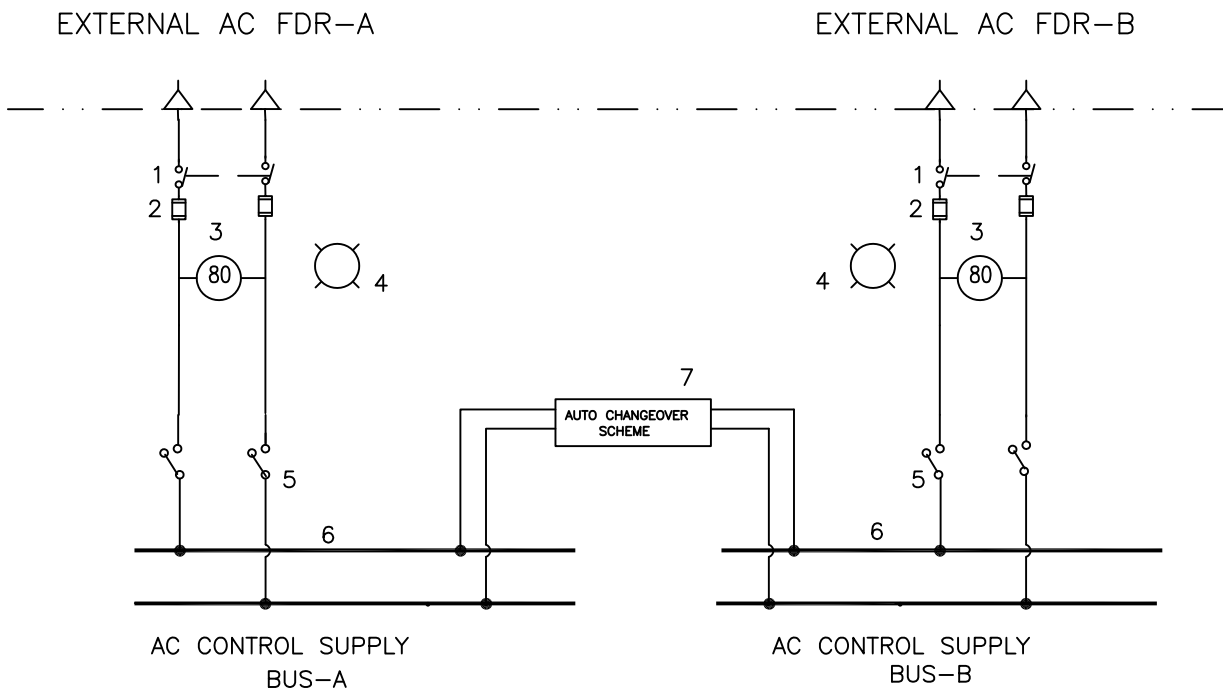
REV

B269-999-16-50-DS-0008
SHT 1 OF 105

B

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PROJECT: PANIPAT REFINERY EXPANSION(P-25) CLIENT: M/S IOCL	REV	DATE	PURPOSE	BY	CHKD	APPRV
	A	05.05.2020	ISSUED WITH MR/TENDER	JLC	HK	HK
	B	08.09.2021	ISSUED WITH MR/TENDER	SNM	AKG	HK



EQUIPMENT DATA (FOR EACH AC BUS SECTION)			
ITEM NO.	NEMA NO.	QTY.	DESCRIPTION
1	—	1	DP SWITCH 25A (MIN)
2	—	2	HRC FUSE
3	80	1	AC SUPPLY FAILURE RELAY (30–60%) WITH 2NO + 2NC CONTACTS FOR OWNERS USE
4	—	1	INDICATING LAMP – LED TYPE
5	—	1	CONTROL (ON/OFF) SWITCH
6	—	3	AC CONTROL SUPPLY BUS
7	—	AS REQD	ALL COMPONENTS FOR AUTO CHANGEOVER SCHEME

NOTES:

1. THE ONE LINE DIAGRAM SHOWN ABOVE IS ONLY INDICATIVE ALL THE ITEMS SPECIFIED UNDER "EQUIPMENT DATA" AND IN SPECIFICATION SHALL BE IN VENDOR'S SCOPE.
2. THE COMPONENT RATING ARE INDICATIVE AND SAME SHALL BE SIZED BASED ON AC POWER REQUIREMENT OF THE SWITCHBOARD BY THE VENDOR. ALL RELAYS SHALL BE NUMERICAL TYPE.
3. IN NORMAL CONDITION, EACH AC FEEDER SHALL BE FEEDING RESPECTIVE AC BUS. IN CASE OF TRIPPING OF ONE INCOMER, AUTO-CHANGEOVER SHALL TAKE PLACE SO THAT COMPLETE BUS SECTION CAN BE FED FROM HEALTHY SOURCE. ONCE POWER IS AGAIN AVAILABLE AT BOTH INCOMERS, RESTORATION SHALL BE DONE SO THAT THERE IS NO LOSS OF CONTROL POWER.
4. THE CHANGEOVER SCHEME SHALL BE 'MAKE BEFORE BREAK TYPE'.



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NEW DELHI
TECHNICAL AMENDMENT NO. 01

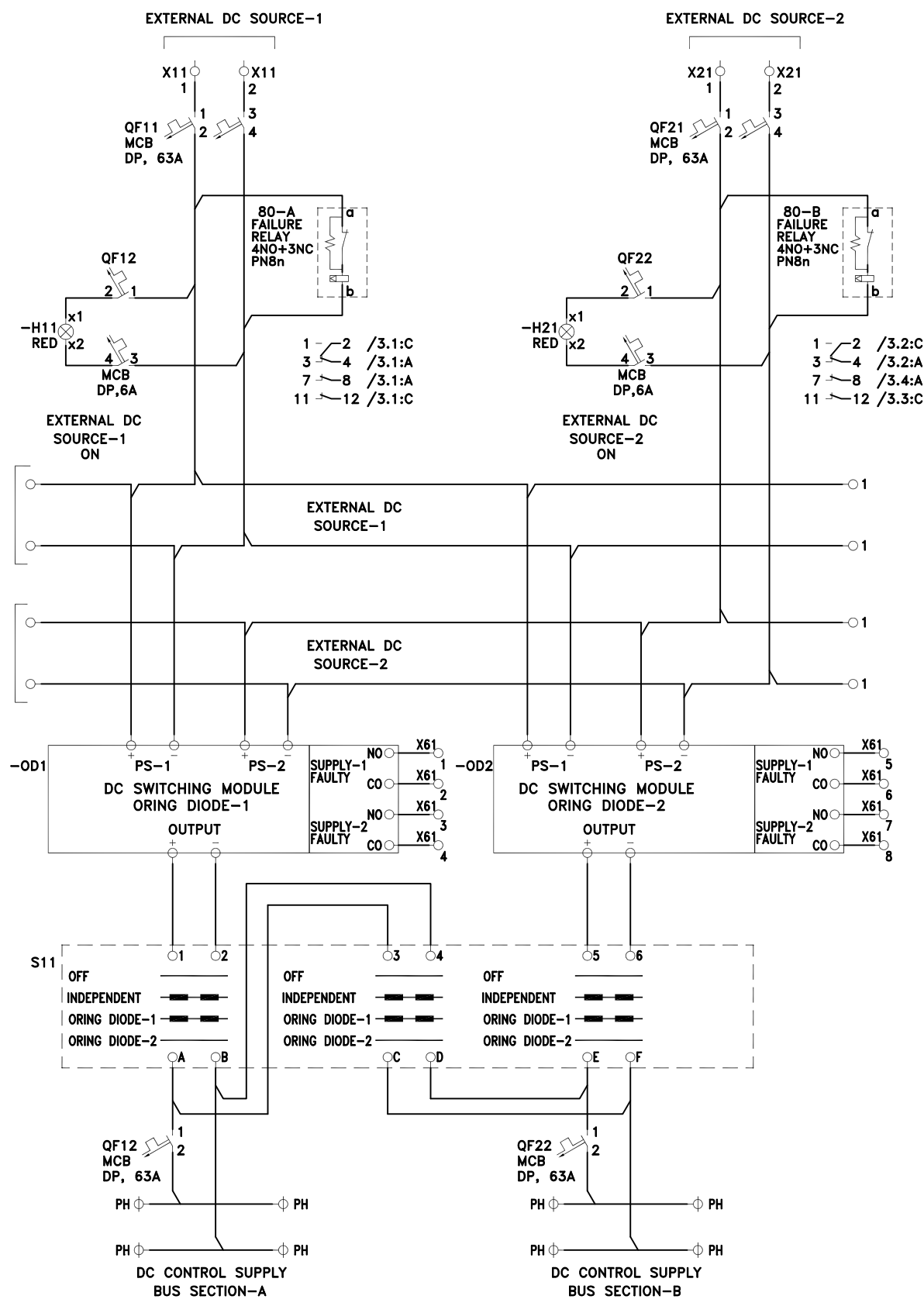
HARDWARE DATASHEET FOR
CHANGEOVER SCHEME FOR AC
CONTROL SUPPLY
FOR HV AND MV SWITCHBOARD

DATA SHEET
B269-999-16-50-DS-0010
Sheet 1 of 2

REV
B

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PROJECT: P25 PROJECT CLIENT: M/s IOCL	REV	DATE	PURPOSE	BY	CHKD	APPD
	B	13.09.2021	ISSUED WITH MR	SNM	AKG/RSR	HK



ENGINEERS INDIA LIMITED
NEW DELHI
TECHNICAL AMENDMENT NO. 01

DC SUPPLY AUTO CHANGEOVER FOR SWBD

DATA SHEET

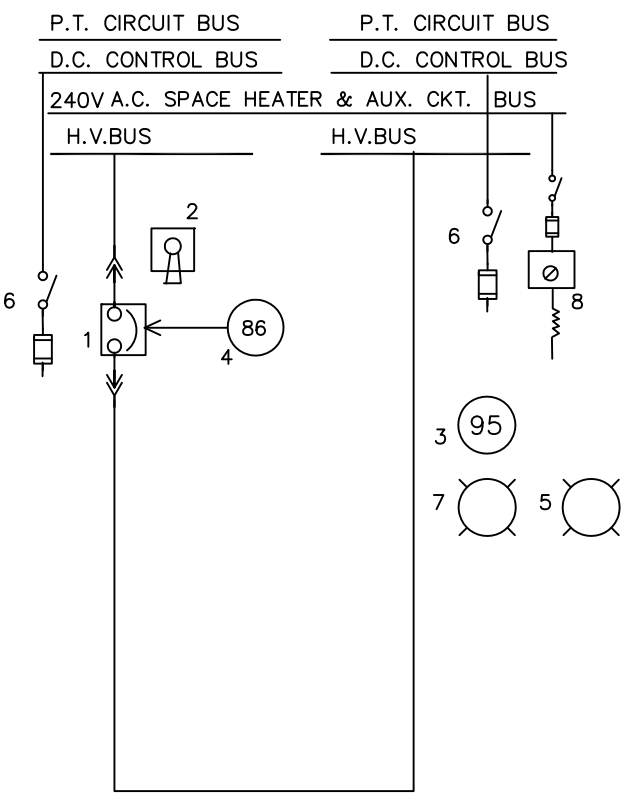
REV

B269-999-16-50-DS-0010
SHT 2 OF 2

B

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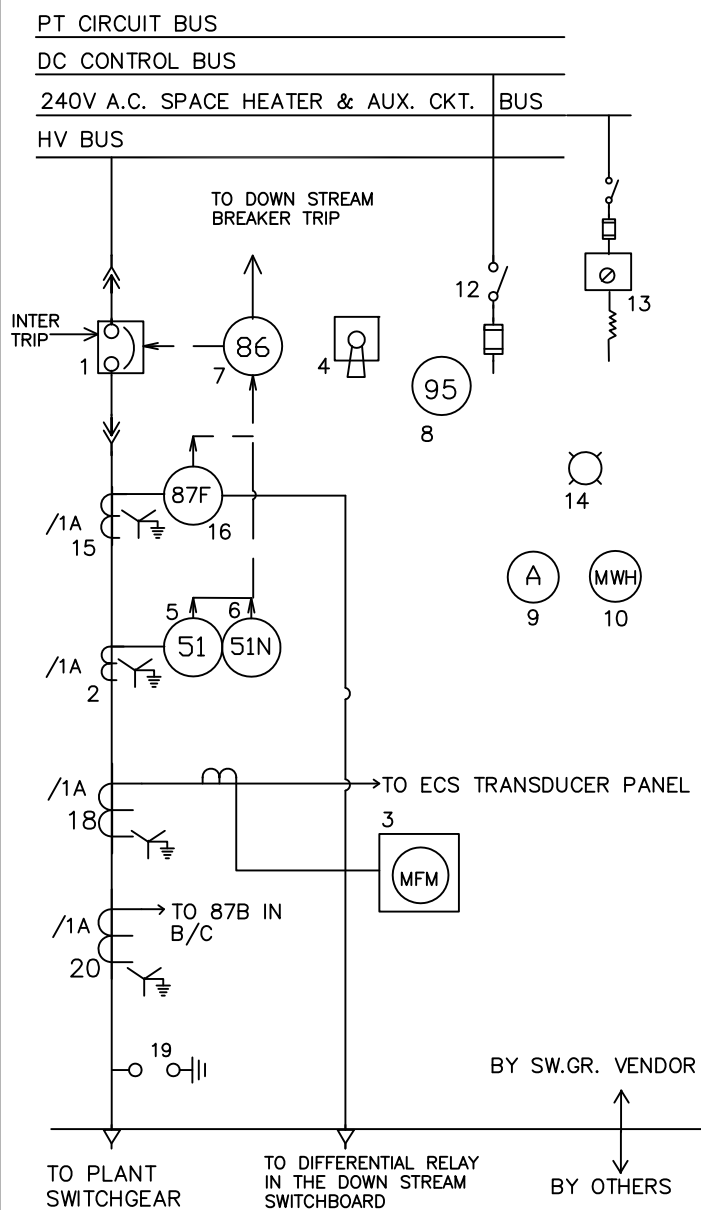
PROJECT: PANIPAT REFINERY EXPANSION(P-25) CLIENT: M/S IOCL	REV	DATE	PURPOSE	BY	CHKD	APPD
	A	05.05.2020	ISSUED WITH MR/TENDER	JLC	HK	HK
	B	08.09.2021	ISSUED WITH MR/TENDER	SNM	AKG	HK



EQUIPMENT DATA			
ITEM NO	NEMA NO.	QTY.	DESCRIPTION
1	52	1	CIRCUIT BREAKER
2	-	1	BREAKER CONTROL SWITCH CLOSE-NEUTRAL TRIP (SPRING RETURN TO NEUTRAL)
3	95	1	TRIP CKT. SUPERVISION RELAY (CONVENTIONAL)
4	86	1	TRIPPING RELAY (CONVENTIONAL)
5	-	1	CUBICLE LAMP WITH SWITCH AND FUSE
6	-	2	DP SWITCH 10A WITH FUSE FOR D.C. CONTROL SUPPLY
7	-	AS REQD.	CLUSTER LED TYPE INDICATING LAMP
8	-	1	PANEL SPACE HEATER WITH SWITCH FUSE & THERMOSTAT

- NOTE:
1. ANTIPUMPING RELAY USED, IF ANY, SHALL BE CONSIDERED AS PART OF BREAKER MECHANISM.
 2. THE ONE LINE DIAGRAM SHOWN ABOVE IS ONLY INDICATIVE . ALL THE ITEMS SPECIFIED UNDER "EQUIPMENT DATA" AND IN SPECIFICATION 6-51-0001 SHALL BE IN VENDOR'S SCOPE.
 3. THERE SHALL BE ONE COMMON CONTROL SWITCH FOR ALL CONTROL SUPPLY FEEDER. SEPARATE FUSES FOR FOLLOWING BRANCH CIRCUIT SHALL BE PROVIDED:
 - SPRING CHARGING CIRCUIT
 - CLOSING CIRCUIT
 - TRIPPING AND CONTACT MULTIPLIER CIRCUIT
 - INDICATION CIRCUIT

PROJECT: PANIPAT REFINERY EXPANSION(P-25) CLIENT: M/S IOCL	REV.	DATE	PURPOSE	BY	CHKD	APPD.
	A	05.05.2020	ISSUED WITH MR/TENDER	JLC	HK	HK



EQUIPMENT DATA			
ITEM NO	NEMA NO.	QTY.	DESCRIPTION
1	52	1	CIRCUIT BREAKER
2	—	1	METERING/PROTECTION C.T. CI.—1/5P10
3	—	1	DIGITAL MULTIFUNCTION METER
4	—	1	BREAKER CONTROL SWITCH CLOSE—NEUTRAL—TRIP (SPRING RETURN TO NEUTRAL)
5	51	2	IDMTL O/C RELAY (50—200%)
6	51N	1	IDMTL E/F RELAY (10—40%)
7	86	1	TRIPPING RELAY (VAJH TYPE)
8	95	1	TRIP CKT SUPERVISION RELAY
9	—	1	AMMETER (3 PHASE)
10	—	1	MWH METER
11	—	1	CUBICLE LAMP (CFL) WITH SWITCH AND FUSE
12	—	1	DP. SWITCH WITH FUSE FOR D.C. CONTROL SUPPLY
13	—	1	PANEL SPACE HEATER WITH SWITCH AND THERMOSTAT
14	—	AS REQD	CLUSTER LED TYPE INDICATING LAMPS
15	—	3	FEEDER DIFFERENTIAL CTs, CI.—PS
16	87F	1SET	FEEDER DIFF RELAY TYPE 'HORM—4' WITH STABILISING RESISTOR & METROSIL.
17	—	AS REQD.	AUX RELAY
18	—	3	METERING CT CLASS 1.0, 15VA
19	—	1 SET	METAL OXIDE TYPE SURGE ABSORBERS
20	—	3	PROTECTION C.T. FOR 87B PROT. CI.—PS

NOTES:

1. ANTIPUMPING RELAY USED, IF ANY, SHALL BE CONSIDERED AS PART OF BREAKER MECHANISM.
2. THE ONE LINE DIAGRAM SHOWN ABOVE IS ONLY INDICATIVE . ALL THE ITEMS SPECIFIED UNDER JOB SPEC., INSTRUCTIONS TO VENDOR AND IN SPECIFICATION 6-51-0001 SHALL BE IN VENDOR'S SCOPE.
3. CT VA BURDEN(EXCEPT METERING CT) SHALL BE DECIDED BY VENDOR.
4. ALL PROTECTION RELAYS SHALL BE NUMERICAL COMMUNICABLE TYPE SUITABLE FOR IEC61850 PROTOCOL.
5. DIGITAL MULTIFUNCTION METERS SHALL BE PROVIDED WITH 1 NO. AMMETER (3PHASE), 1 NO. MWH METER.
6. FEEDER DIFFERENTIAL RELAY FOR RECEIVING END INCOMER SHALL BE LOOSE SUPPLIED BY THE SWITCHBOARD VENDOR/CONTRACTOR.
7. THERE SHALL BE ONE COMMON CONTROL SWITCH FOR ALL CONTROL SUPPLY FEEDER. SEPARATE FUSES FOR FOLLOWING BRANCH CIRCUIT SHALL BE PROVIDED:
 - SPRING CHARGING CIRCUIT
 - CLOSING CIRCUIT
 - TRIPPING, CONTACT MULTIPLIER & DIGITAL INPUT CIRCUIT
 - INDICATION CIRCUIT
 - NUMERICAL RELAY SUPPLY (INCOMING OF NUMERICAL RELAY SUPPLY FUSE SHALL BE TAPPED BEFORE THE CONTROL SUPPLY SWITCH)



ENGINEERS INDIA LIMITED
NEW DELHI

TECHNICAL AMENDMENT NO. 01

6.6KV SWITCHBOARD HARDWARE DATASHEET FOR PLANT FEEDER

DATA SHEET

B269-999-16-50-DS-0028

SHT 1 OF 1110

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 ENGINEERS INDIA LIMITED (भारत सरकार का उपक्रम) (A Govt. of India Undertaking)				220 kV GIS FEEDER DETAIL DATASHEET (HV-100103)										Data sheet No. B269-999-16-50-DS-0034 Rev.No. D				
D	06-04-2022	REVISED & ISSUED WITH TA-01						MKM		RAHUL			HK					
C	27-09-2021	REVISED AND REISSUED WITH TENDER						AKG		HK			HK					
B	05-07-2021	REVISED AND REISSUED WITH TENDER						AKG		HK			HK					
Rev.	Date							Prepared		Checked			Approved					
Project		P25 PANIPAT				Unit		SUBSTATION				Client		IOCL-PR				
Switchgear No.		HV-100103				Location		Substation-100 (MRSS)				Auto/ Manual Xfr.		Not Applicable				
Voltage		220 kV				Curent		2000 Amps				Fault Level		50 kA (3 Sec)				
Bus Differential		Required				Bus Diff. CT Ratio		2000/1										
S.No.	Feeder Nameplate Inscription				Bus Section			Breaker Rating/ Feeder Designation	CT Primary Rating (A)*				Cable Details			Reference Datasheet		Remarks
	Panel No. @	Feeder No. #	Feeder Description	Rating (MVA)#	Left	Right	Metering		Protection			Run	Core	Size	EIL Hardware Datasheet B269-999-16-50-	Vendor Scheme No.@		
									O/C,S/C, E/F	Trafo/ Feeder Differential	REF Protection							
1			Incomer from PR 220kV Indoor GIS in S/S-64 (GRID-A) (With Line PT)		1		2000	2000	2000	2000	-	3	1	400	0036		Note-4	
2			Incomer from PR 220kV Indoor GIS in S/S-64 (GRID-A) (With Line PT)		1		2000	2000	2000	2000	-	3	1	400	0036		Note-4	
3			Incomer from PR 220kV Outdoor GIS in New Gantry S/S (GRID-B) (With Line PT)			1	2000	2000	2000	2000	-	6	1	630	0036		Note-4	
4			Incomer from PR 220kV Outdoor GIS in New Gantry S/S (GRID-B) (With Line PT)			1	2000	2000	2000	2000	-	6	1	630	0036		Note-4	
5			Bus Coupler 1A-1B		1		2000	2000	2000	-	-	-	-	-	0038			
6			Bus Coupler 2A-2B			1	2000	2000	2000	-	-	-	-	-	0038			
7			Bus Sectionalizer 1A-2A		1		2000	2000	2000	-	-	-	-	-	0038			
8			Bus Sectionalizer 1B-2B			1	2000	2000	2000	-	-	-	-	-	0038			
9			Bus PT 1A		1		-	-	-	-	-	-	-	-	0039		Note-7	
10			Bus PT 1B		1		-	-	-	-	-	-	-	-	0039		Note-7	

 ENGINEERS INDIA LIMITED (भारत सरकार का उपक्रम) (A Govt. of India Undertaking)				220 kV GIS FEEDER DETAIL DATASHEET (HV-100103)										Data sheet No. B269-999-16-50-DS-0034 Rev.No. D				
D	06-04-2022	REVISED & ISSUED WITH TA-01						MKM		RAHUL			HK					
C	27-09-2021	REVISED AND REISSUED WITH TENDER						AKG		HK			HK					
B	05-07-2021	REVISED AND REISSUED WITH TENDER						AKG		HK			HK					
Rev.	Date							Prepared		Checked			Approved					
Project		P25 PANIPAT				Unit		SUBSTATION				Client		IOCL-PR				
Switchgear No.		HV-100103				Location		Substation-100 (MRSS)				Auto/ Manual Xfr.		Not Applicable				
Voltage		220 kV				Curent		2000 Amps				Fault Level		50 kA (3 Sec)				
Bus Differential		Required				Bus Diff. CT Ratio		2000/1										
S.No.	Feeder Nameplate Inscription				Bus Section			Breaker Rating/ Feeder Designation	CT Primary Rating (A)*				Cable Details			Reference Datasheet		Remarks
	Panel No. @	Feeder No. #	Feeder Description	Rating (MVA)#	Left	Right	Metering		Protection			Run	Core	Size	EIL Hardware Datasheet B269-999-16-50-0034	Vendor Scheme No.@		
									O/C,S/C, E/F	Trafo/ Feeder Differential	REF Protection							
11			Bus PT 2A			1	-	-	-	-	-	-	-	-	-	0039		Note-7
12			Bus PT 2B			1	-	-	-	-	-	-	-	-	-	0039		Note-7
13			Transformer Feeder (TR-100011)	75	1		1250A	250	250	250	250	3	1	400	0040		Note-4	
14			Transformer Feeder (TR-100012)	75	1		1250A	250	250	250	250	3	1	400	0040		Note-4	
15			Transformer Feeder (TR-100013)	200		1	1250A	630	630	630	630	3	1	630	0040		Note-4	
16			Transformer Feeder (TR-100014)	200		1	1250A	630	630	630	630	3	1	630	0040		Note-4	
17			Transformer Feeder (TR-100015)	200		1	1250A	630	630	630	630	3	1	630	0040		Note-4	
18			Transformer Feeder (TR-100016)	200		1	1250A	630	630	630	630	3	1	630	0040		Note-4	
19			Transformer Feeder (Spare)	200		1	1250A	630	630	630	630	3	1	630	0040		Note-4	
20			Transformer Feeder (Spare)	75	1		1250A	250	250	250	250	3	1	400	0040		Note-4	
Notes : 1 '*' CT primary current ratings indicated are tentative and shall be finalised during drawing approval stage without any cost implication. CT secondary shall be 1 Amps for all. 2 '#' These shall be finalised during drawing approval stage and shall not have any cost implication. 3 '@' Data to be furnished by Vendor.																		

 ENGINEERS INDIA LIMITED (भारत सरकार का उपक्रम) (A Govt. of India Undertaking)				220 kV GIS FEEDER DETAIL DATASHEET (HV-100103)				Data sheet No. B269-999-16-50-DS-0034 Rev.No. D										
D	06-04-2022	REVISED & ISSUED WITH TA-01				MKM		RAHUL		HK								
C	27-09-2021	REVISED AND REISSUED WITH TENDER				AKG		HK		HK								
B	05-07-2021	REVISED AND REISSUED WITH TENDER				AKG		HK		HK								
Rev.	Date					Prepared		Checked		Approved								
Project		P25 PANIPAT				Unit		SUBSTATION		Client								
Switchgear No.		HV-100103				Location		Substation-100 (MRSS)		Auto/ Manual Xfr.								
Voltage		220 kV				Curent		2000 Amps		Fault Level								
Bus Differential		Required				Bus Diff. CT Ratio		2000/1		50 kA (3 Sec)								
S.No.	Feeder Nameplate Inscription				Bus Section		Breaker Rating/ Feeder Designation	CT Primary Rating (A)*				Cable Details			Reference Datasheet		Remarks	
	Panel No. @	Feeder No. #	Feeder Description	Rating (MVA)#	Left	Right		Metering	Protection				Run	Core	Size	EIL Hardware Datasheet B269-999-16-50-		Vendor Scheme No.@
									O/C,S/C, E/F	Trafo/ Feeder Differential	REF	Protection						
4	Total number of runs collectively for R,Y and B phase are indicated. Cable runs and cable sizes are indicative and actual cable size shall be informed during review of documents post order without any time or cost implication.																	
5	Gas Insulated surge arrestor shall be provided in incomers and all outgoing feeders. Line PT and Bus PT shall also be Gas Insulated Type.																	
6	Bus differential protection and Bus wire check supervision shall be provided for the switchboard including corresponding CTs.																	
7	Independent Bus PT panel shall be provided for all the four buses of the Double Bus GIS switchboard.																	

 ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)				66 kV GIS FEEDER DETAIL DATASHEET (HV-100111)								Data sheet No. B269-999-16-50-DS-0035 Rev.No. D							
D	06-04-2022	REVISED AND REISSUED WITH TA-01				MKM		RG		HK									
C	27-09-2021	REVISED AND REISSUED WITH TENDER				AKG		HK		HK									
B	05-07-2021	REVISED AND REISSUED WITH TENDER				AKG		HK		HK									
Rev.	Date					Prepared		Checked		Approved									
Project		P25 PANIPAT				Unit		SUBSTATION		Client		IOCL-PR							
Switchgear No.		HV-100111				Location		Substation-100 (MRSS)		Auto/ Manual Xfr.		Not Applicable							
Voltage		66 kV				Curent		3150 Amps		Fault Level		40 kA (3 Sec)							
Bus Differential		Required				Bus Diff. CT Ratio		3150/1											
S.No.	Feeder Nameplate Inscription				Bus Section			Breaker Rating/ Feeder Designation	CT Primary Rating (A)*				Cable Details			Reference Datasheet		Remarks	
	Panel No. @	Feeder No. #	Feeder Description	Rating (MVA)#	Left	Mid	Right		Metering	Protection				Run	Core	Size	EIL Hardware Datasheet B269-999-16-50-		Vendor Scheme No.@
										O/C,S/C, E/F	Trafo/ Feeder Differential	REF	Protection						
1			Incomer from Transformer (With Line PT)	200			5	2000A	2000	2000	2000	-	GIBD			0042		Note-8	
2			Incomer from Transformer (With Line PT)	75	3			1250A	800	800	800	-	GIBD			0042		Note-8	
3			Bus Coupler 1A-2A		1			3150A	3150	3150	-	-	-	-	-	0044			
4			Bus Coupler 1B-2B				1	3150A	3150	3150	-	-	-	-	-	0044			
5			Bus Sectionalizer 1A-1B			1		3150A	3150	3150	-	-	-	-	-	0044			
6			Bus Sectionalizer 2A-2B			1		3150A	3150	3150	-	-	-	-	-	0044			
7			Bus Sectionalizer 1B-1C				1	3150A	3150	3150	-	-	-	-	-	0044			
8			Bus Sectionalizer 2B-2C				1	3150A	3150	3150	-	-	-	-	-	0044			
9			Bus PT 1A		1			-	-	-	-	-	-	-	-	0045		Note-7	
10			Bus PT 1B		1			-	-	-	-	-	-	-	-	0045		Note-7	
11			Bus PT 2A				1	-	-	-	-	-	-	-	-	0045		Note-7	
12			Bus PT 2B				1	-	-	-	-	-	-	-	-	0045		Note-7	
13			Bus PT 3A			1		-	-	-	-	-	-	-	-	0045		Note-7	
14			Bus PT 3B			1		-	-	-	-	-	-	-	-	0045		Note-7	
15			Transformer Feeder	12.5		2	2	1000A	120	120	120	-	3	1	300	0046		Note-4	
16			Transformer Feeder	16		2	1	1000A	160	160	160	-	3	1	300	0046		Note-4	

 ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)				66 kV GIS FEEDER DETAIL DATASHEET (HV-100111)						Data sheet No. B269-999-16-50-DS-0035 Rev.No. D								
D	06-04-2022	REVISED AND REISSUED WITH TA-01				MKM		RG		HK								
C	27-09-2021	REVISED AND REISSUED WITH TENDER				AKG		HK		HK								
B	05-07-2021	REVISED AND REISSUED WITH TENDER				AKG		HK		HK								
Rev.	Date					Prepared		Checked		Approved								
Project		P25 PANIPAT				Unit		SUBSTATION		Client		IOCL-PR						
Switchgear No.		HV-100111				Location		Substation-100 (MRSS)		Auto/ Manual Xfr.		Not Applicable						
Voltage		66 kV				Curent		3150 Amps		Fault Level		40 kA (3 Sec)						
Bus Differential		Required				Bus Diff. CT Ratio		3150/1										
S.No.	Feeder Nameplate Inscription				Bus Section			CT Primary Rating (A)*				Cable Details			Reference Datasheet		Remarks	
	Panel No. @	Feeder No. #	Feeder Description	Rating (MVA)#	Left	Mid	Right	Breaker Rating/ Feeder Designation	Metering	Protection			Run	Core	Size	EIL Hardware Datasheet B269-999-16-50		Vendor Scheme No.@
										O/C,S/C, E/F	Trafo/ Feeder Differential	REF Protection						
17			Transformer Feeder	20		1	1	1000A	200	200	200	-	3	1	300	0046		Note-4
18			Transformer Feeder	25	4	4	4	1000A	250	250	250	-	3	1	300	0046		Note-4
19			Transformer Feeder	31.5	2	6	5	1000A	320	320	320	-	3	1	400	0046		Note-4
20			Tie Transformer Feeder - I/C	125	1	1		1250A	1250	1250	1250	1250	6	1	1000	0048		Note-4
21			Tie Transformer Feeder - O/G	125	1	1		1250A	1250	1250	1250	1250	6	1	1000	0047		Note-4
22			Transformer feeder-Spare	12.5				1000A	120	120	120	-	3	1	300	0046		Note-4
23			Transformer feeder-Spare	16				1000A	160	160	160	-	3	1	300	0046		Note-4
24			Transformer feeder-Spare	20		1	1	1000A	200	200	200	-	3	1	300	0046		Note-4
25			Transformer feeder-Spare	25		1	1	1000A	250	250	250	-	3	1	300	0046		Note-4
26			Transformer feeder-Spare	31.5	1	1	2	1000A	320	320	320	-	3	1	400	0046		Note-4
Notes : 1 `*` CT primary current ratings indicated are tentative and shall be finalised during drawing approval stage without any cost implication. CT secondary shall be 1 Amps for all. 2 `#` These shall be finalised during drawing approval stage and shall not have any cost implication. 3 `@` Data to be furnished by Vendor. 4 Total number of runs collectively for R,Y and B phase are indicated. Cable runs and cable sizes are indicative and actual cable size shall be informed during review of documents post order without any time or cost implication. 5 Gas Insulated surge arrestor shall be provided in incomers and all outgoing feeders. Line PT and Bus PT shall also be Gas Insulated Type. 6 Bus differential protection and Bus wire check supervision shall be provided for the switchboard including corresponding CTs. 7 Independent Bus PT panel shall be provided for all the four buses of the Double Bus GIS switchboard. 8 For two numbers future incomers GIBD/Cable connection shall be finalised post order during detail engineering with any time and cost implication to EIL/Owner.																		



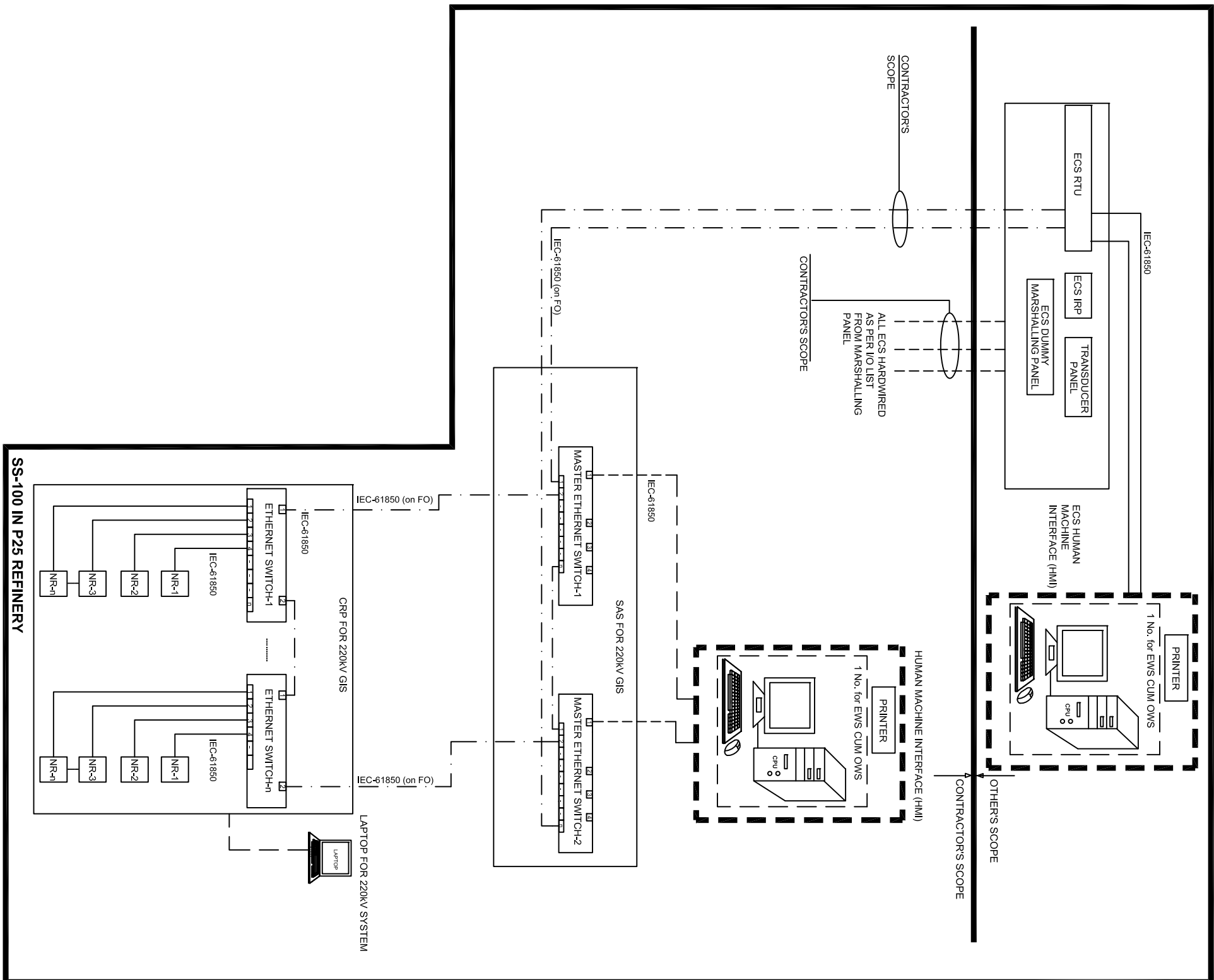
ENGINEERS INDIA LIMITED
NEW DELHI

**PROJECT : PANIPAT REFINERY
EXPANSION (P-25)**

C	11.04.2022	REVISED AND REISSUED WITH TENDER	RG	HK	HK
B	05.07.2021	REVISED AND REISSUED WITH TENDER	AKG	HK	HK
A	12.05.2020	ISSUED WITH TENDER	HK	HK	
REV.	DATE		BY	CHK	APPROVED

BLOCK DIAGRAM FOR NUMERICAL RELAY LAN & SUBSTATION AUTOMATION SYSTEM 220KV GAS INSULATED SWITCHBOARD (MRSS-100)

DRAWING NO.	REV.
B269-999-16-50-DS-0052	C



NOTES

1. System architecture defines basic requirement of numerical relays integration with HMI & Electrical Control System (ECS) as a part of substation automation. Detailed architecture shall be developed by Contractor or their selected manufacturer.
2. System shall be engineered such that any board can be taken out for maintenance or removed without affecting communication with other boards.
3. Protocol shall be IEC 61850-RSTP providing all functionalities such as protection, control, relay parameterization, time synchronization, down loading disturbance record etc. Protocol for communication to ECS-RTU shall IEC 61850.
4. Scope split between Owner and Contractor, refer Job Specification attached with bid document. Interface cabling between ECS-RTU and ECS I/F panels shall be done by Owner/ Other Contractor.
5. LAPTOP along with programming and application software shall be supplied as required with license.
6. The supplied architecture should, in addition to this architecture, meet the requirement of numerical relay data sheet, Job Specification and EIL Specification 6-51-0055 attached with the bid document.
7. The communication protocol between Numerical relay and Ethernet Switches shall be IEC-61850.
8. The communication protocol between Ethernet switches and ECS RTU panel shall be IEC-61850.
9. CONTRACTOR shall furnish detailed system architecture drawing giving explicit details of protocol, redundancy and topology in line with Tender requirements.
10. Human Machine Interface-HMI/ shall communicate with Ethernet switches over IEC-61850 Protocol.
11. Refer clause no. 6.1.2 & Figure No.-02 of attached specification for Numerical relay & Substation Automation System Doc. No. (6-51-0055) for system configuration details.
12. ICD files shall be provided for IEDs (relays etc.) any other device as required by vendor as the same shall be required by ECS vendor for configuration purpose during detailed engineering.
13. GPS and antenna shall be provided in each substation for time synchronization as per Tender requirement.

 ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)		33kV HV ISOLATING BREAKER PANEL DATA SHEET		Document No. B269-999-16-50-DS-0071 Rev. No. C Page 1 of 4	
Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE
Unit	COMMON	Location		Job No.	B269
				Unit No.	999
PURCHASER'S DATA					
A. Site Conditions					
1.	Maximum Ambient Temperature	°C	50		
2.	Minimum Ambient Temperature	°C	5		
3.	Design Ambient Temperature	°C	45		
4.	Relative Humidity	%	90		
5.	Altitude Above MSL	mm	1000		
6.	Environment	Hot, Humid & Corrosive			
B. Operating Conditions					
1.	Voltage	kV	33 +/- 10 %		
2.	Frequency	Hz	50 +/- 3 %		
3.	No of phases	Three			
4.	System fault level	kA	40		
5.	System earthing	Solidly Earthed			
6.	Auxiliary supply				
	AC	V	240 +/- 10 %		
	DC	V	220 +/- 15 % / -10 % DC		
C. Electrical Data					
1.	Busbar current rating (inside panel at design temp.)	As per Job Specification			
2.	1 sec. Short Circuit withstand capacity	kA	40		
3.	System Breaking capacity	kA	40		
	% D.C. Component	As per IEC			
4.	System making capacity	kA(peak)	100		
5.	Type of Circuit Breaker	VCB			
	Shunt Trip Coil-1 :	V	220 DC		
	Shunt Trip Coil-2 :	V	NotApplicable		
6.	Duty Cycle of C.B.	O-3min-CO-3min-CO			
7.	Suitability for Cap. Switching	Not Required			
8.	Surge supressor for Motor Feeder.	No			
9.	Provision of earthing				
	Earthing truck	Required			
	Earthing switch	Not Required			
D. Miscellaneous					
1.	Interface with ECS	Required			
2.	Incoming Power Entry	Cable			
3.	Cable Entry	Bottom			
4.	Separate bolted removable gland palte for cable entry	Reqd.(Gland Plate Drilled at side)			
5.	Cable glands and lugs for cable termination	Included			
6.	Paint shade	RAL-7032			
7.	Windows at the rear side of panels for thermography	Required			
MANUFACTURER'S DATA					
A. Switchboards					
1.	Make				
C	06-APR-2022	REVISED & ISSUED WITH TENDER	RAHUL GANGULY	HARISH KUMAR	HARISH KUMAR
B	14-JUL-2021	ISSUED WITH MR	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
A	12-MAY-2020	ISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE	
Unit	COMMON		Location	Job No.	B269	Unit No. 999
2.	Type designation					
3.	Degree of protection					
4.	Max. overall weight of C.B. panel		Kg			
5.	Overall dimensions of C.B. panel					
	Width		mm			
	Depth		mm			
	Height		mm			
6.	Overall dimensions of dummy /gland palte for cable entry					
	Width		mm			
	Depth		mm			
	Height		mm			
7.	Overall weight and dimensions of largest shipping section					
	Weight		Kg			
	Width		mm			
	Depth		mm			
	Height		mm			
8.	Overall dimensions of each swbd. including all dummy/adaptor/rear extension panels					
	Width		mm			
	Depth		mm			
	Height		mm			
9.	Recommended clearances					
	Front		mm			
	Rear		mm			
	Above		mm			
10.	Shock loading on foundation					
11.	Max. size/no. of cables that can be terminated inside the panel					
	without rear extension panel					
	with rear extension panel					
	size of rear extension panel					
12.	Clearance in air					
	Phase to Phase (min.)		mm			
	Phase to Earth (min.)		mm			
13.	Busbar current rating at design ambient temperature		A			
14.	Busbar (separately for each swbd)					
	(a).Horizontal main busbar size (No. of flats x size of each flat)					
	(b).Horizontal main busbar size as tested at CPRI for full short ckt					
	withstand as per specification requirement (No. of flats x size of each flat)					
	(c).Vertical dropper size (No. of flats x size of each flat)					
15.	Horizontal main busbar/Vertical busbar material					
16.	Insulating material (Busbar supports)					
17.	Earth busbar size					
18.	Earth busbar material					
19.	1 min. power frequency withstand voltage (rms		kV			
	Over voltage factor for PTs					
20.	Impuse withsatnd voltage (peak)		kV			
C	06-APR-2022	REVISED & ISSUED WITH TENDER	RAHUL GANGULY	HARISH KUMAR	HARISH KUMAR	
B	14-JUL-2021	ISSUED WITH MR	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR	
A	12-MAY-2020	ISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR	
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By	

Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE	
Unit	COMMON	Location		Job No.	B269	Unit No. 999
	Wave shape of impulse voitage					
21.	1 sec. short ckt. Withstand capacity	kA				
22.	Peak dynamic withsatnd capacity	kA				
23.	Safety Features					
	(a).Heat shrinkable sleeves, rated to					
	withstand the system line to line					
	voltage for one min., provided on busbar					
	(b).Removable FRP shrouds for all busbar					
	joints and tap-off connections provided					
	(c).Arc propagation barrier in busbar					
	compartment provided					
	(d).Breaker service, test and drawn-					
	out position provided					
	(e).Distinct overall lockable door for					
	breaker compartment provided					
	(f).Automatic safety shutter provided					
	(g).Independent pressure release					
	flaps provided for all HV compartments					
	(h).Wire mesh for all louvered					
	openings provided					
	(i).Suitable intrlocks to prevent					
	faulty operation as per Cl. 4.4.10					
	of spec. 6-51-0001 provided					
	B. Circuit Breaker					
1.	Type					
	2nd shunt trip coil for VFD feeders					
2.	Make					
3.	Type Designation					
4.	Circuit Breaker mounting in panel					
5.	No. of poles/phase					
6.	Current rating (in free air)	A				
7.	Current rating inside the panel at specified design tempeature	A				
8.	Short time rating (1sec.)	kA				
9.	Symmetrical breaking capapcity	kA				
9.1	% D.C. Component					
10.	Peak making current	kA				
11.	1 min. dry withsatnd voltage (power frequency)	kV				
12.	Duty Cycle					
13.	Total openeing time	m sec.				
14.	Total closing time	m sec.				
15.	Power required for opening	W/VA				
16.	Power required for closing	W/VA				
17.	Power required for spring charging motor	W/VA				
18.	Breaker is trip free					
19.	Closing mechanism					
20.	Provision of manual spring charging provided					
21.	Mechanical Trip PB provided					
C	06-APR-2022	REVISED & ISSUED WITH TENDER	RAHUL GANGULY	HARISH KUMAR	HARISH KUMAR	
B	14-JUL-2021	ISSUED WITH MR	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR	
A	12-MAY-2020	ISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR	
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By	

Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE
Unit	COMMON	Location		Job No.	B269
				Unit No.	999
22.	Mech. On/Off indicator provided				
23.	Operation counter provided				
24.	Time taken for spring charging	sec.			
25.	No. of aux. contacts and their current ratings				
26.	Interrupter				
	(a).Make				
	(b).Pressure switch for monitoring of SF6 gas pressure provided				
	(c).Re-filling arrangement of SF6				
27.	LOTO (Lock-Out Tag-Out) Provision for mechanical locking arrangement				
28.	Suppressor				
	Type designation				
	Make				
27.	Derating reqd. for Cap. Switching				
29.	Earthing System				
30.	Copies of following test certificates enclosed				
	For each type of offered circuit breaker panel with breake				
	(a).Short Circuit tests (Peak and 1 sec.withstand)				
	(b).Heat run test				
	(c).Internal arc test				
	(d).Impulse and power freq. withstand				
	For each type of offered circuit breaker (in panel)				
	(a).Short Circuit test duties				

Eil Notes

- Internal Arc classification for HV switchboards shall be 40kA for 0.2sec.
- Variation/ Clarification against the standard specification for HV switchboards 6-51-0001, shall be as per the MoU agreed with EIL by respective HV switchboard manufacturer. No further deviations to tender requirements shall be entertained.

C	06-APR-2022	REVISED & ISSUED WITH TENDER	RAHUL GANGULY	HARISH KUMAR	HARISH KUMAR
B	14-JUL-2021	ISSUED WITH MR	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
A	12-MAY-2020	ISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

6.6 kV HV SWITCHGEAR FEEDER DETAIL DATA SHEET (HV-100201)

Data sheet No.

B269-999-16-50-DS-0075

Rev. No. A

A	01.04.2022	ISSUED WITH TECHNICAL AMENDMENT-01	MKM	RG	HK
Rev.	Date		Prepared	Checked	Approved

Project	P-25	Unit	MRSS+ETP+RODM+RWTP	Client	M/s IOCL - PANIPAT
Switchgear No.	HV-100201	Location	MRSS # 100	Fast Bus Transfer	Required
Voltage	6.6 kV	Curent	2500Amps	Fault Level	40 kA (1 Sec)
Bus Differential	Required	Bus Diff. CT Ratio	2500 /1	IAC	40 kA (0.2 Sec)

S.No.	Feeder Nameplate Inscription				Bus Section			Breaker Rating/ Feeder Designation	CT Primary Rating (A)*				Cable Details #			Reference		Remarks
	Panel No. @	Feeder No. #	Feeder Description	Rating (kW)#	Left	Mid	Right		Metering	Protection			Run	Core	Size	EIL Hardware Datasheet	Vendor Scheme No.@	
										O/C,S/C, E/F & Motor	Feeder/ Motor Differential	REF Protection						
1			Incomer from TR-100031 (20/25 MVA Power Trafo.)		1			2500A	2500	2500	2500	2500	-	-	-	DS-0003		Bus Duct Connection
2			Incomer from TR-100032 (20/25 MVA Power Trafo.)				1	2500A	2500	2500	2500	2500	-	-	-	DS-0003		Bus Duct Connection
3			Line PT - Incomer 1		1			-	-	-	-	-	-	-	-	DS-0003		
4			Line PT - Incomer 2				1	-	-	-	-	-	-	-	-	DS-0003		
5			Bus PT - Bus 1		1			-	-	-	-	-	-	-	-	DS-0011		
6			Bus PT - Bus 2				1	-	-	-	-	-	-	-	-	DS-0011		
7			Bus Coupler - 1			1		2500A	2500	2500	-	-	-	-	-	DS-0005		
8			Bus Coupler - 2			1		2500A	2500	2500	-	-	-	-	-	DS-0016		
9			Capacitor Feeder - 1		1			800A	300	300	-	-	\$	\$	\$	DS-0008		
10			Capacitor Feeder - 2				1	800A	300	300	-	-	\$	\$	\$	DS-0008		
11			Transformer Feeder TR-100041 (min. 2.5 MVA)		1			800A	300	300	-	-	\$	\$	\$	DS-0006		
12			Transformer Feeder TR-100042 (min. 2.5 MVA)				1	800A	300	300	-	-	\$	\$	\$	DS-0006		
			Transformer Feeder TR-100043 (min. 2.5 MVA)				1	800A	300	300	-	-	\$	\$	\$	DS-0006		
13			Spare Transformer Feeder (min. 2.5 MVA)		1		1	800A	300	300	-	-	\$	\$	\$	DS-0006		
16	Format No: EIL-165	165	Plant Feeder to HV-122201 I/C-1		1			800A	300	800	800		2	3	300	DS-0028	All rights reserved	All rights reserved

Format No: EIL 1650-3001A Rev.2

Page 1 of 2

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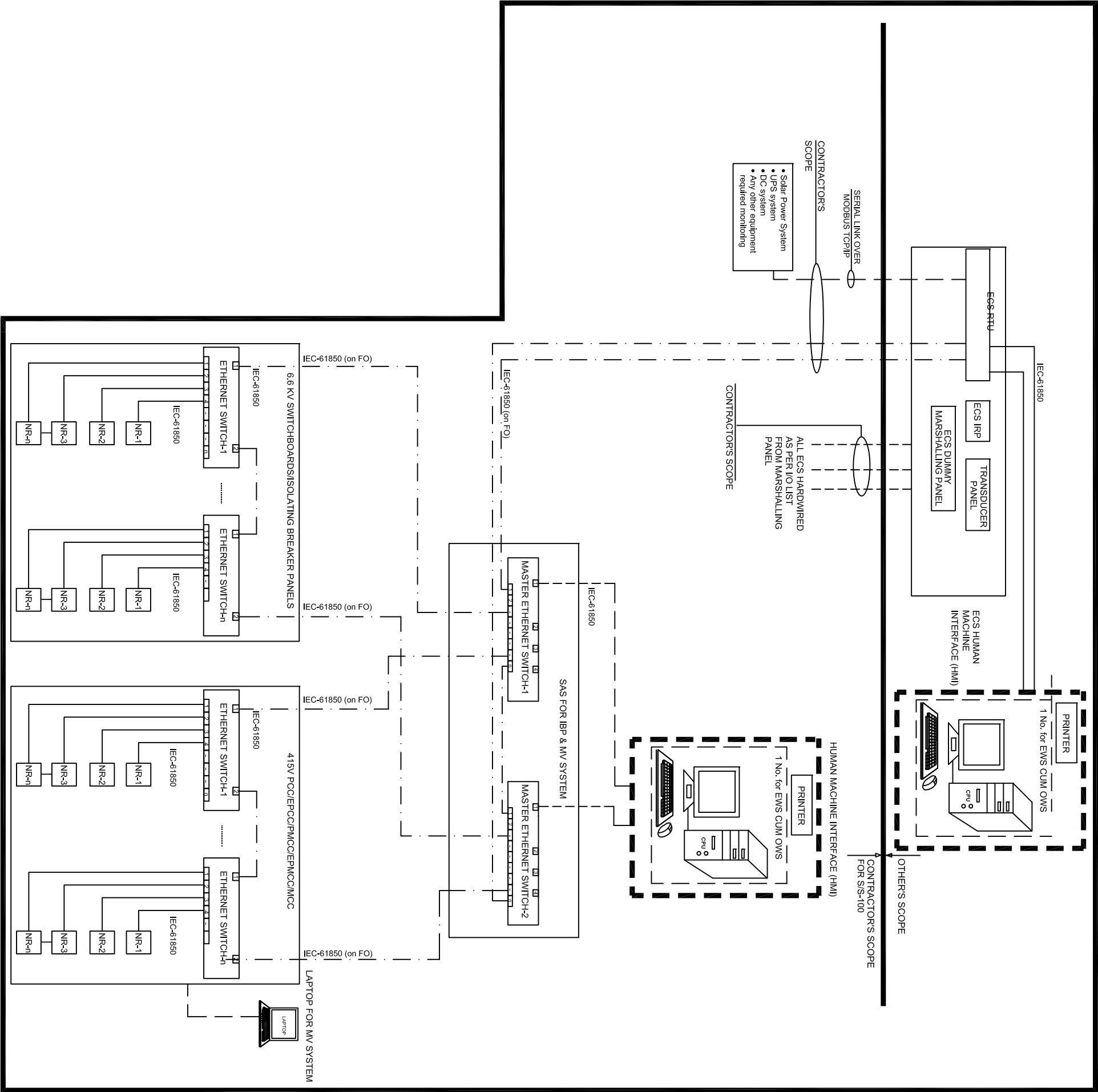
S.No.	Feeder Nameplate Inscription				Bus Section			Breaker Rating/ Feeder Designation	CT Primary Rating (A)*				Cable Details #			Reference		Remarks
	Panel No. @	Feeder No. #	Feeder Description	Rating (kW)#	Left	Mid	Right		Metering	Protection			Run	Core	Size	EIL Hardware Datasheet	Vendor Scheme No.@	
										O/C,S/C, E/F & Motor	Feeder/ Motor Differential	REF Protection						
17			Plant Feeder to HV-122201 I/C-2				1	800A	800	800	800		2	3	300	DS-0028		Feeders to be used by Owner
18			Plant Feeder to HV-112201 I/C-1		1			800A	800	800	800		2	3	300	DS-0028		
19			Plant Feeder to HV-112201 I/C-2				1	800A	800	800	800		2	3	300	DS-0028		
20			Plant Feeder to HV-109201 I/C-1		1			800A	800	800	800		2	3	300	DS-0028		
21			Plant Feeder to HV-109201 I/C-2				1	800A	800	800	800		2	3	300	DS-0028		
22			Spare Plant Feeder		1		1	800A	800	800	800		2	3	300	DS-0028		
23			Dummy Panel															As required

Notes :

- 1 `\*` CT primary current ratings indicated are tentative and shall be finalised during drawing approval stage without any cost implication. CT secondary shall be 1 Amps for all.
- 2 `#` These shall be finalised during drawing approval stage and shall not have any cost implication.
- 3 `\$` Data to be furnished by Contractor.
- 4 Cable sizes are indicative and actual cable size shall be informed during review of documents.
- 5 Dummy panel with flexibles shall be provided for switchboards located in substations having expansion joints in the building.
- 6 Any additional 6.6kV feeders required for feeding 220kV GIS package loads shall be provided by Contractor without any time and cost implications.

NOTES

1. System architecture defines basic requirement of numerical relays integration with HMI & Electrical Control System (ECS) as a part of substation automation. Detailed architecture shall be developed by Contractor or their selected manufacturer.
2. System shall be engineered such that any board can be taken out for maintenance or removed without affecting communication with other boards.
3. Protocol shall be IEC 61850-RSTP providing all functionalities such as protection, control, relay parameterization, time synchronization, down loading disturbance record etc. Protocol for communication to ECS-RTU shall IEC 61850.
4. Scope split between Owner and Contractor, refer Job Specification attached with bid document. Interface cabling between ECS-RTU and ECS I/F panels shall be done by Owner/ Other Contractor.
5. LAPTOP along with programming and application software shall be supplied as required with license.
6. The supplied architecture should, in addition to this architecture, meet the requirement of numerical relay data sheet, Job Specification and EIL Specification 6-51-0055 attached with the bid document.
7. The communication protocol between Numerical relay and Ethernet Switches shall be IEC-61850.
8. The communication protocol between Ethernet switches and ECS RTU panel shall be IEC-61850.
9. CONTRACTOR shall furnish detailed system architecture drawing giving explicit details of protocol, redundancy and topology in line with Tender requirements.
10. Human Machine Interface-HMI/ shall communicate with Ethernet switches over IEC-61850 Protocol.
11. Refer clause no. 6.1.2 & Figure No.-02 of attached specification for Numerical relay & Substation Automation System Doc. No. (6-51-0055) for system configuration details.
12. ICD files shall be provided for IEDs (relays etc.)/ any other device as required by vendor as the same shall be required by ECS vendor for configuration purpose during detailed engineering.
13. GPS and antenna shall be provided in each substation for time synchronization as per Tender requirement



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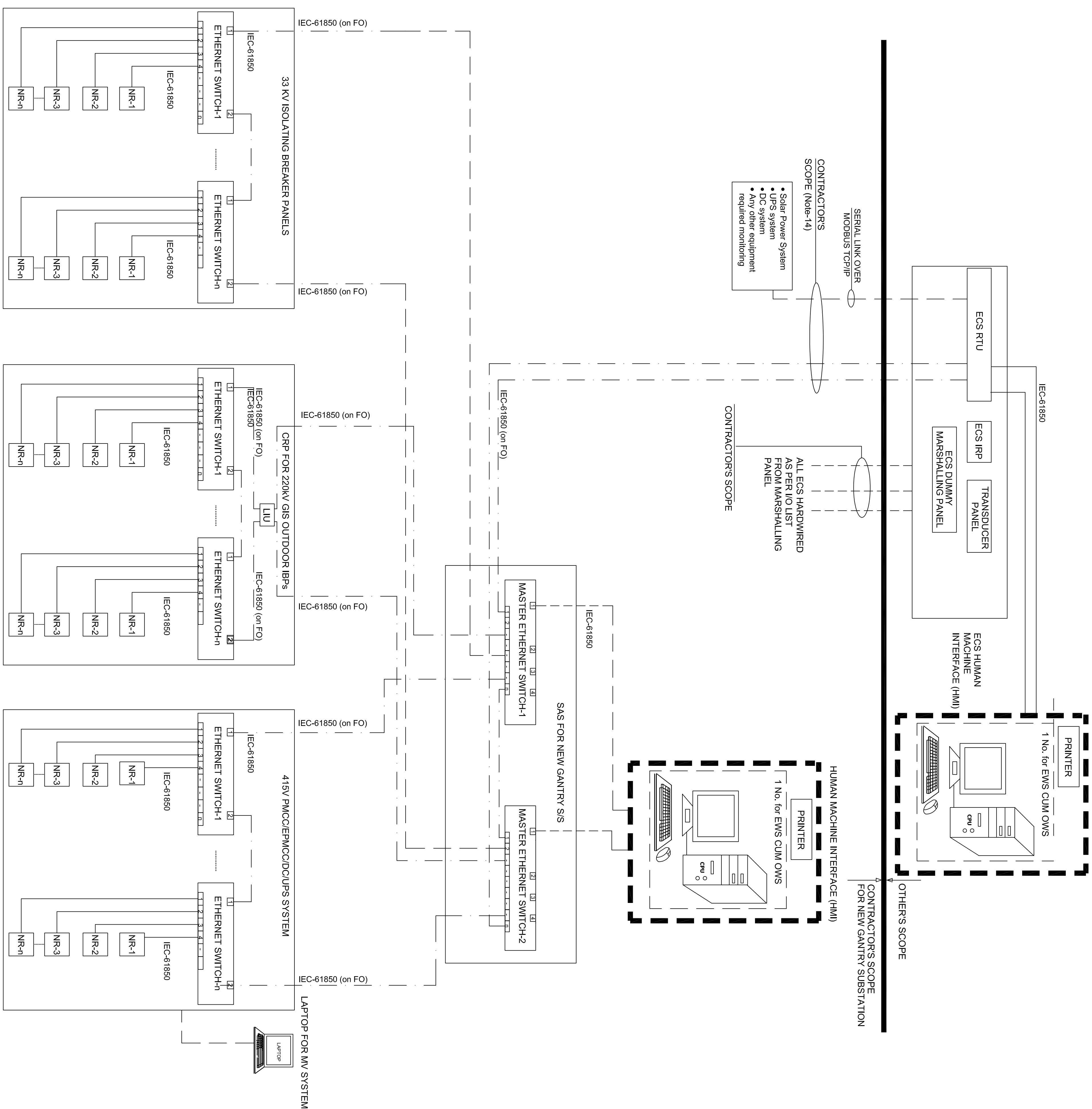
ENGINEERS INDIA LIMITED
NEW DELHI

PROJECT : PANIPAT REFINERY
EXPANSION (P-25)
CLIENT : M/s IOCL-PANIPAT

REV.	DATE	ISSUED WITH TENDER	BY	CHK	APPROVED
A	12.05.2020	ISSUED WITH TENDER	AKG	HK	HK
B	05.07.2021	REVISED AND REISSUED WITH TENDER	AKG	HK	HK
C	11.04.2022	REVISED AND REISSUED WITH TENDER	RG	HK	HK

BLOCK DIAGRAM FOR
NUMERICAL RELAY LAN & SUBSTATION
AUTOMATION SYSTEM
HV IBPs & MV SWITCHBOARDS
(MRSS-100)

DRAWING NO.	REV.
B269-999-16-50-DS-0130	C



NOTES

1. System architecture defines basic requirement of numerical relays integration with HMI & Electrical Control System (ECS) as a part of substation automation. Detailed architecture shall be developed by Contractor or their selected manufacturer.
2. System shall be engineered such that any board can be taken out for maintenance or removed without affecting communication with other boards.
3. Protocol shall be IEC 61850-RSTP providing all functionalities such as protection, control, relay parameterization, time synchronization, down loading disturbance record etc. Protocol for communication to ECS-RTU shall IEC 61850.
4. Scope split between Owner and Contractor, refer Job Specification attached with bid document. Interface cabling between ECS-RTU and ECS I/F panels shall be done by Owner/ Other Contractor.
5. LAPTOP along with programming and application software shall be supplied as required with license.
6. The supplied architecture should, in addition to this architecture, meet the requirement of numerical relay data sheet, Job Specification and EIL Specification 6-51-0055 attached with the bid document.
7. The communication protocol between Numerical relay and Ethernet Switches shall be IEC-61850.
8. The communication protocol between Ethernet switches and ECS RTU panel shall be IEC-61850.
9. CONTRACTOR shall furnish detailed system architecture drawing giving explicit details of protocol, redundancy and topology in line with Tender requirements.
10. Human Machine Interface-HMI/ shall communicate with Ethernet switches over IEC-61850 Protocol.
11. Refer clause no. 6.1.2 & Figure No.-02 of attached specification for Numerical relay & Substation Automation System Doc. No. (6-51-0055) for system configuration details.
12. ICD files shall be provided for IEDs (relays etc.)/ any other device as required by vendor as the same shall be required by ECS vendor for configuration purpose during detailed engineering.
13. GPS and antenna shall be provided in each substation for time synchronization as per Tender requirement.
14. Supply and termination of FO cables & HDPE Duct between New Gantry S/S to ECS Panel in MRSS-100 shall be done by Contractor. Laying of this FO cable by other.

									
ENGINEERS INDIA LIMITED									
NEW DELHI									
PROJECT : PANIPAT REFINERY									
EXPANSION (P-25)									
CLIENT : M/s IOCL-PANIPAT									
REV.	A	DATE	11.04.2022	ISSUED WITH TENDER	RC	HK	HK	APPROVED	APPROVED

		HV CAPACITOR BANK DATA SHEET		Document No. B269-999-16-50-DS-0150 Rev. No. A Page 1 of 3	
Project Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery		Client IOCL REFINERY DIVISION - HEAD OFFICE			
Unit COMMON		Location		Job No. B269 Unit No. 999	
PURCHASER'S DATA					
A. Site Conditions					
1.	Maximum Ambient Temperature	°C	50		
2.	Minimum Ambient Temperature	°C	5		
3.	Design Ambient Temperature	°C	45		
4.	Relative Humidity	%	90		
5.	Altitude Above MSL	mm	1000		
6.	Environment	Hot, Humid & Corrosive			
B. Technical particulars					
1.	System nominal voltage	kV	6.6 ± 10 %		
2.	Frequency	Hz	50 ± 3 %		
3.	System earthing	Resistance Earthed			
4.	Fault level	kA	40		
5.	No. of phases	Three			
6.	Power frequency withstand				
	Capacitor bank	kV	28		
	Series reactor	kV			
	RVT	kV			
7.	Impulse withstand voltage				
	Capacitor bank	kVp	75		
	Series reactor	kVp			
	RVT	kVp			
8.	Minimum clearance Ph-Ph	mm	229		
9.	Minimum clearance Ph-E	mm	178		
10.	Capacitor bank				
a.	Rating at rated voltage at rated frequency	Refer Job Specification			
b.	Nameplate nominal voltage				
c.	Location	Indoor Panel Mounted			
d.	Incoming isolator				
e.	Lightning arrester				
f.	Compensation for kVAR loss due to series reactor included	Yes			
11.	Capacitor unit				
a.	Rating				
b.	Nameplate Nominal voltage				
c.	Power frequency/ Impulse voltage				
12.	Series reactor				
a.	Connected Load	Capacitor Bank			
b.	Percentage reactance	%	6		
c.	Location	Indoor Panel Mounted			
d.	Incoming cable				
13.	Residual voltage transformer				
a.	Primary voltage	kV	6.6/v3		
b.	Secondary voltage	V	110/V3 & 110/V3		
c.	Connection :	Primary	Star		
		Secondary	Star & Open Delta		
A	12-MAY-2020	ISSUED WITH MR/TENDER	JAYENDRA L CHAUHAN	HARISH KUMAR	HARISH KUMAR
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

 ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)		HV CAPACITOR BANK DATA SHEET		Document No. B269-999-16-50-DS-0150 Rev. No. A Page 2 of 3																									
Project Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client IOCL REFINERY DIVISION - HEAD OFFICE																										
Unit COMMON		Location		Job No. B269	Unit No. 999																								
d.	Rated output		VA																										
e.	Accuracy class																												
f.	Location		Indoor Panel Mounted																										
A. Capacitor bank MANUFACTURER'S DATA																													
1.	Make																												
2.	Applicable Standard																												
3.	Output	Rated	kVAR																										
		maximum	kVAR																										
4.	Voltage	Rated	kV																										
		maximum	kV																										
5.	Frequency	Rated	Hz																										
		maximum	Hz																										
6.	Inrush current	Initial	kA																										
		Back to back	kA																										
7.	Temperature rise (Max.)		°C																										
8.	Type of connection																												
9.	No. of capacitor units per bank																												
10.	No. of capacitor units in parallel per phase																												
11.	Power Frequency Withstand Voltage		kV RMS																										
12.	1.2/ 50 microsec impulse volt withstand		kV peak																										
13.	Minimum clearance Ph-Ph		mm																										
14.	Minimum clearance Ph-E		mm																										
15.	Dimension	Length	mm																										
		Breadth	mm																										
		Height	mm																										
16.	Weight		kg																										
B. Capacitor units																													
1.	Rated output voltage		kV																										
2.	Type of foil material																												
3.	Type of impregnant																												
4.	Dielectric strength of impregnant																												
5.	Residual voltage		V																										
6.	Discharge time		sec																										
7.	Dielectric losses																												
8.	Tangent of dielectric loss angle																												
9.	Power Frequency Withstand Voltage		kV RMS																										
10.	1.2/ 50 microsec impulse volt withstand		kV peak																										
11.	Dimension	Length	mm																										
		Breadth	mm																										
		Height	mm																										
12.	Weight		kg																										
C. Series reactor																													
1.	Make																												
2.	Type of core																												
3.	Type of cooling																												
<table border="1"> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>A</td> <td>12-MAY-2020</td> <td>ISSUED WITH MR/TENDER</td> <td>JAYENDRA L CHAUHAN</td> <td>HARISH KUMAR</td> <td>HARISH KUMAR</td> </tr> <tr> <td>Rev. No.</td> <td>Date</td> <td>Purpose</td> <td>Prepared By</td> <td>Reviewed By</td> <td>Approved By</td> </tr> </table>																		A	12-MAY-2020	ISSUED WITH MR/TENDER	JAYENDRA L CHAUHAN	HARISH KUMAR	HARISH KUMAR	Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By
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Project Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client IOCL REFINERY DIVISION - HEAD OFFICE		
Unit	COMMON	Location	Job No. B269	Unit No. 999	
4.	Rating	kVA			
5.	Rated voltage	kV			
6.	Rated frequency	Hz			
7.	Current	Rated	A		
		Maximum	A		
8.	Resistance per phase	ohms			
9.	Reactance per phase	ohms			
10.	Reactive drop per phase	V			
11.	Rated load loss at 75°C	W			
12.	Temperature rise winding	°C			
13.	Power Frequency Withstand Voltage	kV RMS			
14.	1.2/ 50 microsec impulse volt withstand	kV peak			
15.	Short time symmetrical current	A			
		Duration	sec		
16.	Resonance frequency	Hz			
17.	Dimension	Length	mm		
		Breadth	mm		
		Height	mm		
18.	Weight	kg			
D. Residual voltage transformer					
1.	Make				
2.	Primary Voltage				
3.	Secondary Voltage				
4.	Connection				
5.	Rated output & Accuracy class				
6.	Residual voltage	V			
7.	Power Frequency Withstand Voltage	kV RMS			
8.	1.2/ 50 microsec impulse volt withstand	kV peak			
9.	Dimension	Length	mm		
		Breadth	mm		
		Height	mm		
10.	Weight	kg			

Eil Notes

- 1 The Connection for RVT shall be Primary Star/ Secondary Star/Secondary Open Delta
- 2 Each Step shall be provided with separate RVT.

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 ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)		HV / MV Cable DATA SHEET		Document No. B269-999-16-50-DS-0200 Rev. No. A Page 1 of 2	
Project Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client IOCL REFINERY DIVISION - HEAD OFFICE		
Unit COMMON		Location		Job No. B269	Unit No. 999
PURCHASER'S DATA					
A. Site Conditions					
1.	Maximum Ambient Temperature	°C	50		
2.	Minimum Ambient Temperature	°C	5		
3.	Design Ambient Temperature	°C	45		
4.	Relative Humidity	%	90		
5.	Altitude Above MSL	mm	1000		
6.	Environment	Hot, Humid & Corrosive			
B. Technical particulars					
1.	System Voltage				
	Nominal	6.6KV(UE) / 33KV (E)			
	Highest	7.2KV / 36KV			
	Voltage grade	6.6/6.6KV, 19/33KV			
2.	Frequency	Hz	50 +/- 3 %		
3.	Conductor material				
	HV Power cable	Aluminium / Copper			
	MV Power cable	NA			
	MV control cable	NA			
4.	Installation under DGMS jurisdiction (See Note)	No			
5.	Applicable spec.	6-51-0051			
6.	Insulation	XLPE			
7.	PVC compound type	ST-2			
8.	Type of conductor	Stranded			
9.	Conductor class	As per Spec			
10.	Types of cable	FRLS - Outersheathed			
11.	Armour				
	Type	Refer EIL Spec 6-51-0051			
	Size of armour	As per 7098 (part-2)			
12.	Type of drum	Steel			
MANUFACTURER'S DATA					
A. Technical particulars					
1.	Name of manufacturer				
2.	MR/PR item no.				
3.	Cable type/ code				
4.	Conductor material				
5.	Conductor semiconducting screen (HV cables)				
	Material				
	Thickness	mm			
6.	Insulation				
	Type of compound				
	Thickness	mm			
7.	Insulation semiconducting screen (HV cables)				
	Material				
A	29-MAR-2022	ISSUED WITH MR	VVSN MURTY VALLEM	MANISH KUMAR	HARISH KUMAR
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Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE
Unit	COMMON	Location		Job No. B269	Unit No. 999

	Thickness	mm	
8.	Copper tape		
	Thickness	mm	
9.	Inner sheath		
	Type of compound		
	Thickness	mm	
10.	Nominal dia under armour	mm	
11.	Calculated dia under armour	mm	
12.	Armour		
	Material		
	Type		
	Size		
13.	Nominal dia under outersheath	mm	
14.	Calculated dia under outersheath	mm	
15.	Outersheath		
	Type of compound		
	Thickness	mm	
16.	Nominal outer dia of cable	mm	
17.	Tolerance on outer dia	%	
18.	Weight of cable per km	kg	
19.	Maximum drum length	mtr.	
20.	Maximum DC resistance of conductor at 20 °C		
21.	AC resistance at 90 °C		
22.	Reactance of cable at 50 Hz		
23.	Capacitance of cable		
24.	Zero sequence impedance of cable		
25.	Capacitive charging current per km		

Notes

- E- Earthed system
UE-Un Earthed system
- Single Line to Ground fault for sizing of Insulation screen for 6.6 kV cables shall be considered as 600 Amps (1 Second)
- Single Line to Ground fault for sizing of Insulation screen for 33 kV cables shall be considered as 40 kAmps (1 Second)
- Cables shall comply to EIL Standard Specification (Doc. No. 6-51-0051)
- Cables shall be dispatched in non-returnable Steel Drums.
- Vendor shall furnish the duly filled-in cable data sheet for each item separately.
- Vendor to provide and include following details for each cable type/size in cable data sheet:
 - nominal dia over armour
 - Current carrying capacity (in air at 40 deg C, in ground at 30 deg C, in duct at 30 deg C)
 - Short circuit current (KA) of conductor for 1 sec
 - Minimum bending radius
 - Embossing details as per EIL Specification 6-51-0051
- Vendor to provide following dimensions for each cable type/size: individual core dia. over insulation, individual core dia. Bare and dia. of individual core over shielding.

A	29-MAR-2022	ISSUED WITH MR	VVSN MURTY VALLEM	MANISH KUMAR	HARISH KUMAR
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PURCHASER'S DATA					
A Site conditions					
1	Maximum ambient temperature:	50 °C	4	Relative humidity:	90 %
2	Minimum ambient temperature:	5 °C	5	Altitude	< 1000 m
3	Design ambient temperature:	45 °C	6	Environment:	Humid & corrosive
B Technical particulars					
1	System voltage		5	Rated earth fault current (Corrugated aluminium sheath)	
	Nominal Highest Voltage grade			Current (66kV)	40 KA
	66KV (E) 72.5KV 38/66KV			Duration	1 sec
	110KV(E) 123KV 64/110KV				
	132KV(E) 145KV 76/132KV		6	Moisture Barrier	Corrugated Aluminium
	220KV(E) 245KV 127/220KV				
	400KV(E) 420KV 400/220KV		7	Metallic screen bonding Link boxes	Yes/No
2	Frequency	50Hz ± %	3		
			8	Sheath Voltage Limiter	Required/Not-required
3	Conductor material	Copper	9	Type of termination kits	Heat Shrinkable
4	Rated system fault level				
	Current (66kV)	40 KA	10	Type of jointing kits	Heat Shrinkable
	Duration	1 sec			
			11	Applicable spec.	As per MR
MANUFACTURER'S DATA					
A Cable					
1	Name of manufacturer		11	Inner sheath	
2	MR/PR Item no.			Type of compound	
3	Cable type/ code			Thickness	mm
4	Cross-section of conductor		12	Nominal dia under armour	mm
5	Conductor material		13	Calculated dia under armour	mm
6	Conductor semiconducting screen		14	Armour	
	Material			Material	
	Thickness	mm		Type	
7	Insulation			Size	
	Type of compound		15	Nominal dia under outersheath	mm
	Thickness	mm	16	Calculated dia under outersheath	mm
8	Insulation screen		17	Outer sheath	
	Non metallic			Type of compound	
	Material			Thickness	mm
	Thickness	mm	18	Material of conductive coating over	
	Thickness of water swellable tape layer	mm		outer sheath	
	Metallic		19	Nominal outer dia of cable	mm
	Size & no.of copper wires		20	Tolerance on outer dia	%
	size & thickness of copper tape	mm	21	Weight of cable per mtr	Kg
	Thickness of water swellable tape layer	mm	22	Maximum drum length	mtr.
9	Moisture barrier		23	Bending radius	mm
	Material		24	Recommended type of metallic screen/	
	Thickness	mm		sheath bonding scheme	
10	Metallic Sheath		25	Current carrying capacity	
	Material			In air at 45°C	
	Thickness	mm		In ground at 35°C	
B Accessories					
1	Metallic screen bonding Link Boxes		3	Termination kit	
	Make			Make	
	Material of construction			Type	
	Degree of Ingress protection		4	Jointing Kit	
2	Sheath Voltage Limiter			Make	
	Make			Type	
	Type				
	Voltage				

Notes

- 1 E - Earthed
- 2 Creepage distance for cable accessories shall be selected considering heavily polluted (31mm/KV) environment as per IEC

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Project Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery

Client IOCL REFINERY DIVISION - HEAD OFFICE

Unit COMMON

Location

Job No. B269

Unit No. 999

PURCHASER'S DATA

A. Site Conditions			
1.	Maximum Ambient Temperature	°C	50
2.	Minimum Ambient Temperature	°C	5
3.	Design Ambient Temperature	°C	45
4.	Relative Humidity	%	90
5.	Altitude Above MSL	mm	1000
6.	Environment		Hot, Humid & Corrosive
B. Technical particulars			
1.	Tag no.:		
2.	Duty:		Continuous
3.	No. of windings:		Two
4.	Type of cooling:		ONAN/ONAF
5.	Rated MVA		
6.	Oil type		Mineral (as per IS 335)
7.	Rated voltage		
	HV winding	kV	66
	LV-1 winding	kV	6.9
	LV-2 winding	kV	Not applicable
8.	HV Phase sequence		UVW
9.	LV Phase sequence		To suit switchgear
10.	System earthing:		
	HV side		Solidly earthed
	LV side-1		Resistance earthed
	LV side-2		Not applicable
11.	Rated frequency:	Hz	50 +/- 3 %
12.	No. of phases:		Three
13.	Fault level on HV side:	kA	40
14.	Connection		
	HV side		Delta
	LV side-1		Star
	LV side-2		Not applicable
15.	Vector group:		Dyn1
16.	Impedance at max. MVA:		
	HV-LV1	%	8
	HV-LV2	%	Not applicable
17.	Insulation class:		A
18.	Insulation level		
	P.f withstand		
	HV winding	kV	AS PER IS & CBIP
	LV-1 winding	kV	AS PER IS & CBIP
	LV-2 winding	kV	Not applicable
	Impulse withstand		
	HV winding	kVp	AS PER IS & CBIP
	LV-1 winding	kVp	AS PER IS & CBIP
	LV-2 winding	kVp	Not applicable

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Unit COMMON

Location

Job No. B269

Unit No. 999

19.	Winding insulation type:	
	HV winding	Uniform
	LV winding-1	Uniform
	LV winding-2	Not applicable
20.	Creepage distance	
	HV winding	31 mm/kV
	total	mm As per IS/CBIP
	protected	mm As per IS/CBIP
	LV-1 winding	31 mm/kV
	total	mm As per IS/CBIP
	protected	mm As per IS/CBIP
	LV-2 winding	NOT APPLICABLE
	total	mm Not applicable
21.	Continuous parallel operation	NOT APPLICABLE
22.	Limiting dimension	12M X 12M Bay
23.	Noise level	AS PER IS & CBIP
24.	Clearance:	
	Ph-Ph	mm AS PER IS & CBIP
	Ph-N	mm AS PER IS & CBIP
25.	Tap changer	
	Location	HV winding
	Type	OLTC
	Range	% ± 10
	No. of steps	17
	RTCC Panel	Required
	AVR	Required
	Master-follower sys.	Required
	Bi Dir. Power flow	Not Required
	Local Remote operation	Required
26.	Normal load:	% 30-40
27.	Temp. rise at extreme tap having max. losses :	
	oil	°C 45
	winding	°C 50
28.	Minimum guaranteed efficiency at 0.8 p.f at 40% of ONAN rating	Minimum 99.5
29.	Power flow:	Unidirectional
30.	Explosion protection	PRV
31.	Terminal location:	
	HV side	Larger side
	LV w.r.t HV	° 90
32.	Terminal connection	
	HV side	Cable box
	LV side	Busduct
33.	Cable size	
	HV side	3R X 1C X 300mm ²
	LV-1 side	Not applicable
	LV-2 side	Not applicable

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Location

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Unit No. 999

	Neutral	
34.	Neutral CT specification:	
	51G	
	HV side	VA During Detail Engg.CL 5P10
	LV-1 side	VA During Detail Engg.CL 5P10
	LV-2 side	VA
	64R	CL PS
	HV side	
	Vk	V During Detail Engg
	Im at Vk/2	mA During Detail Engg
	RCT	ohm During Detail Engg
	LV-1 side	
	Vk	V During Detail Engg
	Im at Vk/2	mA During Detail Engg
	RCT	ohm During Detail Engg
	LV-2 side	
	Vk	V Not applicable
	Im at Vk/2	mA Not applicable
	RCT	ohm Not applicable
35.	Installation	Outdoor
36.	Painting & colour	Epoxy & Shade RAL 7031
37.	AC Auxiliary voltage	V 415 +/- 10 % TPN
38.	Bidirectional roller type	Flat
39.	φ distance of flat rollers	mm 1754
40.	Applicable specifications	EIL Specification 6-51-0068
41.	Loss Capitalization	Not applicable
	Rate for copper loss Rs./kW:	
	Rate for iron loss Rs./kW:	
	Rate for aux. loss Rs./kW:	
42.	ECS interface	
	Digital output from RTCC:	Required
	Tap changer out of step	Required
	Tap changer stuck	Required
	Tap changer status signal	Required
	Supply failure	Required
	Individual/Parallel mode	Required
	Raiser/Lower control	Required
	Digital o/p from cooling control panel	Required
	Fan 'ON' (for each fan)	Required
	Fan 'Tripped'(for each fan)	Required
	Auto manual mode	Required
43.	Accessories requirement	
	Sampling valve	Yes
	Conservator drain valve	Yes
	Top oil filter valve	Yes

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	Explosion vent/PRV	Yes
	Air bag for conservator	Yes
	Dial type thermometer & contacts for OTI, WTI	Yes (See Notes)
	Drain valve	Yes
	Marshalling box	Yes
	Double float Buchholz	Yes
	Channels, towing lugs :	Yes
	Rollers	Yes
	Neutral bushing outside terminal box with connector assembly	Yes
	Inspection cover	Yes
	Disconnecting chamber	Yes
	WTI & OTI	Yes
	Busduct flange on LV	Yes
	Lugs and cable glands	Yes
44.	OLTC accessories	
	Single float Buchholz/oil surge relay	Yes
45.	Additional loose supply	
	Tap position indicator	No
	Raise/lower push buttons	No
	Transducers and necessary interface	No
46.	Tests requirements	
	Impulse test:	Test Certificate to be furnished (See Note-8)
	Heat run test	Required (See Notes-6 & 8)
	Short circuit test (On Transformer) :	Test Certificate to be furnished (See Note-8)
	Short circuit test (On Terminal box) :	Test Certificate to be furnished (See Note-8)
	Vaccum test on tank	Required (See Note-9)
	Pressure test on tank	Required (See Note-9)
	Oil leakage test	Required

MANUFACTURER'S DATA

A. Make:	
Rating MVA	
B. Performance	
1. No load loss at	
100% Voltage :	kw
110% Voltage :	kw
2. Full load copper loss at 75 °C	kw
3. Auxillary losses:	kw
4. No load current at	
100% Voltage :	A
110% Voltage :	A
5. Efficiency at full load at 75 °C	
at 0.8 p.f.	%
at 1.0 p.f.	%
6. Eff.at 50% load at 75 °C	
at 0.8 p.f.	%
at 1.0 p.f.	%

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7.	Maximum efficiency:	
	at 0.8 p.f.	%
	at 1.0 p.f.	%
8.	Load at which max eff. Occurs:	
	at 0.8 p.f.	MVA
	at 1.0 p.f.	MVA
9.	Regulation at 75 C	
	at 0.8 p.f.	%
	at 1.0 p.f.	%
10.	X1/R1 Ratio	
	X0/R0 Ratio	
11.	Zero sequence in impedance, Z0	
12.	Inrush Current	A
13.	Duration of Inrush Current	Sec
14.	Value of Permissible Overloading	
	For 0.5 Hrs	%
	For 1 Hrs	%
	For 2 Hrs	%
	For 4 Hrs	%
	For 6 Hrs	%
	For 8 Hrs	%
	For 12 Hrs	%
	For 24 Hrs	%
C	Construction features	
1.	Location of terminals	
	Primary	
2.	No of cooler banks	
3.	Qty of cooling fans:	
	Working:	Nos.
	Standby:	Nos.
4.	Location of Neutral CT	
5.	Explosion Protection	
6.	OLTC Specification:	
	Rated Voltage	kV
	Rated Current	A
	Location	
	Accessories	
D	Mechanical Data	
1.	Core & winding weight	kgs.
2.	Tank & fitting weight	kgs.
3.	Radiator without oil weight	kgs.
4.	Total weight	kgs.
5.	Total quantity of oil :	kgs.
6.	Quantity of oil in radiators :	ltrs.
7.	Qty of oil in OLTC chamber	ltrs.
8.	Overall dimensions	
	Length	mm

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Project Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery

Client IOCL REFINERY DIVISION - HEAD OFFICE

Unit COMMON

Location

Job No. B269

Unit No. 999

Breadth

mm

Height

mm

Notes

- 1 Performance data shall be furnished for ONAN rating.
- 2 Minimum guaranteed efficiency at 0.8 pf at 40% of ONAN rating shall be 99.5% (inclusive of tolerance)
- 3 Make of components shall be as per vendor list enclosed.
- 4 Losses shall be inclusive of positive tolerance and shall be at nominal tap.
- 5 Transducers for providing 4-20mA signal for OTI and WTI for owner interface shall be provided.
- 6 Heat Run test shall be conducted on one transformer of each rating.
- 7 Following details shall be submitted for scrutiny after design finalization :
 - a.) Yoke lamination bonding
 - b.) Type of core joint
 - c.) Number of laminations / lay
 - d.) Overlap length
 - e.) Angle of overlap
 - f.) Gap at joints
 - g.) Operation flux density
 - h.) Proportion of corner weight
 - i.) X0/X1
 - j.) X/R
 - k.) Z variation at +/-10% tap position
- 8 Vendor to ensure that valid type test certificates for offered design of transformer are available for heat run test, short circuit test and impulse test. The same shall also be furnished for Owner's record during detail engineering. In case the valid type test certificates are not available, bidder shall carryout the type tests without any additional cost and time implication to Owner/EIL. In case of non-availability of short circuit test reports, manufacturer certified comparative statement in line with IEC-60076 part 5 / IS 2026 part 5 shall be furnished.
- 9 Pressure test and vacuum test shall be conducted at vendors works on one transformer tank of each size.
- 10 String insulators with high creepage distances shall be used in terminal box of transformers.
- 11 Pollution level for all outdoor electrical equipments shall be considered as heavy

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Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE
Unit	COMMON	Location		Job No.	B269
				Unit No.	999
PURCHASER'S DATA					
A. Site Conditions					
1.	Maximum Ambient Temperature	°C	50		
2.	Minimum Ambient Temperature	°C	5		
3.	Design Ambient Temperature	°C	45		
4.	Relative Humidity	%	90		
5.	Altitude Above MSL	mm	1000		
6.	Environment	Hot, Humid & Corrosive			
B. Technical particulars					
1.	Rated voltage	Volts	6.6/v3		
2.	Rated current (short time rating)	A			
3.	Short time rating	10 Sec.			
4.	Continuous rating (10% of short time rating)	Not Required			
5.	Resistance of NGR	Ohms			
6.	Terminal connections				
6.1	Transformer neutral to NGR				
	Cable size	sq. mm.			
	Voltage grade	kV (E/UE)			
6.2	NGR to Earth				
	Size	sq. mm.			
	Voltage grade	kV (E/UE)			
7.	Installation	Outdoor			
8.	Cable connections				
8.1	Cable entry	Bottom			
8.2	Separate bolted removable gland plate for cable entry	Required			
8.3	Cable glands & lugs	Required			
9.	Current transformer	Not Required			
	Voltage grade				
	Ratio				
	Burden				
	Accuracy class				
10.	Painting/Painting shade	Epoxy & shade RAL 7031			
11.	Degree of protection	IP31 for Enclosure, IP 55 For Terminal Box			
12.	Applicable EIL specification	6-51-0043			
MANUFACTURER'S DATA					
A. Technical particulars					
1.	Make				
2.	Resistor element				
	Material code				
	Specific resistance	ohm cm			
	Temp. co-efficient				
	Resistance of banks	ohms			
	No. of resistor banks				
	Series	nos.			
	Parallel (Min.two)	nos..			
3.	Separate canopy provided				
A	13-MAY-2020	ISSUED WITH MR/TENDER	JAYENDRA L CHAUHAN	HARISH KUMAR	HARISH KUMAR
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE
Unit	COMMON	Location		Job No.	B269
				Unit No.	999
4.	Min. creepage distance				
	Total	mm			
	Protected	mm			
5.	P.f withstand voltage	kV (rms)			
6.	Overall dimensions				
	Width	mm			
	Depth	mm			
	Height	mm			
7.	Overall weight of panel	kg			
8.	Copies of type test certificates furnished				

Eil Notes

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A	13-MAY-2020	ISSUED WITH MR/TENDER	JAYENDRA L CHAUHAN	HARISH KUMAR	HARISH KUMAR
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

PROJECT : PANIPAT REFINERY EXPANSION (P-25) PROJECT

OWNER : M/s INDIAN OIL CORPORATION LTD.

EPMC : ENGINEERS INDIA LTD.

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This ECS I/O list is applicable for the 6.6kV HV Switchgear in substations

ECS I/O List

Type	Pt type	Description	Set condition	Reset condition	Interface	Remarks
INCOMER FROM TRANSFORMER						
DI	S	Ready to close			RELAY LAN	
DI	S	Synch. OK			RELAY LAN	
DI	D	Over Current			RELAY LAN	
DI	D	Earth Fault			RELAY LAN	
DI	D	51G Operated			RELAY LAN	
DI	D	Under Voltage			RELAY LAN	
DI	D	Reverse BLOCKING activated			RELAY LAN	
DI	D	64R Operated			RELAY LAN	
AI	A	R phase current			RELAY LAN	
AI	A	Y phase current			RELAY LAN	
AI	A	B phase current			RELAY LAN	
AI	W	3-Phase Real Power			RELAY LAN	
AI	R	3-Phase Reactive Power			RELAY LAN	
AI		Power Factor			RELAY LAN	
AI		Frequency			RELAY LAN	
DI	S	CB in service &	Closed	Not closed	HARDWIRED	
DI	S	CB in service &	Open	Not open	HARDWIRED	
DI	D	Relay 86	Operated	Reset	HARDWIRED	
DI	D	Relay 95	Operated	Reset	RELAY LAN	
DI	D	Trip on under voltage	Activated	Reset	RELAY LAN	
DI	D	Numerical Relays	Unhealthy	Healthy	RELAY LAN	
DO	C	Trip from ECS	Activated	Reset	HARDWIRED	
DO	C	Close Inhibit (From ECS)	Operated	Reset	HARDWIRED	
DI	D	Trafo Trouble Alarm (Buch., OTI,WTI)			RELAY LAN	
DI	D	Trafo Trouble Trip (Buch., OTI,WTI)			RELAY LAN	
AI	T	Oil Temperature			HARDWIRED	4-20mA through transducers in Trafo MB
AI	T	Winding Temperature			HARDWIRED	
DI	D	Transformer Differential	Operated=1		RELAY LAN	87T
DI	D	Over Temperature monitoring system	Operated	Reset	HARDWIRED	
INCOMER FROM ANOTHER SWITCHBOARD						
AI	A	R phase current			RELAY LAN	
AI	A	Y phase current			RELAY LAN	
AI	A	B phase current			RELAY LAN	
AI	W	3-Phase Real Power			RELAY LAN	
AI	R	3-Phase Reactive Power			RELAY LAN	

Type	Pt type	Description	Set condition	Reset condition	Interface	Remarks
AI		Power Factor			RELAY LAN	
AI		Frequency			RELAY LAN	
DI	S	CB in service &	Closed	Not closed	HARDWIRED	
DI	S	CB in service &	Open	Not open	HARDWIRED	
DI	D	Relay 86	Operated	Reset	HARDWIRED	
DI	D	Relay 95	Operated	Reset	RELAY LAN	
DI	D	Trip on under voltage	Activated	Reset	RELAY LAN	
DI	D	Numerical Relays	Unhealthy	Healthy	RELAY LAN	
DO	C	Trip from ECS	Activated	Reset	HARDWIRED	
DO	C	Close Inhibit (From ECS)	Operated	Reset	HARDWIRED	
DI	D	Feeder Differential	Operated=1		RELAY LAN	87F
DI	D	Over Temperature monitoring system	Operated	Reset	HARDWIRED	
LINE PT						
AI	V	R-Y Line Voltage			RELAY LAN	
AI	V	Y-B Line Voltage			RELAY LAN	
AI	V	R-B Line Voltage			RELAY LAN	
DI	D	Line PT Secondary MCB	Tripped=1		HARDWIRED	
BUS COUPLER-1						
AI	A	R phase current			RELAY LAN	
AI	A	Y phase current			RELAY LAN	
AI	A	B phase current			RELAY LAN	
AI	W	3-Phase Real Power (Bi-directional)			RELAY LAN	
AI	R	3-Phase Reactive Power			RELAY LAN	
AI		Power Factor			RELAY LAN	
DI	S	CB in service &	Closed	Not closed	HARDWIRED	
DI	S	CB in service &	Open	Not open	HARDWIRED	
DI	D	Relay 86	Operated	Reset	HARDWIRED	
DI	D	Relay 95	Operated	Reset	RELAY LAN	
DI	D	Trip on under voltage	Activated	Reset	RELAY LAN	
DI	D	Numerical Relays	Unhealthy	Healthy	RELAY LAN	
DO	C	Trip from ECS	Activated	Reset	HARDWIRED	
DO	C	Close Inhibit (From ECS)	Operated	Reset	HARDWIRED	
DI	D	Auto-changeover	Blocked	Not blocked	HARDWIRED	
DI	S	Switchboard (A-I-M selector switch)	Auto		HARDWIRED	
DI	S	Switchboard (A-I-M selector switch)	Independent		HARDWIRED	
DI	S	Switchboard (A-I-M selector switch)	Manual		HARDWIRED	
DI	D	AC control supply #1	Failed	Healthy	HARDWIRED	

Type	Pt type	Description	Set condition	Reset condition	Interface	Remarks
DI	D	AC control supply #2	Failed	Healthy	HARDWIRED	
DI	D	DC control supply #1	Failed	Healthy	HARDWIRED	
DI	D	DC control supply #2	Failed	Healthy	HARDWIRED	
DI	S	Ready to close			RELAY LAN	
DI	S	Synch. OK			RELAY LAN	
DI	D	Over Current / Earth Fault			RELAY LAN	
DI	D	Auto-changeover	Blocked	Not blocked	RELAY LAN	
DI	S	I/C-1 Under Voltage			RELAY LAN	
DI	S	I/C-2 Under Voltage			RELAY LAN	
DI	D	Reverse BLOCKING activated			RELAY LAN	
BUS COUPLER-2						
DI	S	CB in service &	Closed	Not closed	HARDWIRED	
DI	S	CB in service &	Open	Not open	HARDWIRED	
DI	D	Relay 86	Operated	Reset	HARDWIRED	
DI	D	Relay 95	Operated	Reset	HARDWIRED	
OUTGOING TRANSFORMER FEEDER						
AI	A	R phase current			RELAY LAN	
AI	A	Y phase current			RELAY LAN	
AI	A	B phase current			RELAY LAN	
AI	W	3-Phase Real Power			RELAY LAN	
AI	R	3-Phase Reactive Power			RELAY LAN	
AI		Power Factor			RELAY LAN	
AI		Frequency			RELAY LAN	
DI	S	CB in service &	Closed	Not closed	HARDWIRED	
DI	S	CB in service &	Open	Not open	HARDWIRED	
DI	D	Relay 86	Operated	Reset	HARDWIRED	
DI	D	Relay 95	Operated	Reset	RELAY LAN	
DI	D	Trip on under voltage	Activated	Reset	RELAY LAN	
DI	D	Numerical Relay	Unhealthy	Healthy	RELAY LAN	
DO	C	Trip from ECS	Activated	Reset	HARDWIRED	
DO	C	Close Inhibit (From ECS)	Operated	Reset	HARDWIRED	
DI	D	Transformer Trouble	Operated=1		RELAY LAN	63TX, 51G, 64R
DO	C	Outgoing trafo fdr re-closing	Activated	Reset	HARDWIRED	
DI	S	Ready to close			RELAY LAN	
DI	D	Over Current			RELAY LAN	
DI	D	Earth Fault			RELAY LAN	
DI	D	Trafo Trouble Alarm (Buch., OTI,WTI)			RELAY LAN	
DI	D	Trafo Trouble Trip (Buch., OTI,WTI)			RELAY LAN	
DI	D	64R from Downstream			RELAY LAN	

Type	Pt type	Description	Set condition	Reset condition	Interface	Remarks
DI	D	Reverse BLOCKING activated			RELAY LAN	
DI	D	51G from Downstream			RELAY LAN	
OUTGOING PLANT FEEDER						
AI	A	R phase current			RELAY LAN	
AI	A	Y phase current			RELAY LAN	
AI	A	B phase current			RELAY LAN	
AI	W	3-Phase Real Power			RELAY LAN	
AI	R	3-Phase Reactive Power			RELAY LAN	
AI		Power Factor			RELAY LAN	
DI	S	CB in service &	Closed	Not closed	HARDWIRED	
DI	S	CB in service &	Open	Not open	HARDWIRED	
DI	D	Relay 86	Operated	Reset	HARDWIRED	
DI	D	Relay 95	Operated	Reset	RELAY LAN	
DI	D	Trip on under voltage	Activated	Reset	RELAY LAN	
DI	D	Numerical Relays	Unhealthy	Healthy	RELAY LAN	
DO	C	Trip from ECS	Activated	Reset	HARDWIRED	
DI	D	Feeder Differential	Operated=1		RELAY LAN	
DI	S	Ready to close			RELAY LAN	
DI	D	Over Current			RELAY LAN	
DI	D	Earth Fault			RELAY LAN	
DI	D	Reverse BLOCKING activated			RELAY LAN	
DI	D	Line Differential Operated			RELAY LAN	
OUTGOING CAPACITOR FEEDER						
AI	A	R phase current			RELAY LAN	
AI	A	Y phase current			RELAY LAN	
AI	A	B phase current			RELAY LAN	
AI	R	3-Phase Reactive Power			RELAY LAN	
AI	R	3-Phase Reactive Power			RELAY LAN	
AI		Power Factor			RELAY LAN	
DI	S	CB in service &	Closed	Not closed	HARDWIRED	
DI	S	CB in service &	Open	Not open	HARDWIRED	
DI	D	Relay 86	Operated	Reset	HARDWIRED	
DI	D	Relay 95	Operated	Reset	RELAY LAN	
DI	D	Trip on under voltage	Activated	Reset	RELAY LAN	
DI	D	Numerical Relay	Unhealthy	Healthy	RELAY LAN	
DO	C	Close from ECS	Activated	Reset	HARDWIRED	
DO	C	Trip from ECS	Activated	Reset	HARDWIRED	
DI	S	Local / ECS Selector Switch in	LOCAL	Not_Local	HARDWIRED	
DI	S	Local / ECS Selector Switch in	ECS	Not_ECS	HARDWIRED	

Type	Pt type	Description	Set condition	Reset condition	Interface	Remarks
DI	S	Ready to close			RELAY LAN	
DI	D	Over Current			RELAY LAN	
DI	D	Earth Fault			RELAY LAN	
DI	D	Over Voltage			RELAY LAN	
DI	D	Under Voltage			RELAY LAN	
DI	D	Reverse BLOCKING activated			RELAY LAN	
OUTGOING MOTOR FEEDER						
DI	D	Motor Differential Operated			RELAY LAN	Applicable for motors $\geq 1500\text{kW}$
AI	A	R phase current			RELAY LAN	
AI	A	Y phase current			RELAY LAN	
AI	A	B phase current			RELAY LAN	
AI	W	3-Phase Real Power			RELAY LAN	
AI	R	3-Phase Reactive Power			RELAY LAN	
AI		Power Factor			RELAY LAN	
DI	S	CB in service &	Closed	Not closed	HARDWIRED	
DI	S	CB in service &	Open	Not open	HARDWIRED	
DI	D	Relay 86	Operated	Reset	HARDWIRED	
DI	D	Relay 95	Operated	Reset	RELAY LAN	
DI	D	Trip on under voltage	Activated	Reset	RELAY LAN	
DI	D	Numerical Relays	Unhealthy	Healthy	RELAY LAN	
DO	C	Trip from ECS	Activated	Reset	HARDWIRED	
DO	C	Close Inhibit (From ECS)	Operated	Reset	HARDWIRED	
DI	D	Motor Trip from Process	Operated=1		HARDWIRED	
DI	S	Ready to close			RELAY LAN	
DI	D	49T/50/50LR			RELAY LAN	
DI	D	Earth Fault			RELAY LAN	
DI	D	Unbalance Trip			RELAY LAN	
DI	D	Under Voltage Trip			RELAY LAN	
DI	S	Re-Acceleration			RELAY LAN	
DI	D	Reverse BLOCKING activated			RELAY LAN	
DI	D	Process Trip			RELAY LAN	
DI	S	Breaker 'ON' indication			RELAY LAN	
DI	S	Breaker 'OFF' indication			RELAY LAN	
DI	S	L/R switch in Local Indication			RELAY LAN	
DI	S	L/R switch in Remote Indication			RELAY LAN	
DI	S	Process Trip indication			RELAY LAN	
DI	S	Electrical fault trip indication			RELAY LAN	

Type	Pt type	Description	Set condition	Reset condition	Interface	Remarks
DI	S	Motor ready to start			RELAY LAN	
BUS PT						
AI	V	R-Y Line Voltage			RELAY LAN	
AI	V	Y-B Line Voltage			RELAY LAN	
AI	V	R-B Line Voltage			RELAY LAN	
DI	D	Bus PT Secondary MCB	Tripped=1		HARDWIRED	
DI	S	Dead Bus (<40%)			RELAY LAN	
DI	D	Under Voltage (<80%)			RELAY LAN	
DI	D	BPT not in Service / PT MCB Unhealthy			RELAY LAN	
DI	D	UF & df/dt Signal	Operated	Reset	Hardwired (4 Nos)	
OUTGOING VFD TRANSFORMER FEEDER						
AI	A	R phase current			RELAY LAN	
AI	A	Y phase current			RELAY LAN	
AI	A	B phase current			RELAY LAN	
AI	W	3-Phase Real Power			RELAY LAN	
AI	R	3-Phase Reactive Power			RELAY LAN	
AI		Power Factor			RELAY LAN	
DI	S	CB in service &	Closed	Not closed	HARDWIRED	
DI	S	CB in service &	Open	Not open	HARDWIRED	
DI	D	Relay 86	Operated	Reset	HARDWIRED	
DI	D	Relay 95	Operated	Reset	RELAY LAN	
DI	D	Trip on under voltage	Activated	Reset	RELAY LAN	
DI	D	Numerical Relay	Unhealthy	Healthy	RELAY LAN	
DO	C	Trip from ECS	Activated	Reset	HARDWIRED	
DO	C	Close Inhibit (From ECS)	Operated	Reset	HARDWIRED	
DI	D	Transformer Trouble	Operated=1		RELAY LAN	63TX, 51G, 64R
DI	S	Ready to close			RELAY LAN	
DI	D	Over Current			RELAY LAN	
DI	D	Earth Fault			RELAY LAN	
DI	D	Trafo Trouble Alarm (Buch., OTI, WTI)			RELAY LAN	
DI	D	Trafo Trouble Trip (Buch., OTI, WTI)			RELAY LAN	
DI	D	Trip from VFD			RELAY LAN	
DI	D	Reverse BLOCKING activated			RELAY LAN	
ISOLATING BREAKER PANEL						
AI	W	3-Phase Real Power			RELAY LAN	
AI	R	3-Phase Reactive Power			RELAY LAN	
AI		Power Factor			RELAY LAN	
DI	D	Line PT Secondary MCB	Tripped=1		HARDWIRED	

Type	Pt type	Description	Set condition	Reset condition	Interface	Remarks
DI	S	CB in service &	Closed	Not closed	HARDWIRED	
DI	S	CB in service &	Open	Not open	HARDWIRED	
DI	D	Relay 86	Operated	Reset	HARDWIRED	
DI	D	Relay 95	Operated	Reset	RELAY LAN	
DI	D	Trip on under voltage	Activated	Reset	RELAY LAN	
DI	D	Numerical Relays	Unhealthy	Healthy	RELAY LAN	
DO	C	Trip from ECS	Activated	Reset	HARDWIRED	
DI	D	Feeder Differential	Operated=1		RELAY LAN	
DI	D	Transformer Trouble	Operated=1		RELAY LAN	63TX, 51G, 64R
DI	D	Trafo Trouble Alarm (Buch., OTI, WTI)	Operated=1		RELAY LAN	
DI	D	Trafo Trouble Trip (Buch., OTI, WTI)	Operated=1		RELAY LAN	
VFD TIE FEEDER						
DI	S	CB in service &	Closed	Not closed	HARDWIRED	
DI	S	CB in service &	Open	Not open	HARDWIRED	
DI	D	Trip Circuit Supervision	Unhealthy	Healthy	HARDWIRED	
MISCELLANEOUS I/O SIGNALS						
DI	D	All Signals/ data related to Online temperature Monitoring System (OTMS).			RELAY LAN	Refer to Job Specification and System Architecture Drawing for data interface related to OTMS system with owner's ECS.

Notes

- 1.0 Acquisition of input/output (I/O) signals as hardwired or software:
 - a) All numerical relays shall be connected to ECS-RTU. ECS shall acquire relay and metering status I/O signals of the relays. These I/O signals have been indicated as "relay and metering LAN" in the typical I/O list above.
 - b) All other I/Os shall be acquired hardwired and have been indicated as "hardwired" in the typical I/O list above. All hardwired signals shall be wired and terminated in respective panels.
 - c) In case any of these data cannot be acquired over the relay LAN, these signals have to be provided as hardwired. For requirement of numerical relays, refer Electrical part of contract document.
- 2.0 This I/O list is indicative only. Any other I/O required for meeting the contract requirements shall be identified and provided by CONTRACTOR.
- 3.0 Transformer oil temperature and transformer winding temperature shall be acquired hardwired from 66kV power transformers only. These I/Os shall be acquired as a 4-20 mA signal from the transformer.

Guidelines for ECS I/O Interface Design

Analogue Input Signals	Signal transducers for hard-wired analogue inputs shall have accuracy

	class 0.1 for the range 0-120%. All transducers shall be externally-powered types. External power supply shall be 230V AC UPS.
	For all measurements for I, V, MW, MVAR, Hz, obtained on the relay and metering LAN, maximum possible accuracy shall be ensured
Digital Input Signals	
Alarm (D)	Alarm is a signal which requires operator to be alerted such as VT circuit MCB (closed, open), relays 86 & 95 (operated, reset), auto-changeover (blocked, not blocked), DC control supply (healthy, failed), line voltage (unhealthy, healthy), bus voltage (unhealthy, healthy), motor trip from process, under-voltage trip. This shall be hardwired / on relay LAN as specified.
	For hardwired signal, potential free contacts of rating 1 A, 110V DC or 240 V AC, make to alarm (NO) preferred. CONTRACTOR shall specifically indicate if NC contact is being provided in place of NO contact.
	Generally a hardwired alarm point is put under "sequence of event" monitoring
Status (S)	For hardwired signal, potential free contacts of rating 1 A, 110V DC or 240 V AC, make to alarm (NO) required
Digital Output Signals	
Command (C)	Hardwired through potential free changeover type contact of interposing relay, contact rating 5 A, 240 V AC and/or 4 A, 110V DC. Coil rating shall be 24 V DC

CLIENT : INDIAN OIL CORPORATION LTD.
PROJECT : PANIPAT REFINERY EXPANSION PROJECT (P-25)
EIL JOB NO. : B269
DISCIPLINE : ELECTRICAL
MR NO. : B269-999-XI-MR-0440

D	01-04-2022	ISSUED WITH TENDER	MKM	RG	HK
REV. NO	DATE	PURPOSE	PREPARED BY	REVIEWER	APPROVER

PREAMBLE TO VENDOR LIST

1. OWNER/EIL approved vendor list for Electrical items is enclosed in this section. VENDOR shall necessarily procure all the material/equipment forming permanent part of the unit/plant from OWNER/EIL approved vendor only. This shall include sub ordered items/components also. The "Approved Vendors" shall be item specific.
2. VENDOR may procure material from any of OWNER/EIL approved vendors. However current validity of vendor approval & their approved product range and the conditions imposed while according vendor approval as per EIL enlistment letter shall be verified by the VENDOR before placement of order.
 - VENDOR shall also verify the work load, stability and solvency status of the vendor prior to placement of order.
 - Vendors on OWNER/EIL holiday list shall not be considered for ordering, which need to be verified by the VENDOR prior to placement of order. VENDOR shall comply with this requirement without any time or cost implication to Owner.
 - In case any vendor is registered with EIL as an approved vendor subsequent to release of this vendor list, the same may also be considered by the VENDOR with prior intimation to OWNER/EIL and obtain their concurrence prior to placement of order.
 - Wherever job specification calls for requisite proven track record, the same shall be complied and necessary documents to be submitted for EIL/Client/Licenser approval prior to ordering.
3. Compliance to procurement of material from approved vendors is mandatory and shall be fully complied. No deviation to approved vendor list shall generally be acceptable.
4. For items not covered in the above list, the vendor list shall be approved by OWNER/EIL prior to placement of order by VENDOR. VENDOR shall list down the proposed suppliers/vendors for such items and submit the same for OWNER/EIL's review/approval along with necessary documents/credentials. Non-acceptance of a particular proposed vendor due to any reasons whatsoever shall not be a cause of schedule and cost implication.
5. VENDOR shall have an independent assessment of capability of all the vendors for timely deliveries of material/equipment. Any delays in deliveries by vendor(s) shall not be a cause of schedule and cost implication.
6. At any stage of the project, if it comes to the notice of OWNER/EIL that VENDOR has procured material/equipment, intentionally or unintentionally whatsoever, from an unapproved vendor and/or items not falling in approved product range of vendor(s), then the same shall be rejected forthwith and VENDOR shall be liable to replace such material/plant/machinery within the contract price and without any time/schedule implication.
7. Vendor may procure material from any of owners approved vendors. However current validity & range of approval as per enlistment letter, workload, stability & solvency need to be verified by vendor before placement of order.
8. For all equipment and components listed other than above, vendor shall submit past track record for the proposed sub vendors & obtain written approval from EIL/IOCL before placing order.
9. Make of equipment/component of foreign origin other than listed above shall be subject to EIL/IOCL review during detail engineering based on PTR to be submitted by vendor.

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 06AA		Description : HVAC SYSTEM- CENTRAL AIR CONDITIONING		
Approved Suppliers				
1	E178	VERTIV ENERGY PRIVATE LIMITED	INDIA	
2	A336	ADVANCE VENTILATION PVT. LTD	INDIA	
3	3678	ROOTS COOLING SYSTEMS PVT. LTD.	INDIA	
4	B029	BLUE STAR LTD	INDIA	
5	3962	ANEMO PROJECTS PVT LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 06AB		Description : HVAC SYSTEM- PACKAGED AIR CONDITIONING		
Approved Suppliers				
1	B029	BLUE STAR LTD	INDIA	
2	E178	VERTIV ENERGY PRIVATE LIMITED	INDIA	
3	3886	PURVI ENGINEERS INDIA PVT LTD	INDIA	
4	A336	ADVANCE VENTILATION PVT. LTD	INDIA	
5	A381	AIR PERFECTION	INDIA	
6	3678	ROOTS COOLING SYSTEMS PVT. LTD.	INDIA	
7	S461	S K SYSTEMS PVT LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 07AC		Description : CRANE- E.O.T (SAFE AREA)		
Approved Suppliers				
1	3875	MEEKA MACHINERY PVT LTD	INDIA	
2	S377	SAFEX ELECTROMECH PVT LTD	INDIA	
3	M248	MEEKA MACHINERY PVT LTD	INDIA	
4	F023	FURNACE AND FOUNDRY EQUIPMENT CO.	INDIA	
5	C035	CONSOLIDATED HOISTS PVT LTD.	INDIA	
6	E227	ELECTROMECH MATERIAL HANDLING SYSTEMS (I) PVT. LTD.	INDIA	
7	W013	WMI KONECRANES INDIA LTD.	INDIA	
8	S853	STAHL CRANE SYSTEMS GMBH	GERMANY	
9	A266	ANUPAM INDUSTRIES LIMITED (ANAND)	INDIA	
10	H012	HEAVY ENGINEERING CORPORATION LTD	INDIA	
11	T222	TATA STEEL GROWTH SHOP	INDIA	
12	G183	GRIP ENGINEERS PVT.LTD	INDIA	
13	W005	BRADY & MORRIS ENGINEERING CO. LTD.	INDIA	
14	3620	TECHNO INDUSTRIES	INDIA	
15	E072	EDDY CRANES ENGRS (P) LTD	INDIA	
16	S138	SAFEX ENERGY PVT LTD	INDIA	
17	3622	UNIQUE INDUSTRIAL HANDLERS PVT. LTD.	INDIA	
18	3619	TECHNO INDUSTRIES	INDIA	

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 07AH		Description : CHAIN PULLEY BLOCK		
Approved Suppliers				
1	W005	BRADY & MORRIS ENGINEERING CO. LTD.	INDIA	
2	H129	HERCULES HOISTS LTD	INDIA	
3	3921	BAKELITE ELECTRICAL MFG CO.PVT LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13BA		Description : SWITCHBOARD-HV (INDOOR) WITH VCB BREAKR		
Approved Suppliers				
1	A309	ABB INDIA LTD (NASIK)	INDIA	
2	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	
3	L088	LARSEN & TOUBRO LTD- TAMCO DIV.	MALAYSIA	
4	C010	CG POWER AND INDUSTRIAL SOLUTIONS LIMITED	INDIA	
5	B041A	BHEL (BHOPAL)	INDIA	
6	S109	SCHNEIDER ELECTRIC INFRA. LTD(FORM A347)	INDIA	
7	S003	SIEMENS LIMITED	INDIA	
8	3670	STELMEC LIMITED	INDIA	
9	3856	SCHNEIDER ELECTRIC INFRASTRUCTURE LIMITED	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13BC		Description : SWITCHBOARD-M.V.-MCC/PCC/PMCC-DRAWOUT		
Approved Suppliers				
1	C024	CONTROLS & SCHEMATICS LTD	INDIA	
2	L001C	LARSEN & TOUBRO LTD-POWAI	INDIA	
3	3873	ABB INDIA LTD	INDIA	
4	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	
5	S109	SCHNEIDER ELECTRIC INFRA. LTD(FORM A347)	INDIA	
6	S003	SIEMENS LIMITED	INDIA	
7	L063	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13BD		Description : RELAY & CONTROL PANEL		
Approved Suppliers				
1	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	
2	S003B	SIEMENS LTD - GOA	INDIA	
3	3919	VENSON ELECTRIC PRIVATE LIMITED	INDIA	
4	E143	EASUN REYROLLE LTD	INDIA	
5	G147	GE INDIA INDUSTRIAL PVT LTD	INDIA	
6	E156	ENPRO INDUSTRIAL AUTOMATION PVT LTD	INDIA	
7	D153	DANISH PRIVATE LIMITED	INDIA	
8	S003	SIEMENS LIMITED	INDIA	
9	A392	GE T&D INDIA LIMITED	INDIA	
10	3860	HITACHI ENERGY INDIA LIMITED	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13BE		Description : SWITCHBOARD-HV-GAS INSULATED		
Approved Suppliers				
1	S109	SCHNEIDER ELECTRIC INFRA. LTD(FORM A347)	INDIA	
2	A309	ABB INDIA LTD (NASIK)	INDIA	
3	S003B	SIEMENS LTD - GOA	INDIA	
4	A070	ABB INDIA LTD (BARODA)	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13BF		Description : SWITCHBOARD FIXED FOR PACKAGE EQUIPTS		
Approved Suppliers				
1	V124	VIDHYUT CONTROL (INDIA) PVT LTD	INDIA	
2	3837	MILESTONES SWITCHGEARS PVT LTD	INDIA	
3	M264	MAKTEL SYSTEMS	INDIA	
4	A212	ACCUSONIC CONTROLS PVT LTD	INDIA	
5	M138	M.K. ENGINEERS & CONTROLS PVT. LTD.	INDIA	
6	T114	TRICOLITE ELECTRICAL INDUSTRIES PVT LTD	INDIA	
7	4007	INTRELEC	INDIA	
8	N148	NITYA ELECTROCONTROLS PRIVATE LIMITED	INDIA	
9	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	
10	E209	ELECTRO ALLIED PRODUCTS	INDIA	
11	3780	POSITRONICS PVT LTD	INDIA	
12	Z011	ZENITH ENGINEERING CORP.	INDIA	
13	P289	POPULAR SWITCHGEARS PVT LTD	INDIA	

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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13GA		Description : CONTROL STATIONS- WEATHERPROOF		
Approved Suppliers				
1	F165	FCG FLAMPROOF CONTROL GEARS P. LTD(C-157	INDIA	
2	B002	BCH ELECTRIC LTD	INDIA	
3	E111	ELECTRICAL EQUIPMENT CORPORATION	INDIA	
4	3681	FCG POWER INDUSTRIES PVT LTD	INDIA	
5	F141	FCG POWER INDUSTRIES PVT LTD	INDIA	
6	B024	BALIGA LIGHTING EQUIPMENTS (P) LIMITED	INDIA	
7	F036	FLAMEPROOF EQUIPMENTS PVT.LTD	INDIA	
8	G159	PEPPERL & FUCHS MANUFACTURING (INDIA) PRIVATE LIMITED	INDIA	
9	T166	TEKNIC ELECTRIC (I) PVT. LTD.	INDIA	
10	F024	FLEXPRO ELECTRICALS PVT LTD	INDIA	
11	E024	EX-PROTECTA	INDIA	
12	S158	SUDHIR SWITCHGEARS PVT LTD	INDIA	
13	3706	PHOENIX MECANO INDIA PVT. LTD.	INDIA	

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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13HB		Description : BATTERY CHARGERS		
Approved Suppliers				
1	D120	DUBAS ENGINEERING PVT LTD	INDIA	
2	3861	STATCON ENERGIAA PVT. LTD.	INDIA	
3	M225	MASS-TECH CONTROLS PVT LTD	INDIA	
4	C043	CHHABI ELECTRICALS PVT LIMITED	INDIA	
5	A267	AMARA RAJA POWER SYSTEMS LIMITED	INDIA	
6	H010A	HITACHI HI-REL POWER ELECTRONICS PRIVATE LIMITED	INDIA	
7	U021	UNIVERSAL INSTRUMENT MFG CO PVT LTD	INDIA	
8	27401	Borri S.p.A	ITALY	
9	H132	HBL POWER SYSTEMS LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13HD		Description : BATTERIES-NICKLE CADMIUM		
Approved Suppliers				
1	A305	SAFT INDIA PRIVATE LIMITED	INDIA	
2	H132	HBL POWER SYSTEMS LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13IA		Description : U.P.S.SYSTEM		
Approved Suppliers				
1	27401	Borri S.p.A	ITALY	
2	T597	TOSHIBA CORPORATION	JAPAN	
3	C592	CHLORIDE INDUSTRIAL SYSTEMS	FRANCE	
4	D026	VERTIV ENERGY PVT. LTD.	INDIA	
5	H010A	HITACHI HI-REL POWER ELECTRONICS PRIVATE LIMITED	INDIA	
6	G562	GUTOR ELECTRONIC LLC	SWITZERLAND	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13JD		Description : MOTOR INDUCTION-MV (INDL.TYPE SAFE AREA)		
Approved Suppliers				
1	M282	MARATHON ELECTRIC MOTORS (INDIA) LTD.	INDIA	
2	B048	BHARAT BIJLEE LIMITED	INDIA	
3	3668	CG POWER & INDUSTRIAL SOLUTIONS LTD.	INDIA	
4	A310	ABB INDIA LTD-FARIDABAD	INDIA	
5	L065	LAXMI HYDRAULICS PVT LTD	INDIA	
6	A200	ABB INDIA LTD (BANGALORE)	INDIA	
7	3940	HEM INDUSTRIES	INDIA	
8	3986	HAVELLS INDIA LTD	INDIA	
9	S003	SIEMENS LIMITED	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13JK		Description : MOTORS - IMPORTED		
Approved Suppliers				
1	J511	JEUMONT SA / FRAMATONE ANP	FRANCE	
2	C730	GE ENERGY POWER CONVERSION FRANCE SAS	FRANCE	
3	L575	LOHER GMBH	GERMANY	
4	L603	LLOYD DYNAMOWERKE GMBH & CO. KG	GERMANY	
5	W598	WEG EQUIPAMENTOS ELETRICOS S.A.	BRAZIL	
6	G632	GENERAL ELECTRIC CANADA	CANADA	
7	A717	NIDEC ASI SPA	ITALY	
8	W598A	WEGEURO - INDUSTRIA ELECTRICA S.A.	PORTUGAL	
9	H641	HYUNDAI HEAVY INDUSTRIES CO. LTD	KOREA, PEOPLE'S DEMOCRATIC REPUBLIC OF	
10	H510	HITACHI LTD	JAPAN	
11	27420	TOSHIBA MITSUBISHI ELEC. IND. SYS. CORP.	JAPAN	
12	T597	TOSHIBA CORPORATION	JAPAN	
13	C736	CEMP SRL	ITALY	
14	A661	ASEA BROWN BOVERY LTD (ABB LTD)	SWITZERLAND	

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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13KA		Description : TRANSFORMERS-POWER-ABOVE 5MVA		
Approved Suppliers				
1	3713	CG POWER & INDUSTRIAL SOLUTIONS LTD.	INDIA	
2	T129	TRANSFORMERS & RECTIFIERS (I) LTD	INDIA	
3	B048	BHARAT BIJLEE LIMITED	INDIA	
4	S109	SCHNEIDER ELECTRIC INFRA. LTD(FORM A347)	INDIA	
5	3929	ATLANTA ELECTRICALS PRIVATE LIMITED	INDIA	
6	3692	KANO HAR ELECTRICALS LIMITED	INDIA	
7	B184	BHEL JHANSI	INDIA	
8	3684	VOLTAMP TRANSFORMERS LTD	INDIA	
9	K107	KANO HAR ELECTRICALS LTD.	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13KB		Description : TRANSFORMERS-DISTRIBUTION-UP TO 5MVA		
Approved Suppliers				
1	3692	KANOHAR ELECTRICALS LIMITED	INDIA	
2	3812	TRANSFORMERS & RECTIFIERS (I) LTD	INDIA	
3	V003	VOLTAMP TRANSFORMERS LTD	INDIA	
4	3659	CG POWER & INDUSTRIAL SOLUTIONS LTD.	INDIA	
5	R191	RAYCHEM RPG PRIVATE LIMITED	INDIA	
6	K107	KANOHAR ELECTRICALS LTD.	INDIA	
7	S109	SCHNEIDER ELECTRIC INFRA. LTD(FORM A347)	INDIA	
8	P292	HAMMOND POWER SOLUTIONS PRIVATE LIMITED	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13LD		Description : HIGH MAST LIGHTING SYSTEM		
Approved Suppliers				
1	3850	BAJAJ ELECTRICALS LTD	INDIA	
2	B011	BAJAJ ELECTRICALS LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 130A		Description : CABLES-HIGH VOLTAGE-XLPE		
Approved Suppliers				
1	H060	HAVELLS INDIA LTD	INDIA	
2	P254	POLYCAB INDIA LIMITED	INDIA	
3	3770	CMI LIMITED	INDIA	
4	K190A	KEC INTERNATIONAL LIMITED	INDIA	
5	S147	STERLITE POWER TRANSMISSION LIMITED	INDIA	
6	3723	POLYCAB INDIA LIMITED	INDIA	
7	3763	GEMSCAB INDUSTRIES LTD	INDIA	
8	3959	TIRUPATI PLASTOMATICS PVT. LTD.	INDIA	
9	3647	GUPTA POWER INFRASTRUCTURE LIMITED	INDIA	
10	3669	KEI INDUSTRIES LIMITED	INDIA	
11	K082	KEI INDUSTRIES LIMITED	INDIA	
12	U085	APAR INDUSTRIES LTD	INDIA	
13	U003	UNIVERSAL CABLES LTD	INDIA	

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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13OC		Description : CABLES-MEDIUM VOLTAGE-POWER-PVC/XLPE		
Approved Suppliers				
1	U085	APAR INDUSTRIES LTD	INDIA	
2	3732	POLYCAB INDIA LIMITED	INDIA	
3	4001	RAVI INDUSTRIES	INDIA	
4	G156	GEMSCAB INDUSTRIES LTD	INDIA	
5	3969	SHIVPRIYA CABLES PRIVATE LIMITED	INDIA	
6	3796	PARAMOUNT COMMUNICATIONS LTD	INDIA	
7	K082	KEI INDUSTRIES LIMITED	INDIA	
8	3765	THERMO CABLES LTD.	INDIA	
9	C145	CORDS CABLE INDUSTRIES LTD	INDIA	
10	A132	ASSOCIATED FLEXIBLES & WIRES [P] LTD	INDIA	
11	3783	POLYCAB INDIA LIMITED	INDIA	
12	3722	POLYCAB INDIA LIMITED	INDIA	
13	K190A	KEC INTERNATIONAL LIMITED	INDIA	
14	H060	HAVELLS INDIA LTD	INDIA	
15	3781	POLYCAB INDIA LIMITED	INDIA	
16	3647	GUPTA POWER INFRASTRUCTURE LIMITED	INDIA	
17	3669	KEI INDUSTRIES LIMITED	INDIA	
18	3602	Special Cables Pvt. Ltd.	INDIA	
19	S304	SUYOG ELECTRICALS LTD	INDIA	
20	3731	POLYCAB INDIA LIMITED	INDIA	
21	U003	UNIVERSAL CABLES LTD	INDIA	
22	S025	SRIRAM CABLES PVT LTD	INDIA	
23	3854	CHANDRESH CABLES LIMITED	INDIA	
24	3770	CMI LIMITED	INDIA	

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 130D		Description : CABLES:CONTROL (UNPAIRED)-PVC/XLPE		
Approved Suppliers				
1	3784	POLYCAB INDIA LIMITED	INDIA	
2	U003	UNIVERSAL CABLES LTD	INDIA	
3	3722	POLYCAB INDIA LIMITED	INDIA	
4	G156	GEMSCAB INDUSTRIES LTD	INDIA	
5	3724	CORDS CABLE INDUSTRIESLTD.	INDIA	
6	C145	CORDS CABLE INDUSTRIES LTD	INDIA	
7	3814	RR KABEL LIMITED	INDIA	
8	H060	HAVELLS INDIA LTD	INDIA	
9	C019	CMI LIMITED	INDIA	
10	D012	DELTON CABLES LIMITED	INDIA	
11	E063	ELKAY TELELINKS LTD.-	INDIA	
12	K082	KEI INDUSTRIES LIMITED	INDIA	
13	3854	CHANDRESH CABLES LIMITED	INDIA	
14	3872	GUPTA POWER INFRASTRUCTURE LIMITED	INDIA	
15	K190A	KEC INTERNATIONAL LIMITED	INDIA	
16	3752	APAR INDUSTRIES LTD	INDIA	
17	T212	THERMO CABLES LTD (FORM. T-150)	INDIA	
18	3796	PARAMOUNT COMMUNICATIONS LTD	INDIA	
19	S304	SUYOG ELECTRICALS LTD	INDIA	
20	3602	Special Cables Pvt. Ltd.	INDIA	
21	S025	SRIRAM CABLES PVT LTD	INDIA	
22	A034	ASSOCIATED CABLES PVT LTD	INDIA	
23	3969	SHIVPRIYA CABLES PRIVATE LIMITED	INDIA	
24	3669	KEI INDUSTRIES LIMITED	INDIA	
25	3765	THERMO CABLES LTD.	INDIA	
26	A132	ASSOCIATED FLEXIBLES & WIRES [P] LTD	INDIA	
27	3783	POLYCAB INDIA LIMITED	INDIA	
28	4001	RAVI INDUSTRIES	INDIA	

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13OE		Description : CABLES-FIRE ALARM, COMMUNICATION AND CONTROL PAIRED		
Approved Suppliers				
1	K082	KEI INDUSTRIES LIMITED	INDIA	
2	C019	CMI LIMITED	INDIA	
3	D012	DELTON CABLES LIMITED	INDIA	
4	3669	KEI INDUSTRIES LIMITED	INDIA	
5	S304	SUYOG ELECTRICALS LTD	INDIA	
6	U015	UDEY PYROCABLES PVT. LTD.	INDIA	
7	C145	CORDS CABLE INDUSTRIES LTD	INDIA	
8	E063	ELKAY TELELINKS LTD.-	INDIA	
9	T212	THERMO CABLES LTD (FORM. T-150)	INDIA	
10	3724	CORDS CABLE INDUSTRIESLTD.	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13OH		Description : CABLES - EXTRA HIGH VOLTAGE		
Approved Suppliers				
1	S147	STERLITE POWER TRANSMISSION LIMITED	INDIA	
2	H060	HAVELLS INDIA LTD	INDIA	
3	U003	UNIVERSAL CABLES LTD	INDIA	
4	K082	KEI INDUSTRIES LIMITED	INDIA	
5	3885	LS CABLE INDIA PRIVATE LIMITED	INDIA	
6	3974	FINOLEX J-POWER SYSTEMS PVT. LTD.	INDIA	
7	K190A	KEC INTERNATIONAL LIMITED	INDIA	
8	3723	POLYCAB INDIA LIMITED	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13PA		Description : CAPACITORS-HIGH VOLTAGE		
Approved Suppliers				
1	B041A	BHEL (BHOPAL)	INDIA	
2	3860	HITACHI ENERGY INDIA LIMITED	INDIA	
3	3898	TDK INDIA PRIVATE LIMITED	INDIA	
4	U003	UNIVERSAL CABLES LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14AA		Description : AIR CIRCUIT BREAKER		
Approved Suppliers				
1	A200B	ABB INDIA LTD	INDIA	
2	S003	SIEMENS LIMITED	INDIA	
3	G147	GE INDIA INDUSTRIAL PVT LTD	INDIA	
4	S450A	SCHNEIDER ELECTRIC INDIA P LTD-HYDERABAD	INDIA	
5	L001C	LARSEN & TOUBRO LTD-POWAI	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14AB		Description : AUX. RELAYS		
Approved Suppliers				
1	3642	M/S JVS ELECTRONICS PVT LTD	INDIA	
2	3860	HITACHI ENERGY INDIA LIMITED	INDIA	
3	A392	GE T&D INDIA LIMITED	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14BA		Description : BIMETAL RELAYS		
Approved Suppliers				
1	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	
2	S450A	SCHNEIDER ELECTRIC INDIA P LTD-HYDERABAD	INDIA	
3	A200	ABB INDIA LTD (BANGALORE)	INDIA	
4	B002	BCH ELECTRIC LTD	INDIA	
5	S003	SIEMENS LIMITED	INDIA	
6	G147	GE INDIA INDUSTRIAL PVT LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14BB				

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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14BC		Description : BUS DUCT (H.V)		
Approved Suppliers				
1	B184	BHEL JHANSI	INDIA	
2	3954	GODREJ & BOYCE MANUFACTURING COMPANY LIMITED	INDIA	
3	B222	GODREJ & BOYCE MANUFACTURING COMPANY LIMITED	INDIA	
4	U036	UNITED ELECTRIC CO (DELHI) PVT LTD	INDIA	
5	K191	Stardrive Busducts Limited	INDIA	
6	N132	NARMADA SWITCHGEAR PVT. LTD	INDIA	
7	E107	ENPRO ENGINEERING	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14BD		Description : BUCHHOLZ RELAY		
Approved Suppliers				
1	A319	A J SERVICES	INDIA	
2	A318	ATVUS INDUSTRIES	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14CB		Description : CABLE TERMN. & JOINTING KIT		
Approved Suppliers				
1	R160	RAYCHEM RPG PRIVATE LIMITED	INDIA	
2	T217	3M ELECTRO & COMMUNICATION INDIA PRIVATE LIMITED	INDIA	
3	3645	YAMUNA CABLE ACCESSORIES PVT. LTD.	INDIA	
4	H168	HEATSHRINK TECHNOLOGIES LTD (FORM. R136)	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14CC		Description : CIRCUIT BREAKER SF-6 OUTDOOR EHV		
Approved Suppliers				
1	S003	SIEMENS LIMITED	INDIA	
2	3828	GE T&D INDIA LIMITED	INDIA	
3	C010	CG POWER AND INDUSTRIAL SOLUTIONS LIMITED	INDIA	
4	3859	HITACHI ENERGY INDIA LIMITED	INDIA	
5	B041A	BHEL (BHOPAL)	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14CD		Description : CONTACTORS		
Approved Suppliers				
1	S003	SIEMENS LIMITED	INDIA	
2	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	
3	A200	ABB INDIA LTD (BANGALORE)	INDIA	
4	S450A	SCHNEIDER ELECTRIC INDIA P LTD-HYDERABAD	INDIA	
5	G147	GE INDIA INDUSTRIAL PVT LTD	INDIA	
6	B002	BCH ELECTRIC LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14CE		Description : CONTROL SWITCHES (BREAKER)		
Approved Suppliers				
1	S373	SWITRON DEVICES	INDIA	
2	A392	GE T&D INDIA LIMITED	INDIA	
3	R159	RELIABLE ELECTRONIC COMPONENTS PVT LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14CF		Description : CONTROL SWITCHES / SELECTOR SWITCHES		
Approved Suppliers				
1	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	
2	S003	SIEMENS LIMITED	INDIA	
3	R159	RELIABLE ELECTRONIC COMPONENTS PVT LTD	INDIA	
4	S373	SWITRON DEVICES	INDIA	
5	K143	KAYCEE INDUSTRIES LTD.	INDIA	
6	4002	P.P. INDUSTRIES	INDIA	
7	H142	HOTLINE SWITCHGEAR & CONTROLS	INDIA	
8	A392	GE T&D INDIA LIMITED	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14EA		Description : EARTH LEAKAGE CIRCUIT BREAKER		
Approved Suppliers				
1	3824	HAVELLS INDIA LIMITED	INDIA	
2	G147	GE INDIA INDUSTRIAL PVT LTD	INDIA	
3	S450	SCHNEIDER ELECTRIC INDIA PVT LTD	INDIA	
4	A372	ABB INDIA LTD	INDIA	
5	L071	LEGRAND (INDIA) PVT. LTD (FORM. M-006)	INDIA	
6	3726	NOVATEUR ELECTRICAL & DIGITAL SYSTEMS PVT. LTD.	INDIA	
7	S003	SIEMENS LIMITED	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14FA		Description : FUSES		
Approved Suppliers				
1	C194	EATON POWER QUALITY PRIVATE LIMITED	INDIA	
2	S003	SIEMENS LIMITED	INDIA	
3	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	
4	I013	NOVATEUR ELECTRICAL & DIGITAL SYSTEMS P	INDIA	
5	G147	GE INDIA INDUSTRIAL PVT LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14HA		Description : HEAVY DUTY SWITCHES		
Approved Suppliers				
1	S003	SIEMENS LIMITED	INDIA	
2	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14IA		Description : INSTRUMENT TRANSFORMERS CT & PT (MV)		
Approved Suppliers				
1	3901	NEWTEK ELECTRICALS	INDIA	
2	K149	KALPA ELEKTRIKAL PVT LTD	INDIA	
3	3789	PRAGATI ELECTRICALS PVT LTD	INDIA	
4	G135	GILBERT & MAXWELL ELECTRICALS PVT LTD	INDIA	
5	P228	PRAGATI ELECTRICALS PVT LTD	INDIA	
6	N119	NARAYAN POWERTECH PVT LTD	INDIA	
7	S372	SILKAANS ELECTRICALS MFG.CO.PVT.LTD	INDIA	
8	P237	PRECISE ELECTRICALS	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14IB		Description : INSTRUMENT TRANSFORMERS CT & PT (HV)		
Approved Suppliers				
1	3857	SCHNEIDER ELECTRIC INFRASTRUCTURE LIMITED	INDIA	
2	E144	ELECTRICAL CONTROLS & SYSTEMS	INDIA	
3	3859	HITACHI ENERGY INDIA LIMITED	INDIA	
4	3730	GEMINI INSTRATECH LTD	INDIA	
5	P228	PRAGATI ELECTRICALS PVT LTD	INDIA	
6	K013	KAPPA ELECTRICALS	INDIA	
7	K149	KALPA ELEKTRIKAL PVT LTD	INDIA	
8	3862	STRATON ELECTRICALS PRIVATE LIMITED	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14IC		Description : CT/PT OUTDOOR (EHV)		
Approved Suppliers				
1	3967	ELECTRICAL CONTROLS & SYSTEMS	INDIA	
2	3827	GE T&D INDIA LIMITED	INDIA	
3	C010	CG POWER AND INDUSTRIAL SOLUTIONS LIMITED	INDIA	
4	3859	HITACHI ENERGY INDIA LIMITED	INDIA	
5	3788	PRAGATI ELECTRICALS PVT LTD	INDIA	
6	B184	BHEL JHANSI	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14ID		Description : ISOLATOR & EARTHING SWITCH OUTDOOR EHV		
Approved Suppliers				
1	S003	SIEMENS LIMITED	INDIA	
2	S093	S&S POWER SWITCHGEAR LTD	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14IF		Description : ISOLATORS/LOAD BREAK SWITCHES(HV INDOOR)		
Approved Suppliers				
1	S003	SIEMENS LIMITED	INDIA	
2	P302	PANICKER SWITCHGEAR PVT LTD(FORM D-022)	INDIA	



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14LA		Description : LIGHTNING ARRESTORS		
Approved Suppliers				
1	C010	CG POWER AND INDUSTRIAL SOLUTIONS LIMITED	INDIA	
2	O009	OBLUM ELECTRICAL INDUSTRIES (P) LTD	INDIA	
3	W035	W.S. INSULATOR OF INDIA	INDIA	
4	E091	ELPRO INTERNATIONAL LIMITED	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14LB		Description : LIGHTING FIXTURE & ACCESORY-NON HZARDOUS		
Approved Suppliers				
1	3993	LIGHTING TECHNOLOGIES INDIA PRIVATE LIMITED	INDIA	
2	3833	BAJAJ ELECTRICALS LTD	INDIA	
3	3687	PYROTECH ELECTRONICS PVT. LTD. UNIT -1	INDIA	
4	3834	BAJAJ ELECTRICALS LTD	INDIA	
5	3986	HAVELLS INDIA LTD	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14LC		Description : LIGHTING & POWER PANELS (SAFE AREA)		
Approved Suppliers				
1	A372	ABB INDIA LTD	INDIA	
2	I013	NOVATEUR ELECTRICAL & DIGITAL SYSTEMS P	INDIA	
3	3825	HAVELLS INDIA LIMITED	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14LD		Description : DRY TYPE LIGHTING TRANSFORMERS		
Approved Suppliers				
1	V003	VOLTAMP TRANSFORMERS LTD	INDIA	
2	G179	GUJARAT PLUG-IN DEVICES PVT LTD	INDIA	
3	I054	INDCOIL TRANSFORMERS PVT LTD	INDIA	
4	A028	AUTOMATIC ELECTRIC LTD.	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14MA		Description : MCB		
Approved Suppliers				
1	3726	NOVATEUR ELECTRICAL & DIGITAL SYSTEMS PVT. LTD.	INDIA	
2	3824	HAVELLS INDIA LIMITED	INDIA	
3	S003	SIEMENS LIMITED	INDIA	
4	A372	ABB INDIA LTD	INDIA	
5	3888	POLYCAB INDIA LIMITED	INDIA	
6	I168	INDIANA CURRENT CONTROL LTD	INDIA	
7	S450	SCHNEIDER ELECTRIC INDIA PVT LTD	INDIA	
8	S393	STANDARD ELECTRICALS LTD	INDIA	
9	L071	LEGRAND (INDIA) PVT. LTD (FORM. M-006)	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14MB		Description : MCCB		
Approved Suppliers				
1	A200B	ABB INDIA LTD	INDIA	
2	G147	GE INDIA INDUSTRIAL PVT LTD	INDIA	
3	S003	SIEMENS LIMITED	INDIA	
4	S450A	SCHNEIDER ELECTRIC INDIA P LTD-HYDERABAD	INDIA	
5	L001C	LARSEN & TOUBRO LTD-POWAI	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14MC		Description : METERS		
Approved Suppliers				
1	R042	RISHABH INSTRUMENTS PVT LTD	INDIA	
2	A028A	AUTOMATIC ELECTRIC LTD.	INDIA	
3	M239	MECO INSTRUMENTS PVT LTD	INDIA	
4	N130	NIPPEN ELECTRICAL INSTRUMENTS CO.	INDIA	
5	3901	NEWTEK ELECTRICALS	INDIA	
6	S141	SECURE METERS LIMITED	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14MD		Description : MAGNETIC OIL LEVEL GAUGE		
Approved Suppliers				
1	I179	INSTRUMENT & CONTROLS	INDIA	
2	S437	SUKRUT UDYOG	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14OA		Description : OIL TEMPERATURE INDICATOR		
Approved Suppliers				
1	P269	PRECIMEASURE CONTROLS PVT.LTD.	INDIA	
2	P270	PERFECT CONTROLS	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14OB		Description : ON LOAD TAP CHANGER		
Approved Suppliers				
1	B041A	BHEL (BHOPAL)	INDIA	
2	C200	CTR MANUFACTURING INDUSTRIES LTD	INDIA	
3	E165	EASUN-MR TAP CHANGERS P LTD	INDIA	
4	O048	ON LOAD GEARS	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14PA		Description : PROTECTION RELAYS		
Approved Suppliers				
1	S450A	SCHNEIDER ELECTRIC INDIA P LTD-HYDERABAD	INDIA	
2	S003B	SIEMENS LTD - GOA	INDIA	
3	E143	EASUN REYROLLE LTD	INDIA	
4	A070	ABB INDIA LTD (BARODA)	INDIA	
5	A392	GE T&D INDIA LIMITED	INDIA	
6	S824	SCHWEITZER ENGINEERING LABORATORIES	UNITED STATES	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14PB		Description : PUSH BUTTON AND INDICATING LAMPS		
Approved Suppliers				
1	B002	BCH ELECTRIC LTD	INDIA	
2	E173	ESSEN DEINKI	INDIA	
3	S003	SIEMENS LIMITED	INDIA	
4	L001C	LARSEN & TOUBRO LTD-POWAI	INDIA	
5	S365	SHRI TULSI SWITCHGEARS PVT LTD	INDIA	
6	H142	HOTLINE SWITCHGEAR & CONTROLS	INDIA	
7	4002	P.P. INDUSTRIES	INDIA	
8	S450A	SCHNEIDER ELECTRIC INDIA P LTD-HYDERABAD	INDIA	
9	P291	PRECIFINE PRODUCTS PVT. LTD.	INDIA	
10	T166	TEKNIC ELECTRIC (I) PVT. LTD.	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14SA		Description : FUSE SWITCH COMBINATION		
Approved Suppliers				
1	G147	GE INDIA INDUSTRIAL PVT LTD	INDIA	
2	3825	HAVELLS INDIA LIMITED	INDIA	
3	I013	NOVATEUR ELECTRICAL & DIGITAL SYSTEMS P	INDIA	
4	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	
5	S393	STANDARD ELECTRICALS LTD	INDIA	
6	S003	SIEMENS LIMITED	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14TA		Description : TIMERS		
Approved Suppliers				
1	E151	ELECTRONIC AUTOMATION PVT LTD	INDIA	
2	S003	SIEMENS LIMITED	INDIA	
3	B002	BCH ELECTRIC LTD	INDIA	
4	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	



056056054051

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14WA		Description : WINDING TEMPERATURE INDICATOR		
Approved Suppliers				
1	P270	PERFECT CONTROLS	INDIA	
2	P269	PRECIMEASURE CONTROLS PVT.LTD.	INDIA	



056056054051

MANDATORY SPARE LIST (ELECTRICAL) FOR 220kV GIS PACKAGE (TENDER NO. B269-999-16-50-EB-T-0020)

PROJECT : P25 PROJECT

OWNER : M/s INDIAN OIL CORPORATION LTD.

EPMC : ENGINEERS INDIA LTD.

JOB NO. : B269

E	07.04.2022	REVISED AND REISSUED WITH TENDER	MKM	RG	HK
D	01.04.2022	REVISED AND REISSUED WITH TENDER	MKM	RG	HK
C	27.09.2021	REVISED AND REISSUED WITH TENDER	AKG	HK	HK
B	05.07.2021	REVISED AND REISSUED WITH TENDER	AKG	HK	HK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

Mandatory spares for applicable items shall be as per Clause 6.1 of Engineering Design Basis (Electrical), B269-999-16-50-EDB-1001 attached with the tender document.

In addition to the above following mandatory spare shall also be supplied:

[illegible]

NOTES:

1. The word 'TYPE' means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable.
2. The terminology used under 'Item Description' is the commonly used name of the part and may vary from manufacturer to manufacturer.
3. Wherever % age is identified, Contractor shall supply next rounded figure.
4. Mandatory spares as indicated above do not cover commissioning spares.
5. Mandatory spares as indicated above do not cover two year O&M spares.
6. Mandatory spares shall be applicable for electrical items of sub-packages as per mandatory spares philosophy specified elsewhere in the bid document.
7. * 1 no. of each item for each EHV GIS i.e. separate set for 220kV indoor GIS, 220kV outdoor GIS, 66kV & 33kV indoor GIS.
8. ** 1 no. of each item for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV & 66kV Indoor GIS) & New gantry substation(i.e. common set for 220kV Outdoor GIS and 33kV indoor GIS).

Existing 220kV GIS System Details

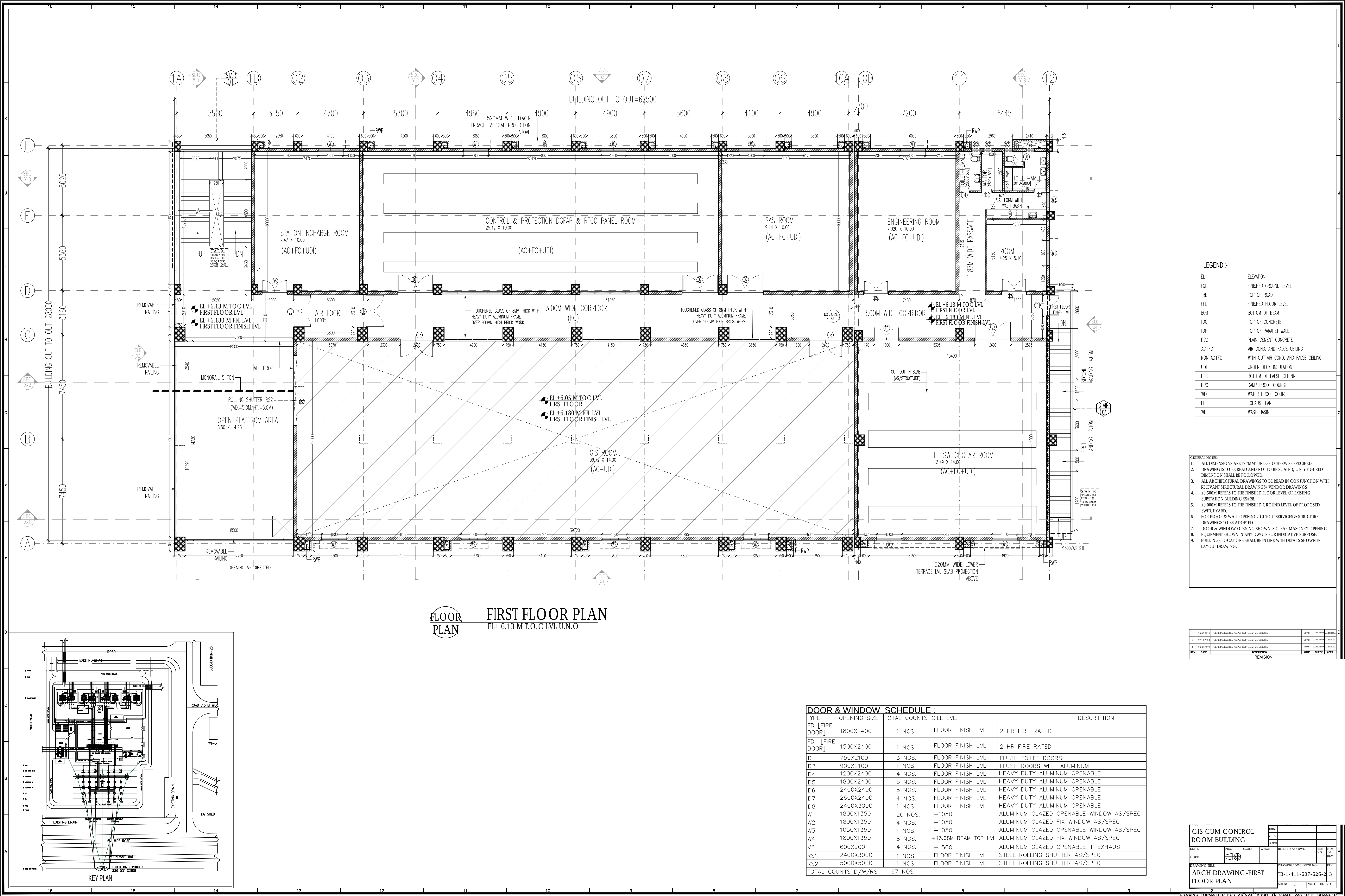
**PROJECT : EPCM SERVICES FOR CAPACITY
EXPANSION OF PANIPAT
REFINERY (P25 PROJECT)**

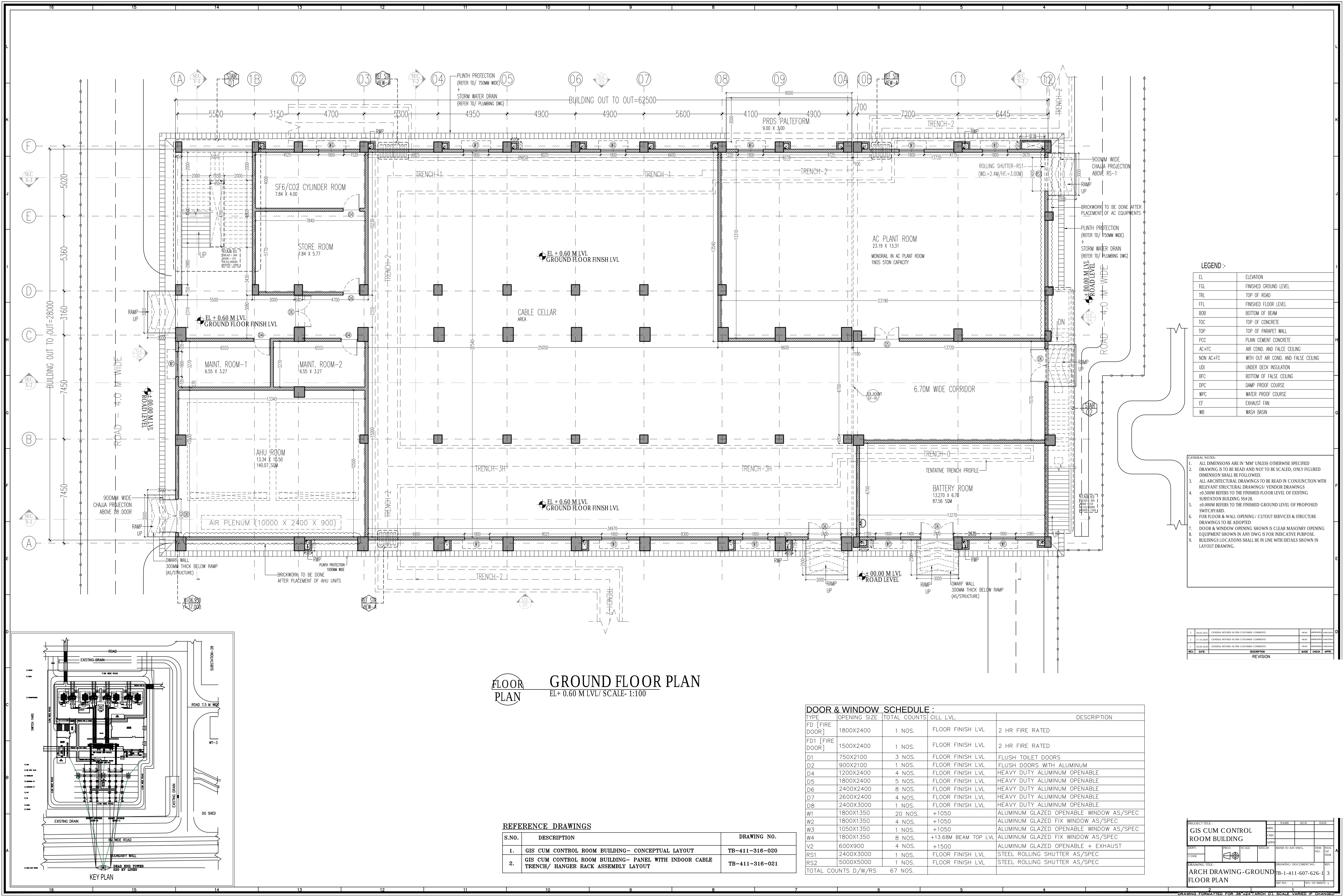
CLIENT : M/s IOCL, PANIPAT REFINERY

EPCM : M/s ENGINEERS INDIA LTD.

JOB NO. : B269

S. No.	Item	Details Required	Site Inputs for Existing (BHEL) 220 KV GIS System
1	BUS BAR Protection Existing 220 KV GIS System (BHEL)	Make and model of the existing Bus bar protection panel.	Make: GE Model: P74194NA6M0700K Protection Type: Low Impedance differential protection Redundant: Yes, both at CUA and PUA level. Additional features: Main and Check features as per standard double bus configuration scheme. Location: Dedicated Busbar protection panel in CRP type 2BB1.
2	220 KV GIS Substation (BHEL)	- Existing Switchyard equipment layout - Existing GIS building layout - Existing Lighting protection (DSLIP) layout - Existing Control building layout	Documents Attached
3	Online PD Monitoring System	Online PD monitoring system make and Model.	MAKE: OHV MODEL:- Model TYPE:- Ultra High Frequency (UHF) Suitable for :- N-type Connector Case:- Portable
4	CRP Panel	The details for the CRP Manufacturer name, and whether numerical relays with 61850 protocol are provided	CRP Make: GE T&D The complete communication is on IEC-61850 only with any interfacing intermediate hardware.
5	Substation Automation System	Make and Model of SAS system	SAS Make: GE T&D Details attached.
6	Fire Alarm System	Details of the make and model of Fire alarm system at substation # 63 at PR.	The FA system to which the system is to be integrated with FA system of existing 220kV GIS Substation (BHEL Scope). The DGFAP shall be located in PX control room. Make: Bosch.
7	Line Differential Relays	The make and model of the Line differential relays at existing 220 KV GIS Substation .	The make of Line differential protection is GE T&D only. The details provided in CRP documents attached as Annex-1
8	PLCC System (BHEL -220 KV GIS System)	The details of the existing PLCC system – make and model.	The PLCC details are attached. PLCC & its associated hardware Make: ABB





FLOOR PLAN
GROUND FLOOR PLAN
EL+0.60 M LVL/ SCALE: 1:100

REFERENCE DRAWINGS

S.NO.	DESCRIPTION	DRAWING NO.
1.	GIS CUM CONTROL ROOM BUILDING- CONCEPTUAL LAYOUT	TB-411-316-020
2.	GIS CUM CONTROL ROOM BUILDING- PANEL WITH INDOOR CABLE TRENCH/ HANGER RACK ASSEMBLY LAYOUT	TB-411-316-021

DOOR & WINDOW SCHEDULE :

TYPE	OPENING SIZE	TOTAL COUNTS	CILL LVL.	DESCRIPTION
FD [FIRE DOOR]	1800X2400	1 NOS.	FLOOR FINISH LVL	2 HR FIRE RATED
FD1 [FIRE DOOR]	1500X2400	1 NOS.	FLOOR FINISH LVL	2 HR FIRE RATED
D1	750X2100	3 NOS.	FLOOR FINISH LVL	FLUSH TOILET DOORS
D2	900X2100	1 NOS.	FLOOR FINISH LVL	FLUSH DOORS WITH ALUMINUM
D4	1200X2400	4 NOS.	FLOOR FINISH LVL	HEAVY DUTY ALUMINUM OPENABLE
D5	1800X2400	5 NOS.	FLOOR FINISH LVL	HEAVY DUTY ALUMINUM OPENABLE
D6	2400X2400	8 NOS.	FLOOR FINISH LVL	HEAVY DUTY ALUMINUM OPENABLE
D7	2600X2400	4 NOS.	FLOOR FINISH LVL	HEAVY DUTY ALUMINUM OPENABLE
D8	2400X3000	1 NOS.	FLOOR FINISH LVL	HEAVY DUTY ALUMINUM OPENABLE
W1	1800X1350	20 NOS.	+1050	ALUMINUM GLAZED OPENABLE WINDOW AS/SPEC
W2	1800X1350	4 NOS.	+1050	ALUMINUM GLAZED FIX WINDOW AS/SPEC
W3	1050X1350	1 NOS.	+1050	ALUMINUM GLAZED OPENABLE WINDOW AS/SPEC
W4	1800X1350	8 NOS.	+13.68M BEAM TOP LVL	ALUMINUM GLAZED FIX WINDOW AS/SPEC
V2	600X900	4 NOS.	+1500	ALUMINUM GLAZED OPENABLE + EXHAUST
RS1	2400X3000	1 NOS.	FLOOR FINISH LVL	STEEL ROLLING SHUTTER AS/SPEC
RS2	5000X5000	1 NOS.	FLOOR FINISH LVL	STEEL ROLLING SHUTTER AS/SPEC
TOTAL COUNTS D/W/RS		67 NOS.		

LEGEND :

EL	ELEVATION
FGL	FINISHED GROUND LEVEL
TRL	TOP OF ROAD
FFL	FINISHED FLOOR LEVEL
BOB	BOTTOM OF BEAM
TOC	TOP OF CONCRETE
TOP	TOP OF PARAPET WALL
PCC	PLAIN CEMENT CONCRETE
AC+FC	AIR COND. AND FALSE CEILING
NON AC+FC	WITH OUT AIR COND. AND FALSE CEILING
UDI	UNDER DECK INSULATION
BFC	BOTTOM OF FALSE CEILING
DPC	DAMP PROOF COURSE
WPC	WATER PROOF COURSE
EF	EXHAUST FAN
WB	WASH BASIN

- GENERAL NOTES:
1. ALL DIMENSIONS ARE IN 'MM' UNLESS OTHERWISE SPECIFIED
 2. DRAWING IS TO BE READ AND NOT TO BE SCALED, ONLY FIGURED DIMENSION SHALL BE FOLLOWED.
 3. ALL ARCHITECTURAL DRAWINGS TO BE READ IN CONJUNCTION WITH RELEVANT STRUCTURAL DRAWINGS/ VENDOR DRAWINGS
 4. +0.500M REFERS TO THE FINISHED FLOOR LEVEL OF EXISTING SUBSTATION BUILDING SS#28.
 5. +0.000M REFERS TO THE FINISHED GROUND LEVEL OF PROPOSED SWITCHYARD.
 6. FOR FLOOR & WALL OPENING/ CUTOUT SERVICES & STRUCTURE DRAWINGS TO BE ADOPTED
 7. DOOR & WINDOW OPENING SHOWN IN CLEAR MASONRY OPENING
 8. EQUIPMENT SHOWN IN ANY DWG IS FOR INDICATIVE PURPOSE.
 9. BUILDINGS LOCATIONS SHALL BE IN LINE WITH DETAILS SHOWN IN LAYOUT DRAWING.

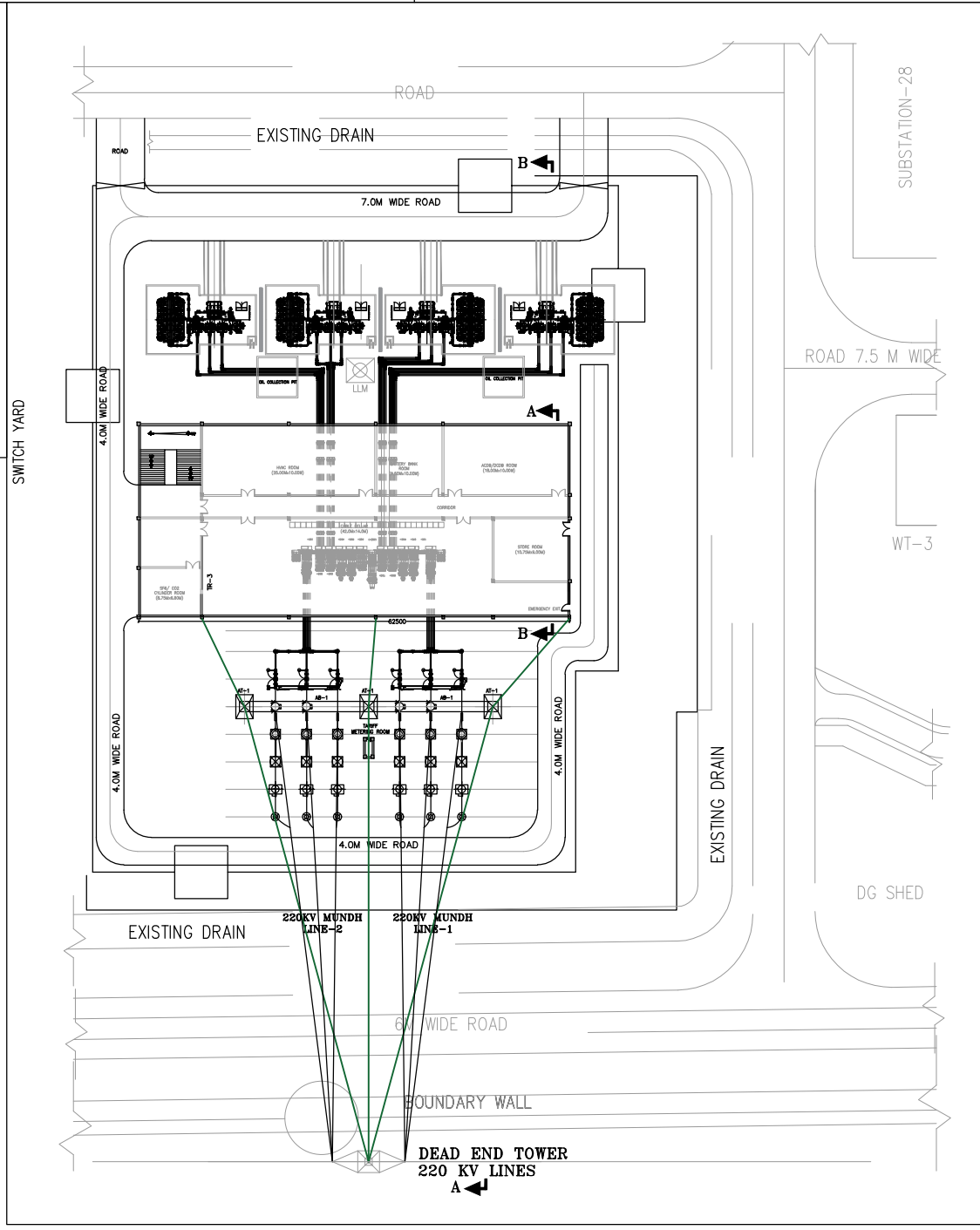
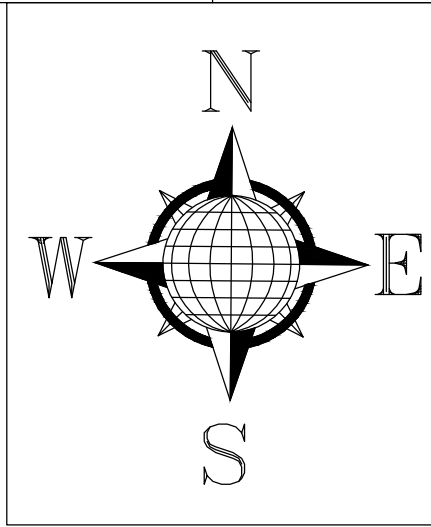
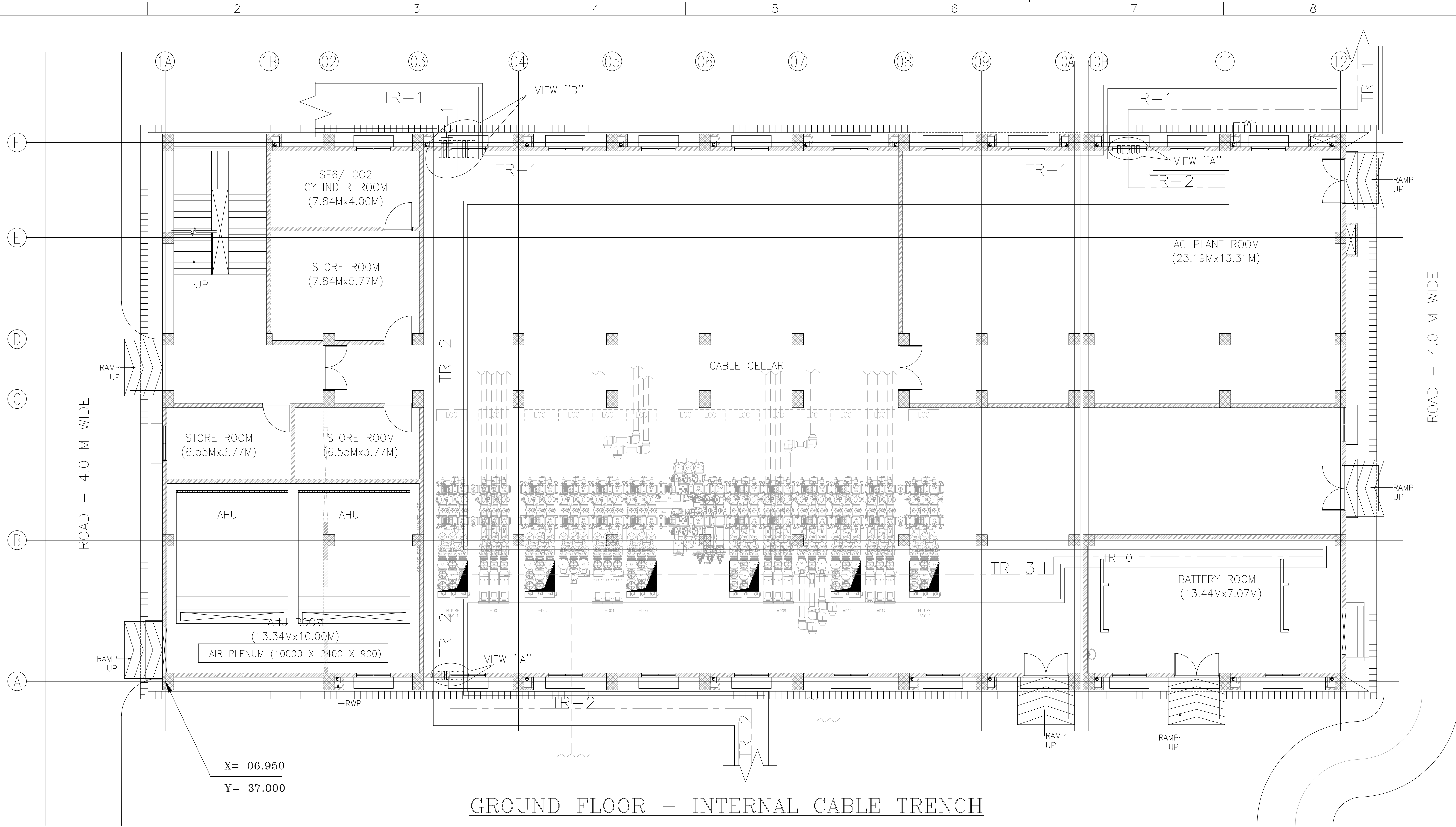
REV.	DATE	DESCRIPTION	MADE	CHECK	APPR.
1	20.08.2024	GENERAL REVIEWED AS PER CUSTOMER COMMENTS			
2	27.08.2024	GENERAL REVIEWED AS PER CUSTOMER COMMENTS			
3	26.09.2024	GENERAL REVIEWED AS PER CUSTOMER COMMENTS			

PROJECT TITLE				NAME	SGIN	DATE
GIS CUM CONTROL ROOM BUILDING				DRN		
				CHKD		
				APPR		
DEPT	PROJ	SCALE		REFER TO ASS DWG.		
CODE					DRM NO.	NOS. OF SHEET
DRAWING TITLE				DRAWING/ DOCUMENT NO.		
ARCH DRAWING-GROUND FLOOR PLAN				TB-1-411-607-626-1 3		
				SHEET NO. 1 NO. OF SHEETS 1		

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

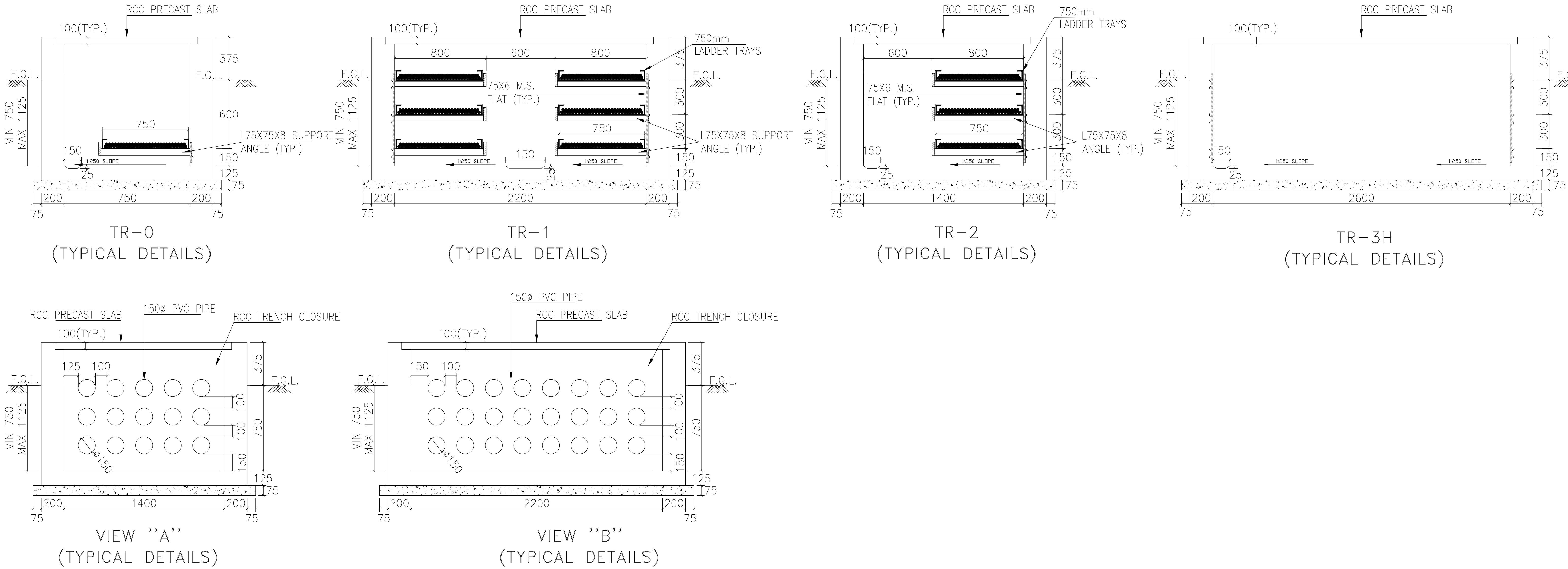
INVENTORY NO
SIGN. AND DATE
REF. DRG. NO.
COMPUTER FILE NAME

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)



NOTES:-

- ALL DIMENSIONS ARE IN mm.
- THE LOCATION OF TRENCHES/ HANGER & RACK ASSEMBLY MARKED IN THIS DRAWING MAY BE MODIFIED TO SUIT SITE CONDITIONS.
- INSERTS MUST BE EMBEDDED FOR FIXING HANGER & RACK ASSEMBLY.
- POWER CABLES SHALL BE LAID IN TOP TIERS AND CONTROL CABLES IN BOTTOM TIERS, AS PER TECHNICAL SPECIFICATION.
- EARTH CONDUCTOR 50x6 GI FLAT SHALL BE RUN ALONG THE TOP TIER AND TO BE WELDED ON THE CABLE SUPPORT BEFORE INSTALLATION OF CABLES.
- ALL OTHER DETAILS PERTAINING TO CIVIL WORKS SHALL REFLECT IN RESPECTIVE CIVIL DRAWINGS.
- ENTRY/ EXIT OF CABLES SHALL BE THROUGH THE PIPE SLEEVES FOR TRENCH CONNECTING WITH BUILDING. FIRE SEALANTS SHALL BE PROVIDED AT THIS LOCATIONS.
- CABLE TRAY IS SIZED CONSIDERING SINGLE LAYER OF CABLES FOR LT POWER CABLES, WHEREAS FOR CONTROL OR INSTRUMENTATION CABLES, MAXIMUM DOUBLE LAYER PER TRAY IS CONSIDERED.
- SEPARATE CABLE TRAYS SHALL BE USED FOR LT POWER CABLE, LT CONTROL CABLE & INSTRUMENTATION CABLES/COMMUNICATION CABLE.
- SUPPORT SPAN IS TO BE PROVIDED AT A DISTANCE OF 1500MM. INSERT PLATE SHALL SUITABLE FOR 3 TIER RACK ASSEMBLY BE PROVIDED IN TR-3H ALSO FOR FUTURE USE OF RACK ASSEMBLY.
- CABLE TRAYS, RACKS AND TRENCHES IS SIZED TO ALLOW FOR 30% FUTURE CABLES
- CABLE TRENCH SHOWN FOR FUTURE PANEL SHALL BE COVERED WITH CHEQUERED PLATE.
- TRENCH SECTION-3H IN AHU ROOM SHALL BE IN BOX CULVERT FORM TO SUITABLE FOR SUSTAINING THE DYNAMIC LOADING OF AHU.



REFERENCE DRAWING (S)/ DOCUMENT(S) -

SL. NO.	DRAWING/ DOCUMENT NO.	DRAWING TITLE
1.	TB-411-316-020	GIS CUM CONTROL ROOM BUILDING- CONCEPTUAL LAYOUT
PROJECT: LSTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY LOA NO. RPRC182491/26286965 DTD.24.01.2020		

REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK
		CHECKED				CHECKED				CHECKED				CHECKED				CHECKED	
		APPROVED				APPROVED				APPROVED				APPROVED				APPROVED	
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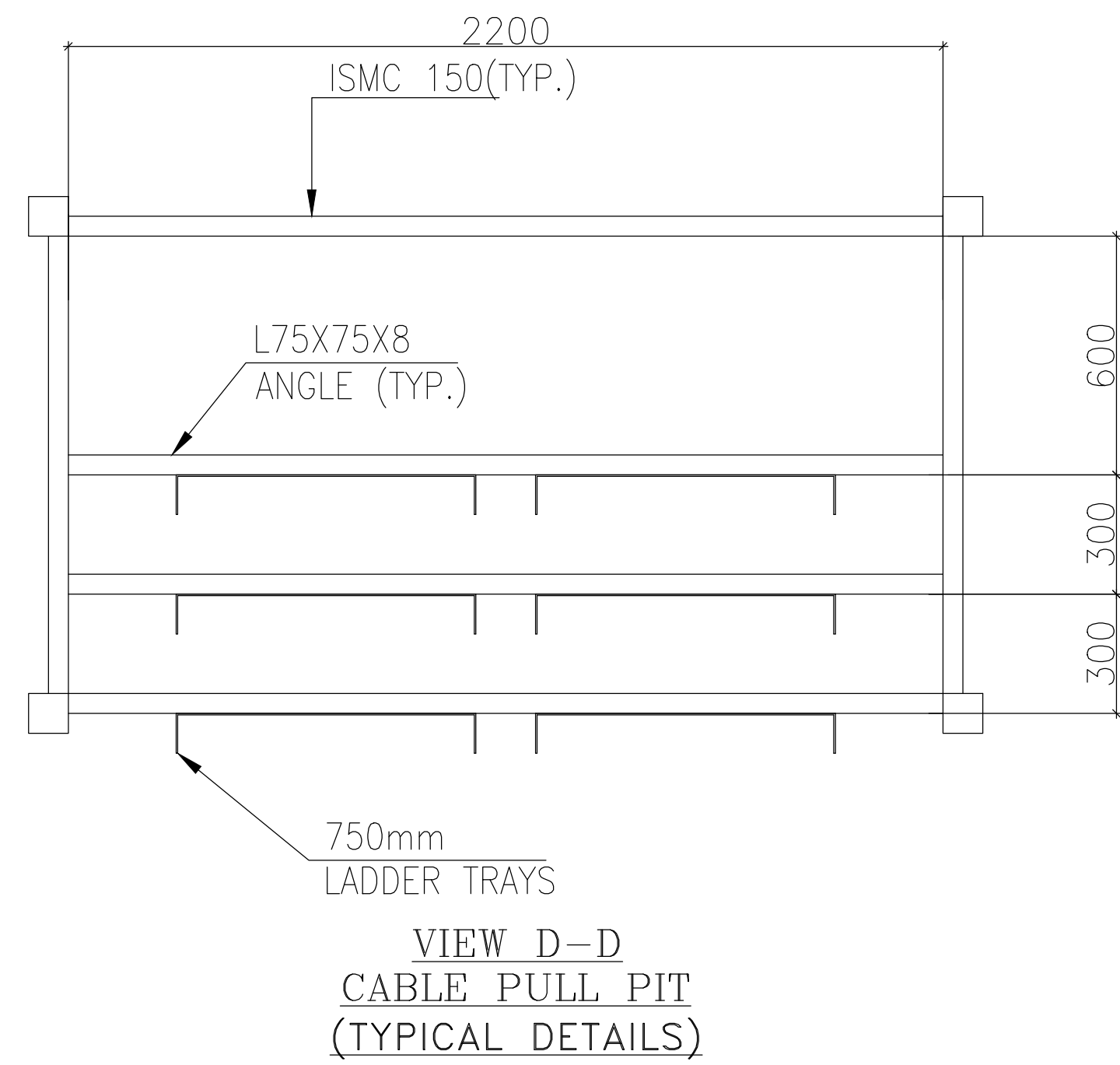
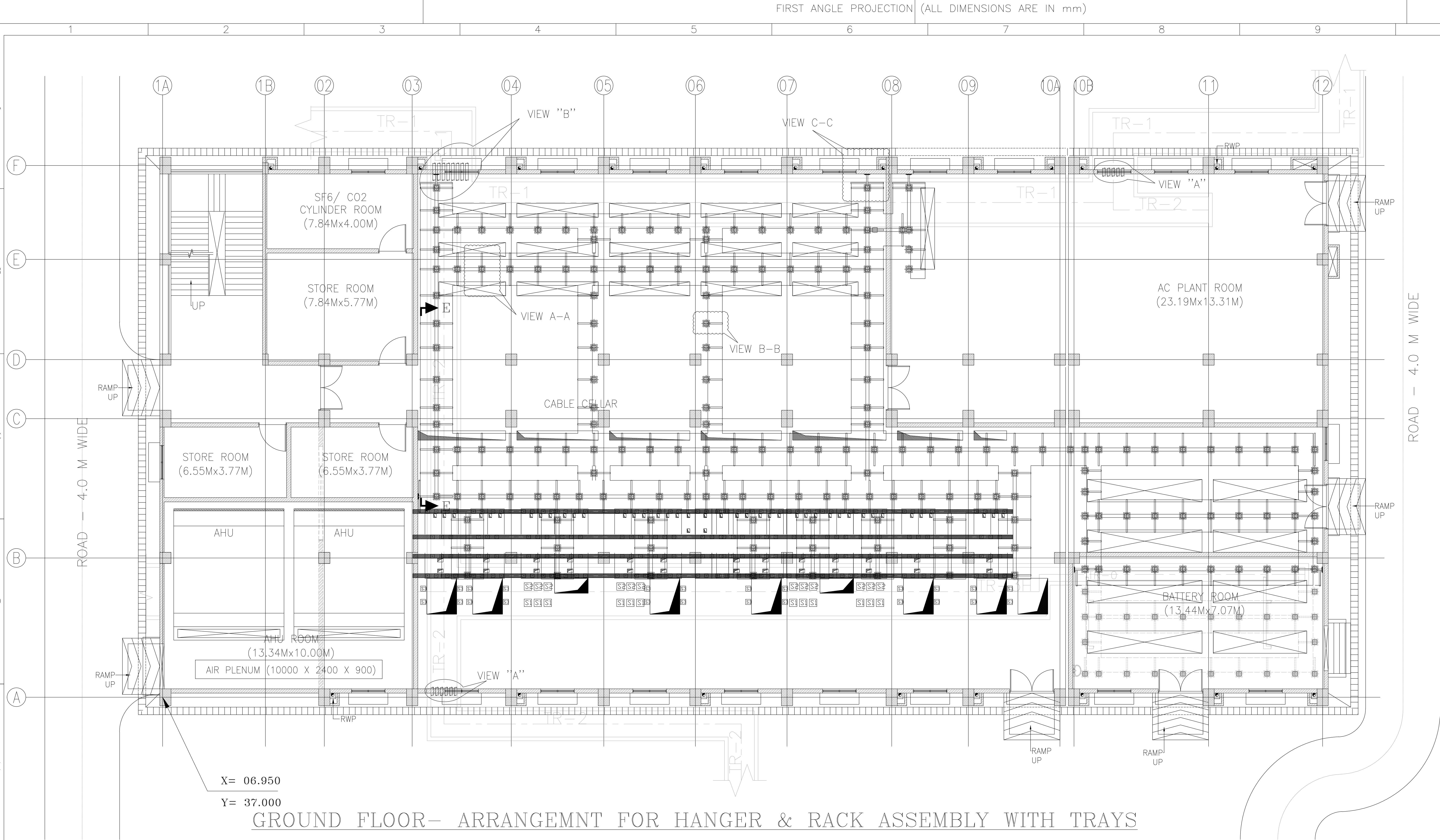
TITLE
GIS CUM CONTROL ROOM BUILDING-
PANEL WITH INDOOR CABLE TRENCH/
HANGER RACK ASSEMBLY LAYOUT

PROJECT DOCUMENT NO.
TB-411-316-021
SHT. No 01 NO. OF SHT. 03

REV.
06

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

INVENTORY NO	SIGN. AND DATE	REF. DRG. NO.	COMPUTER FILE NAME



REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK
		CHECKED		06	13.08.21	CHECKED	DKS	05	03.03.21	CHECKED	DKS	04	10.02.21	CHECKED	DKS	03	08.01.21	CHECKED	DKS
		APPROVED				APPROVED	VK			APPROVED	VK			APPROVED	VK			APPROVED	VK
ZONE				ZONE				ZONE				ZONE				ZONE			

REFERENCE DRAWING (S)/ DOCUMENT(S) -		
SL. NO.	DRAWING/ DOCUMENT NO.	DRAWING TITLE
1.	TB-411-316-020	GIS CUM CONTROL ROOM BUILDING- CONCEPTUAL LAYOUT
PROJECT: LSTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY		
I.OA NO. RPRC182491/26286965 DTD 24.01.2020		

TITLE	PROJECT DOCUMENT NO.	REV.
GIS CUM CONTROL ROOM BUILDING- PANEL WITH INDOOR CABLE TRENCH/ HANGER RACK ASSEMBLY LAYOUT	TB-411-316-021	06
SHT. No	02	NO. OF SHT. 03



REV.	DATE	ALTERED	REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK									
		CHECKED			CHECKED	DKS			CHECKED	DKS			CHECKED	DKS			CHECKED	DKS			CHECKED	DKS									
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ZONE			ZONE		AS PER REVISED INSERT PLATES, AND CUTOOT DETAILS FINALIZED WITH M/S CGPISL AND OTHER VENDORS.		ZONE		AS PER CONSULTANT/TCE AND CUSTOMER/IOCL COMMENTS DTD. 17.02.2021 & 23.02.2021 RESPECTIVELY.		ZONE		STRUCTURE DETAILS CHANGED AS PER ACTUAL LOADING REQUIREMENTS.		ZONE		AS PER CONSULTANT/TCE AND CUSTOMER/IOCL COMMENTS DTD. 12.10.2020 & 15.10.2020 RESPECTIVELY.		ZONE		AS PER CONSULTANT/TCE AND CUSTOMER/IOCL COMMENTS DTD. 07.09.2020 & 10.09.2020 RESPECTIVELY.		ZONE		AS PER CONSULTANT/TCE AND CUSTOMER/IOCL COMMENTS DTD. 05.08.2020 & 05.08.2020 RESPECTIVELY.		ZONE		AS PER CONSULTANT/TCE AND CUSTOMER/IOCL COMMENTS DTD. 05.08.2020 & 05.08.2020 RESPECTIVELY.		

Partial Discharge Sensor

- 1) Type of Mounting : Intruded into GIS
- 2) Type of operation : Ultra High Frequency (UHF)
- 3) Connector : N type
- 4) Frequency : 200MHz – 2000MHz
- 5) No of Sensors on Typical Single-Phase Enclosed 245kV GIS Bay : 2 Nos per phase or 6 Nos per Bay.
- 6) No of Sensors on Typical Single-Phase Enclosed 245kV GIS Busduct : Depends on Length of Busduct, UHF Sensors shall be added in Busduct as shown in project specific SLD.

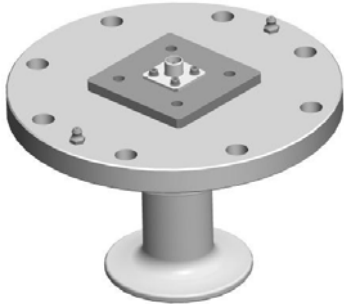
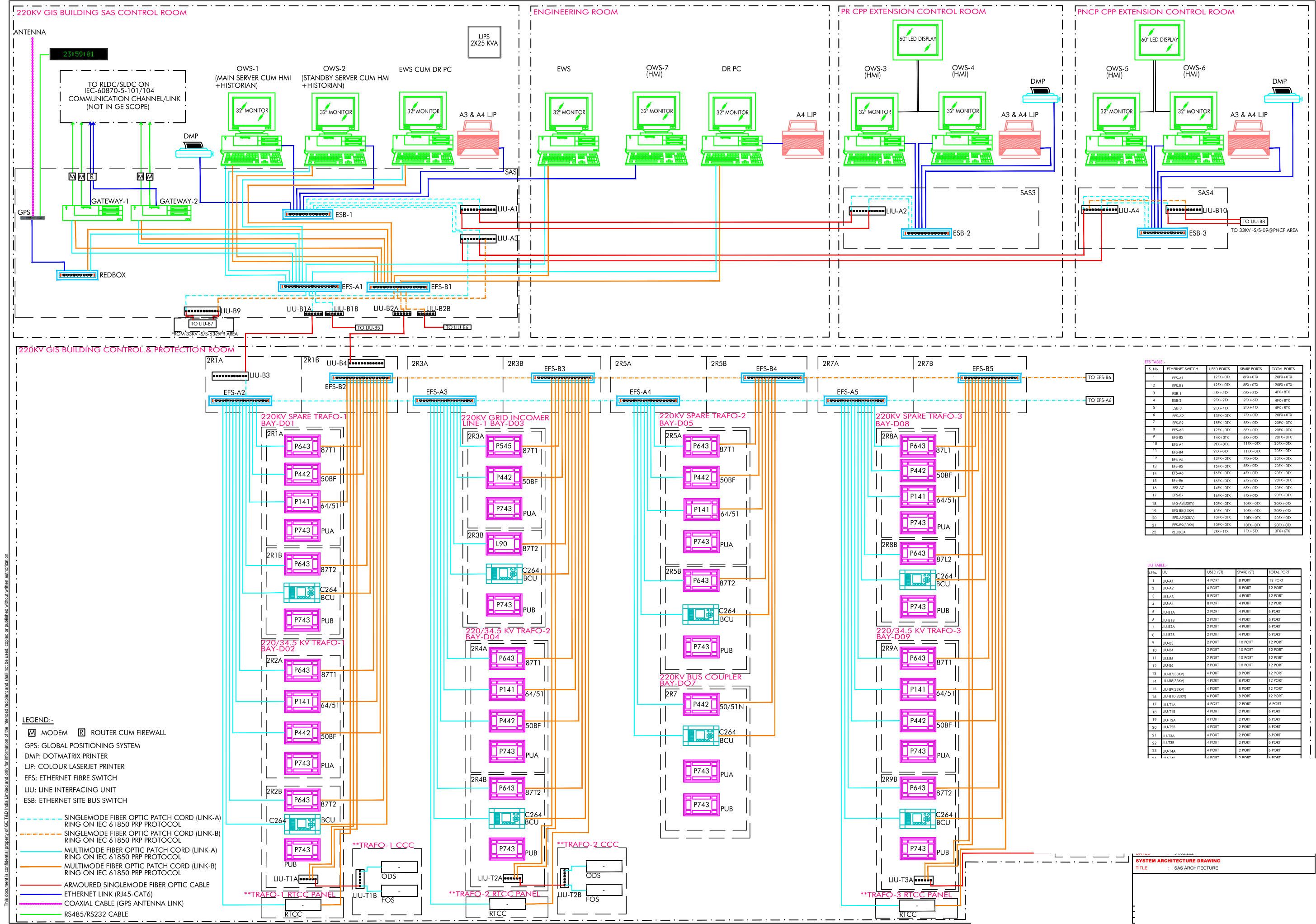
UHF PD Sensor	Mounted on GIS Enclosure
	

Fig:1

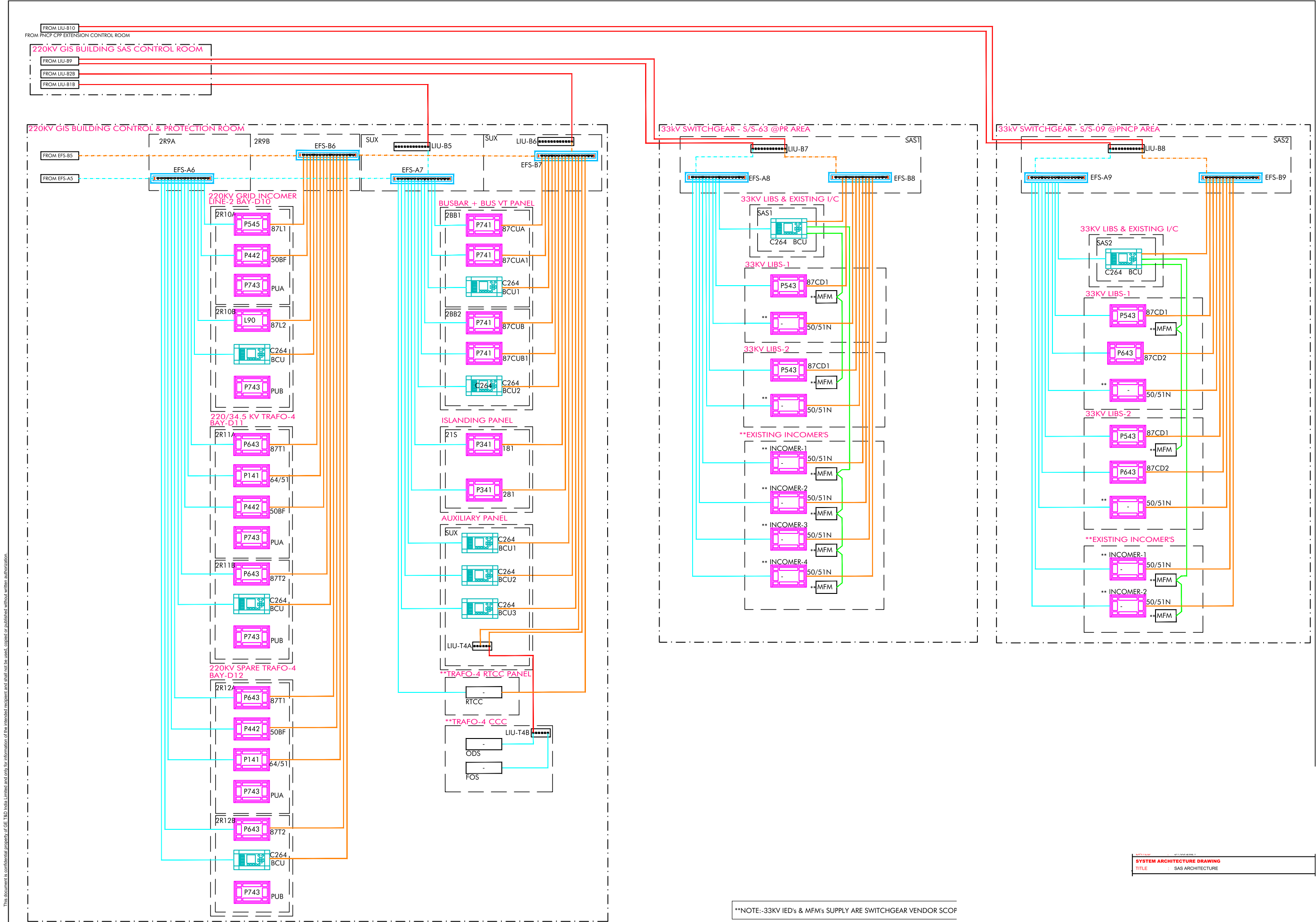
B.6	
Supply: Maintenance Equipment-	Maintenance Equipment- Online Portable PD analyzer/ measurement kit suitable for GIS along with required accessories
GAURANTEED TECHNICAL PARAMETERS FOR	
Purpose	Analyse Partial Discharge activity inside GIS when GIS is in Service
Case	Portable
Type	Ultra High Frequency (UHF)
No of Channels	Three (UHF)
Suitable for	N-type Connector
Measurement range	50 MHz to 2 GHz
Detection sensitivity	-75 dB
Dynamic Range	60 dB
Reported value	Signal peaks in mV
Synch Voltage channel	1
Synch Voltage freq.	20 Hz to 200 Hz
Resolution	12 bit
External power supply	110V – 230V AC +/- 10%, 50Hz/60 Hz
Make	OHV
Model	PDD-3M_UHF
Catalog Enclosed	Yes

Method of Statement	As per approved document No . 20606D-371

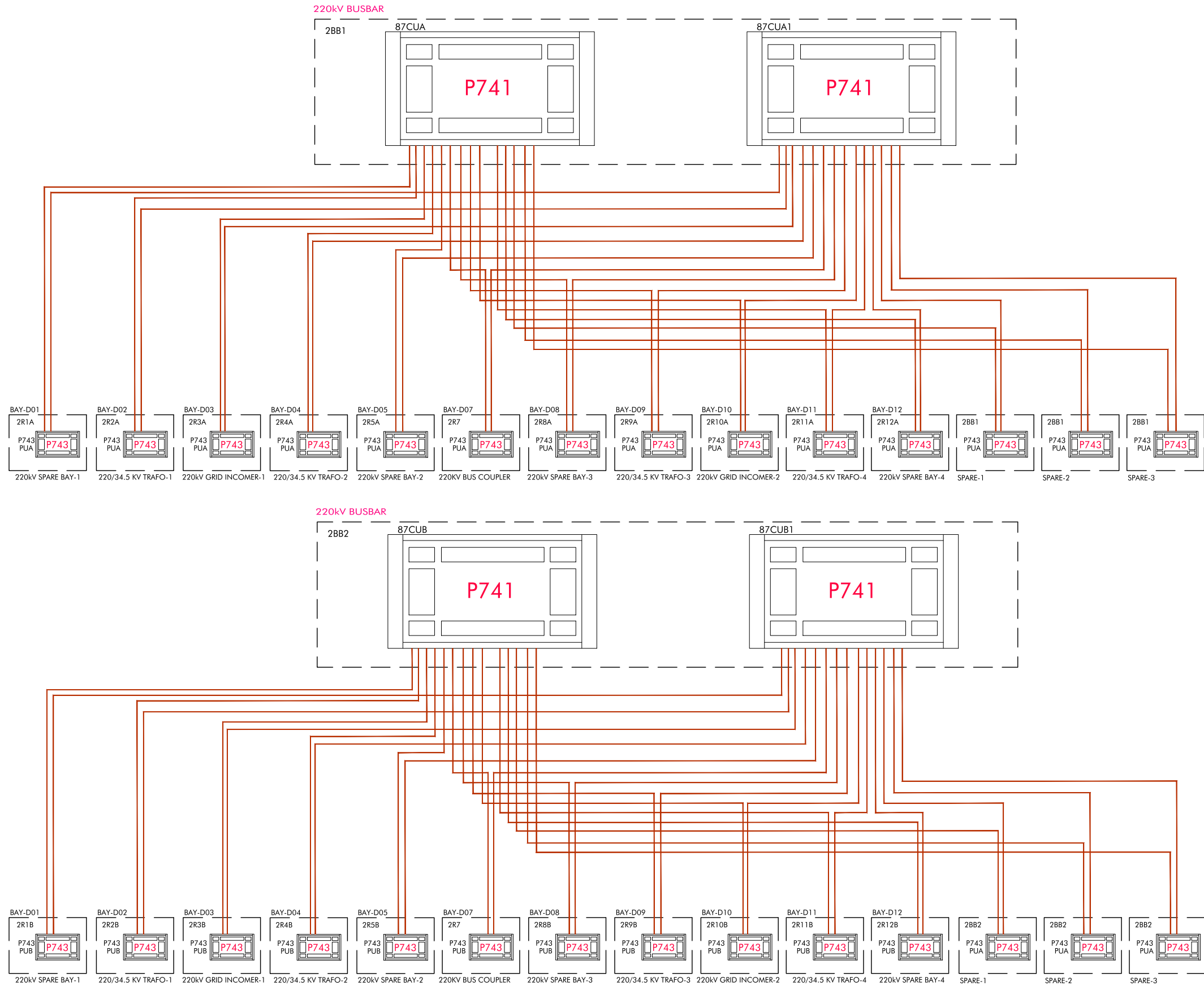
BILL OF MATERIALS	
1. Portable UHF partial discharge Analyzer	1 No
2. Software	1 No
3. Laptop	1 No
4. Pulse Generator	1 No
5. UHF Sensors (fixed in GIS)	As per SLD
6. Connecting Cables/Accessories	1 Set



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LEGEND:-
— MULTIMODE FIBER OPTIC PATCH CORD

DATED : 31.03.2021
SYSTEM ARCHITECTURE DRAWING
TITLE : BUSBAR ARCHITECTURE

I. SAS EQUIPMENTS

1. BAY CONTROL UNIT

S.No.	Equipment	Specification
1	Make	GE T&D India Limited
2	Model	C264
3	Configuration of I/O Cards	As per Scheme
4	Mimic on BCU	LCD display, LED's - 4 System & 13 Programmable, Keypad for local control.
5	Power Supply Board	
	Aux. Supply / Power / Watchdog	220V DC / 60W / One watchdog relay (closed if healthy)
	Communication Port – 1	Configurable RS232/485 (insulated),
	Communication Port – 2	Configurable RS232/422/485 (Insulated)
	Communication Port: Ethernet	10/100 Base Ethernet/Fiber Port
	Inbuilt Function: Auto recloser	Yes
6	Digital Input Board	
	No. of Channels	16 optically insulated DI with 1 common for 2 inputs
	Scanning period	1ms
7	Digital Output Board	
	No. of Channels	8 Single pole Relays with One Normally Open contact (NO), 2 Single pole Relays with one common for 2 Outputs (NO/NC) Current carrying capacity: 5A continuous, 30A for 500ms & 100A for 30ms
	Breaking capacity	DC: 50W resistive, 30W inductive (L/R = 40 ms), AC: 1250VA resistive, 1250VA inductive (cos Φ = 0,7)
8	Analogue Input Board	
	No. of Channels	8 Modular independent analogue inputs of opto-isolated AI on one board (currents)16 bits A/D converter (15 bits + sign)
	Scanning period	100ms to 1000ms – Configurable
9	Transducer less CT/VT module	
	CT/VT	4 CT of two ranges – 1/5 Amperes 5 VT Nominal voltage 57.73 to 500 Vrms
	Accuracy of measurement	Current: 0.2% full scale, Voltage: 0.2% full scale, Frequency: + 0.01 Hz
10	Communication Protocol	IEC61850 - PRP
11	Time synchronization Protocol	SNTP

2. SYNCHRONISING CHECK FUNCTION

S.No.	Equipment	Specification
1	Manufacturer type & designation	Built-in function of Bay Control Unit C264
2	Phase angle setting	Variable between 0° – 90° in steps of 1deg.
3	Voltage difference setting	0 to 100% in steps of 1%
4	Whether dead line charging relay included?	Yes (In built)
5	Frequency	0 to 1Hz in steps of 0.01 Hz
6	Operation indicator provided	Yes
7	Suitable for single & three phase?	Yes
8	Whether Deadline charging relay will be able to monitor the 3-phase voltage - one set connected to line CVTs with a fixed setting of 0.2 X rated voltage - One set connected to bus CVTs with a fixed setting of 0.80 X rated voltage provided?	Yes, provided (In built)

3. OPERATOR WORKSTATION / ENGINEERING / DR WORKSTATION PC

S.No.	Equipment	Specification
1	Make	ADVANTECH
2	Power Supply	Industrial SMPS 400W + 400W – Dual Redundant – Wide Range 96 ~ 264V AC – Auto
3	Processor	Intel Xeon(R) @ 3.20GHz
4	RAM	32GB DDR3
5	HDD	1 TB SATA Drive
6	CD Drive	DVD RW (Support at least Read (48x), Write (24x) & Rewrite (10x) operations with multi-session capacity.
7	Operating Temperature	0° to 40°C
8	Relative Humidity	10 to 95% @ 40°C, non-condensing
9	Vibration	5 – 500 Hz
10	Operating System	Windows 10 LTSC
11	Input /Outputs	VGA: 1, USB: 6, Audio: 2 (LINE-Out and MIC-In) USB Keyboard & Mouse: 1
12	Ethernet Port Details	Dual Gigabit Ethernet Interface: 10/100/1000Base
13	OWS Software	DS Agile
14	EWS Software	S1 Agile, GE Enervista,

4. GATEWAY PC

S. No.	Equipment	Specification
1	Make	ADVANTECH
2	Power Supply	230 V AC / 220V DC, 300W
3	Processor	Intel CORE i7
4	RAM	8 GB DDR3
5	HDD	1 TB SATA Drive
6	CD Drive	DVD RW (Support at least Read (48x), Write (24x) & Rewrite (10x) operations with multi-session capacity.
7	Operating Temperature	0° to 40°C
8	Relative Humidity	10 to 95% @ 40°C, non-condensing
9	Vibration	5 – 500 Hz
11	Operating System	Windows 10 LTSC
12	Input /Outputs	VGA: 1, USB: 6, Audio: 2 (LINE-Out and MIC-In), Serial: 2 Nos RS-232
13	Ethernet Port Details	Dual Gigabit Ethernet Interface: 10/100/1000Base-T Connector: RJ-45 x 2
14	Gateway Software	DS Agile

5. LAPTOP

S. No.	Equipment	Specification
1	Make	DELL/HP
2	Processor	Intel CORE i7
3	RAM	4 GB or higher
4	HDD	1 TB SATA Drive
5	Operating System	Windows 10
6	Input /Outputs	USB: 4 Serial Port : USB to serial port converter (External)
7	Ethernet Port Details	Gigabit Ethernet Interface: 10/100/1000Base-T Connector: RJ-45 x 1
8	Keyboard & Optical Mouse with Pad	Non backlit Inbuilt Laptop Keyboard, External Mouse

6. MONITOR

S.No.	Equipment	Specification
1	Make	SAMSUNG/DELL
2	Type	LED
3	Viewable Size	32"
4	Resolution	1920x 1080
5	Interface	Analogue/Digital
6	Input video signal	Analogue RGB, TMDS Digital Link
7	Input connectors	15 pin D-Sub/USB, DVI-D/HDMI
8	Power Consumption	77W (max.),240V AC 50Hz
9	Stand Type	Adjustable
10	Viewing Angle	178 vertical / 178 horizontal
11	Contrast Ratio	1000 to 1 (typical)

7. LED DISPLAY

S.No.	Equipment	Specification
1	Make	SAMSUNG
2	Type	LED
3	Viewable Size	65"
4	Resolution	1920x 1080 or higher
5	Interface	Analogue/Digital
6	Input video signal	Analogue RGB, TMDS Digital Link
7	Input connectors	15 pin D-Sub/USB,VGA/DVI-D/HDMI
8	Power Consumption	181W (max.),240V AC 50Hz
9	Stand Type	Wall mount
10	Viewing Angle	178 vertical / 178 horizontal
11	Contrast Ratio	1000 to 1 (typical)

8. DOT MATRIX PRINTER

S.No.	Equipment	Specification
1	Make	EPSON
2	Print Head	24 pin
3	Print Modes	Draft and LQ
4	Print Width	136 Column
5	Print Speed	250 cps @ 10 cpi in draft mode 375 cps @ 15 cpi in draft mode
6	Print Method	Impact dot matrix
7	Paper Feed	Tractor (Push and Pull) Rear in, Top out
8	Paper Type	Cut sheet & Fan-Fold continuous stationary
9	Data Buffer	24KB (min.)
10	Print Attributes	Bold, Italics, underline, wide-font, super and sub-scripting
11	Interface	10/100 Base TX External Print Server
12	Power supply	AC 90 to 270V, Approx. 30W
13	Inbuilt testing facility	Provided
14	Offline mode selection for maintenance	Provided
15	Environmental	5-35 Deg @ 10-80% RH

9. A4 MULTIFUNCTION PRINTER

S.No.	Equipment	Specification
1	Make	Xerox/Canon/HP
2	Type	A4 Colour LaserJet
3	Print Speed (Black)	17 ppm or above
4	Print Speed (Colour)	4 ppm or above
5	Processor Speed	360 MHz or above
6	Duty Cycle (monthly, A4)	Up to 50000 pages per month
7	Resolution	Up to 600 X 600 DPI or above
8	Interface	Hi-Speed USB 2.0 Port, Ethernet
9	Memory	64 MB or above
10	Standard Input Capacity	Up to 350 (Sheets) or above
11	Power supply	220V +/- 10V (50Hz AC supply)
12	Power Consumption	Active: 445W or higher, Ready:18W

10. A3 cum A4 MULTIFUNCTION PRINTER

S.No.	Equipment	Specification
1	Make	Xerox
2	Type	A3 & A4 Colour LaserJet
3	Print Speed (Black)	17 ppm or above
4	Print Speed (Colour)	4 ppm or above
5	Processor Speed	360 MHz or above
6	Duty Cycle (monthly, A4)	Up to 50000 pages per month
7	Resolution	Up to 600 X 600 DPI or above
8	Interface	Hi-Speed USB 2.0 Port, Ethernet
9	Memory	64 MB or above
10	Standard Input Capacity	Up to 350 (Sheets) or above
11	Power supply	220V +/- 10V (50Hz AC supply)
12	Power Consumption	Active: 445W or higher, Ready:18W

11. TIME SYNCHRONISATION UNIT

S.No.	Equipment	Specification
1	Make	SERTEL/Masibus
2	Operating Temp.	0° to 50°C
3	Humidity	90% at 40 ° C (Non-condensing)
	GPS Receiver	
4	Size	19" Rack-Mount
5	Power Supply	230V AC / 220V DC
6	Display	Min. 2x20 Character Super twist LCD
7	Functions	- Time: UTC or Local - Position: Latitude, Longitude and Elevation - Clock & Receiver Status 1PPS (input) Deviation - Event Time
8	Status LEDs	Operate (Green), Unlocked (Red)
9	Timing Accuracy	GPS / UTC time $\pm 1 \mu s$
10	Accuracy	Less than one microsecond, depending on network load
11	Output Ports	6 Nos - Pulse: 1 No (PPS/PPM/PPH - site configurable) - IRIG-B: 2 Nos (AM & TTL) - LAN: 3 Nos. LAN interface with RJ45 connector (10/100Base-T). Time synch protocol SNTP, NTP
12	Antenna Mounting Type	Pipe mounted
13	Antenna cable type	RG-6 weatherproof, low loss, 15 m provided
	Time Display Unit (Remote Display)	
14	LEDs	High Intensity LEDs
15	Character Size / No. of Characters	4" (100mm) / 6
16	Interface	The BNC Serial interface with a cable between display unit and receiver. (Length -20 Meter)
17	Input connector	BNC connector
18	Industrial Enclosure	Hang Mounted
19	Operating Temperature / Humidity	0° to 55° C / 0% to 100% Non-condensing
20	Power Requirements	90-260 VAC 50/60Hz
21	Accessories	Rack mounting kit, Power Cord & Operation Manual

12. MANAGED SWITCH

S.No.	Equipment	Specification
1	Make	Hirschman /Ruggedcom
2	Type	Modular Managed
3	Connector Type	MTRJ / ST / LC / RJ45
4	Network Speed	10/100 Mbps
5	No of Ports	As per the approved architecture
6	Auxiliary Voltage	220V DC
7	Features	Graphic user interface, 802.1p QoS Prioritization Tag Base VLANs, IGMP snooping and IGMP-L2 multicast management Port Security, SNMP V2, V3
8	Forwarding Mode	Store and Forward
9	Relative Humidity	5% to 95% (non-condensing)
10	Protocol	IEC 61850

13. LIU

S.No.	Equipment	Specification
1	Make	ARITECH/GENTECH/IVOENET
2	Ports	24/12/6
3	Port Type	ST Type Single mode
4	Product Specification	Loaded with PIGTAILS, Fittings, and related ACCESSORIES
5	Cable Entry	Up to 2(From Rear)
6	Mount	Rack/Din rail

14. PLCC MODEM

S.No.	Equipment	Specification
1	Manufacturer, Type	DECODE
2	Additional Feature	Operating frequencies include telephone band: 300 Hz to 3400 Hz extended to 4000 Hz.
3	Operational characteristics	
4	Operation	
	Modulation Type	FSK
	Procedure	Asynchronous serial
	Tx/Rx Baud Rate	50, 100, 200, 300, 600, 1200 Baud Rate
	UTI-T Standard	R35, R37, R38A, R38B, V23
	Alarm Condition	On DCD loss or watchdog
	Transmission Mode	Full duplex/ Half duplex (point to point or multipoint)
	Data format	7 to 9 useful bit
5	DTE interface	EIA RS232/ITU-T V24-V28 Sub-D 25 / D-9 pin female
6	Dimension	1U Height, 19" Width
8	Nominal voltage	48 V DC

15. REDBOX

S.No.	Equipment	Specification
1	Manufacturer	Hirschman
2	Description	Managed, Industrial Switch DIN Rail, fanless design. Enhanced Redundancy (PRP)
3	Connector Type	RJ45 / LC
4	Communication Ports	6 x 10/100BASE Tx + 2 x SFP slot Fx (100 Mbit)
5	Redundancy Function	PRP
6	Industrial Profiles	IEC61850 protocol (MMS Server, Switch Model)
7	Time Synch	SNTP Server and Client
8	Power Supply	110 - 250 VDC (88V - 320 VDC)

II. PROTECTION EQUIPMENTS

A. TRANSMISSION LINE

1. CURRENT DIFFERENTIAL PROTECTION RELAY for 220 kV CIRCUITS - MAIN – I

S.No.	Equipment	Specification
1	Name	GE T&D India Limited
2	Manufacturer type & designation	P545 (Numerical)
3	Whether Numerical measurement.	Yes
4	Auxiliary DC Voltage with permissible tolerance	125-250V DC
5	CT input, specify whether selectable at site. Permissible over load.	1/5A Site Selectable, 4xIn
6	PT input with permissible over load.	2xVn
7	Type and no. of measuring elements.	6 Individual measuring elements.
8	No. of zones.	5 Zones
9	Type and no. of starting units.	6 Individual starting units.
10	Maximum operating current for each element	64xIn
11	Max. Reactive reach range First zone element Second zone element Third zone element Fourth (Reverse) zone element Power Swing Load Encroachment	1, 50m – 500 Ohms 2, 50m – 500 Ohms 3, 50m – 500 Ohms 4, 50m – 500 Ohms 5, 100m – 500 Ohms 6, 100m – 500 Ohms
12	Max. Resistive reach range First zone element Second zone element Third zone element Fourth (Reverse) zone element Power Swing Load Encroachment	1, 50m – 500 Ohms 2, 50m – 500 Ohms 3, 50m – 500 Ohms 4, 50m – 500 Ohms 5, 100m – 200 Ohms 6, 100m – 500 Ohms
13	Minimum and maximum line length in Km for which the fault can be detected.	10m to 1000KM
14	Reset ratio for Distance Protection function	Above 95%
15	Reset ratio for SOTF	Above 95%
16	Type of power swing blocking (state type and characteristic)	Impedance characteristic.
17	Operating time range First zone Second zone Third zone Fourth (Reverse) zone element PS Blocking timer PS Deblocking timer	1, 0 – 10sec 2, 0 – 10sec 3, 0 – 10sec 4, 0 – 10sec 5, 30m – 1sec 6, 100m – 10sec
18	Relay characteristics angle range for Measuring units Starting units Power swing blocking relays	1, 0-90 deg 2, 0-90 deg 3, 20-90 deg
19	Whether suitable for any communication scheme.	Suitable for all carrier aided schemes
20	Have all carrier auxiliary relays been provided (give technical particulars)	Provided as per scheme
21	No. of Binary inputs and their ratings.	24
22	No. of Binary outputs and their ratings.	32
23	Tripping time carrier (maximum and minimum)	Setting range 0-1sec
24	Type of auto re-close scheme and time range for	1, 0-10sec

	II. Potential circuit III. DC circuits	3, 11 Watts
26	Whether continuous self monitoring and diagnostic feature is available	Yes
27	Relay characteristics possible	Quad/MHO
28	Change in characteristics possible	Yes
29	Burden on CT and VT per phase.	Current: < 0.2 VA Voltage: < 0.1 VA
30	i) No. of tripping relays provided ii) No. of NO/NC contacts of each tripping relays suitable for use in auto reclosure scheme.	i) Yes ii) Provided as per scheme
31	All aux. relay for the scheme provided.	Provided as per scheme
32	All external resistors as required provided.	NA
33	Carrier ON/OFF provided.	Yes
34	Auto re-closure scheme with check relay as per specification in annexure III	Part of BCU
35	Measurements of functions list here.	Current, Voltage & Power
36	No. of Disturbance Records and their different time periods.	50 – Settable Timer from 100m-10sec
37	Manual online testing facility provided through test plug without isolation of any circuit from panel TB	Yes
38	Communication protocols	IEC 61850
39	Time Synchronization	SNTP
40	Is the scheme exactly as per specification	Yes
	LINE DIFFERENTIAL PROTECTION RELAY	
42	The relay shall have all the feature as per Distance protection relay	Yes
43	It shall be working on phase segregated current Differential protection principle	Yes
44	It shall have multiple slope characteristics (preferably) to have stability against CT saturation and heavy through faults as well as sensitivity for internal faults	Yes
45	It shall measure Differential as well as restrain current continuously and shall display the same as measurement	Yes
46	It shall use fiber optic cable or multiplexed digital network to exchange telegrams	Yes
47	It shall communicate to remote end through IEEE C37.94 format	Yes
48	It shall have redundant communication channels for protection communication	Yes
49	It shall communication analogue as well as digital signals to remote end.	Yes
50	It shall have various communication options for remote communication i.e mono-mode / multi-mode for direct communication / communication through multiplexer	Selectable based on line length 1300nm – single mode selected.
51	It shall have Line charging current compensation feature for better sensitivity	Yes
52	Distance protection function can be utilized as independent or as back up of Differential protection in case of failure of remote communication	Yes
53	It shall communicate time coordinated current signals for remote communication to execute Line differential protection algorithm accurately time synchronization through GPS shall also be possible	Yes

54	It shall monitor individual communication links continuously and switchover to standby link after present time in case of failure of one link	Yes
55	It shall supervise individual telegrams	Yes
56	It shall detect reflected telegrams	Yes
57	It shall detect change in communication delay time	Yes
58	It shall measure delay time for remote end along with dynamic compensation of the same in differential protection algorithm	Yes
59	It shall also supervise maximum permissible delay time	Yes
60	It shall generate alarm for heavily disturbed communication link	Yes
	DIFFERENTIAL PROTECTION SETTING	
61	Minimum operating current	100mA – 2A
62	Slope (Single/dual)	Dual
63	End section (Single / dual)	Dual
64	High set operating current	100mA – 32A
65	2 nd Harmonic blocking	Yes
66	Typical operating time	< 35mS
67	Operating time for high set	± 2% or 2ms whichever is greater.
68	Charging current compensation	Yes
	REMOTE COMMUNICATION	
71	Nos. of Analogue signal transfer	R,Y,B - Phase current
72	Nos. of Binary signal transfer	16 Signals
73	Dual Remote Communication module a) 1300 nm – multi-mode OR b) 1300 / 1500 nm – mono-mode	1300nm – Single mode
74	Synchronization mode GPS ECHO	Both available
75	Time delay alarm for communication fail	100m – 600 sec
76	Time delay for switching to redundant channel	Both channels will work parallel
77	Asymmetric delay (For echo mode)	400ms to 30 secs
78	Max. Transmission delay time	250 micro seconds to 1 milli second

2. CURRENT DIFFERENTIAL PROTECTION RELAY for 220 kV CIRCUITS - MAIN – II

S.No.	Equipment	Specification
1	Name	GE Multilin,
2	Manufacturer type & designation	L90 (Numerical)
3	Whether Numerical measurement.	Yes
4	Auxiliary DC Voltage with permissible tolerance	125-250 Vdc
5	CT input, specify whether selectable at site. Permissible over load.	1/5A Site Selectable, 4xIn
6	PT input with permissible overload.	260 V Continuous to neutral
7	Type and no. of measuring elements.	6 Individual measuring elements.
8	No. of zones.	5 Zones
9	Type and no. of starting units.	6 Individual starting units.
10	Maximum operating current for each element	46xIn
11	Max. Reactive reach range First zone element Second zone element Third zone element Fourth (Reverse) zone element Power Swing Load Encroachment	1, 20m – 500 Ohms 2, 20m – 500 Ohms 3, 20m – 500 Ohms 4, 20m – 500 Ohms 5, 100m – 500 Ohms 6, 20m – 250 Ohms
12	Max. Resistive reach range First zone element Second zone element Third zone element Fourth (Reverse) zone element Power Swing Load Encroachment	1, 20m – 500 Ohms 2, 20m – 500 Ohms 3, 20m – 500 Ohms 4, 20m – 500 Ohms 5, 100m – 500 Ohms 6, 20m – 250 Ohms
13	Minimum and maximum line length in Km for which the fault can be detected.	0-2000km
14	Reset ratio for Distance Protection function	Above 95%
15	Reset ratio for SOTF	Above 95%
16	Type of power swing blocking (state type and characteristic)	Impedance characteristic
17	Operating time range First zone Second zone Third zone Fourth (Reverse) zone element PS Blocking timer PS Deblocking timer	1, 0 – 65sec 2, 0 – 65sec 3, 0 – 65sec 4, 0 – 65sec 5, 0 – 65sec 6, 0 – 65sec
18	Relay characteristics angle range for Measuring units Starting units Power swing blocking relays	1, 30-90 deg 2, 30-90 deg 3, 40-140 deg
19	Whether suitable for any communication scheme.	Suitable for all carrier aided schemes
20	Have all carrier auxiliary relays been provided (give technical particulars)	Provided as per scheme
21	No. of Binary inputs and their ratings.	24
22	No. of Binary outputs and their ratings.	28
23	Tripping time carrier (maximum and minimum)	Setting range 0-65 sec
24	Type of auto re-close scheme and time range for III. Dead time IV. Reclaim time	1, 0-655sec 2, 0-655sec
25	VA burden of each phase relay IV. Current circuit V. Potential circuit VI. DC circuits	1, < 0.2 VA 2, < 0.25 VA 3, 20 Watts
26	Whether continuous self monitoring and diagnostic feature is available	Yes
27	Relay characteristics possible	Quad/MHO

28	Change in characteristics possible	Yes
29	Burden on CT and VT per phase.	Current: < 0.2 VA Voltage: < 0.25 VA
30	i) No. of tripping relays provided ii) No. of NO/NC contacts of each tripping relays suitable for use in auto reclosure scheme.	i) Yes ii) Provided as per scheme
31	All aux. relay for the scheme provided.	Provided as per scheme
32	All external resistors as required provided.	NA
33	Carrier ON/OFF provided.	Yes
34	Auto re-closure scheme with check relay as per specification in annexure III	Part of BCU
35	Measurements of functions list here.	Current, Voltage & Power
36	No. of Disturbance Records and their different time periods.	128
37	Manual online testing facility provided through test plug without isolation of any circuit from panel TB	Yes
38	Communication protocols	IEC 61850
39	Time Synchronization	SNTP
40	Is the scheme exactly as per specification	Yes
	LINE DIFFERENTIAL PROTECTION RELAY	
41	The relay shall have all the feature as per Distance protection relay	Yes
42	It shall be working on phase segregated current Differential protection principle	Yes
43	It shall have multiple slope characteristics (preferably) to have stability against CT saturation and heavy through faults as well as sensitivity for internal faults	Yes
44	It shall measure Differential as well as restrain current continuously and shall display the same as measurement	Yes
45	It shall use fiber optic cable or multiplexed digital network to exchange telegrams	Yes
46	It shall communicate to remote end through IEEE C37.94 format	Yes
47	It shall have redundant communication channels for protection communication	Yes
48	It shall communication analogue as well as digital signals to remote end.	Yes
49	It shall have various communication options for remote communication i.e mono-mode / multi-mode for direct communication / communication through multiplexer	Selectable based on line length 1310nm – single mode selected.
50	It shall have Line charging current compensation feature for better sensitivity	Yes
51	Distance protection function can be utilized as independent or as back up of Differential protection in case of failure of remote communication	Yes
52	It shall communicate time coordinated current signals for remote communication to execute Line differential protection algorithm accurately time synchronization through GPS shall also be possible	Yes
53	It shall monitor individual communication links continuously and switchover to standby link after present time in case of failure of one link	Yes
54	It shall supervise individual telegrams	Yes
55	It shall detect reflected telegrams	Yes
56	It shall detect change in communication delay time	Yes

57	It shall measure delay time for remote end along with dynamic compensation of the same in differential protection algorithm	Yes
58	It shall also supervise maximum permissible delay time	Yes
59	It shall generate alarm for heavily disturbed communication link	Yes
	DIFFERENTIAL PROTECTION SETTING	
61	Minimum operating current	0.1 PU to 4 PU
62	Slope (Single/dual)	Dual
63	End section (Single / dual)	Dual
64	High set operating current	0 to 90 PU
65	2 nd Harmonic blocking	Yes
66	Typical operating time	30Ms
67	Operating time for high set	0 to 65 secs
68	Charging current compensation	Yes
	REMOTE COMMUNICATION	
71	Nos. of Analogue signal transfer	R,Y,B,N currents
72	Nos. of Binary signal transfer	8 signals per channel
73	Dual Remote Communication module a) 1300 nm – multi-mode OR b) 1300 / 1500 nm – mono-mode	1310 Mono mode
74	Synchronization mode GPS ECHO	GPS
75	Time delay alarm for communication fail	Yes
76	Time delay for switching to redundant channel	Both channels will work parallel
77	Asymmetric delay (For echo mode)	10mS
78	Max. Transmission delay time	0 to 10 milli seconds

3. GRID ISLAND PROTECTION

S.No.	Equipment	Specification
1	Name and country of Manufacturer	GE T&D India Limited
2	Manufacturer type and designation	P341 (Numerical)
3	Frequency Protection	
	Under / Over Frequency	Available
	Pick-up:	Setting $\pm 0.01\text{Hz}$
	Drop-off:	(Setting $+0.025\text{Hz}$) $\pm 0.01\text{Hz}$
4	Rate of change of frequency	Available
	Pickup	Setting $\pm 0.5\text{Hz/s}$
5	Power Protection	
	Active/Reactive power	Available
	Pick-up:	Setting $\pm 5\%$
	Operating time:	$\pm 2\%$ or 50ms whichever is greater
6	Vector Surge Protection	Available
		V Shift Angle: 2...30 Deg
7	Voltage Based Protection	Available
8	Type of relay	Triple pole Numerical relay
9	Communication	IEC 61850
10	Nominal Current	1A / 5A
11	Whether DR is provided?	Yes (Inbuilt)
12	Scan Rate	1200Hz

B. TRANSFORMER PROTECTION

1. DIFFERENTIAL PROTECTION FOR 220/33 kV TRANSFORMER – Main -1 & Main-2

S.No.	Equipment	Specification
1	Name and country of Manufacturer	GE T&D India Limited
2	Manufacturer type and designation	P643 (Numerical)
3	Whether three instantaneous units Provided?	Yes
4	Whether continuous self-monitoring and diagnostic feature is available	Yes
5	Current circuit rating	1A or 5A
6	Voltage circuit rating	100 V to 120 V
7	Operating Principle	Current Differential Principle
8	Max. V.A burden	
	i) Operating Circuit	< 0.01VA
	ii) Restraining Circuit	< 0.01VA
9	Min. Operating Current	
10	Whether Second and Fifth harmonic restraint feature provided?	Yes
11	Operating current setting range	10% - 250% in steps of 1%
12	Bias setting range	Slope - 1: 0 to 150% Slope - 2: 15 to 150%
13	Operating time at 5x rated current	<30 ms
14	Resetting time	Less than 15 ms
15	How ratio / phase angle corrections are being done (inter posing transformer / internal feature in the relay)	In built feature in the relay
16	Adjustable Bias setting	0-150%
17	Three Pole instantaneous high set units provided	Yes
18	Burden on Purchaser's CT	< 0.01VA
19	Output contact rating	10 A, 300 V
20	Shall have the following function	
	i) Differential Protection	Yes
	ii) Restriction Earth Fault Protection	Yes
	iii) Thermal Over Load Detection	Yes
	iv) Over Fluxing Protection	Yes
	v) LBB	Yes
21	Type of relay	Triple pole Numerical relay
22	Whether DR is provided?	Yes (Inbuilt)
23	Communication a, Type of Port (Front) b, Type of Port (Rear) c, Comm. Protocol d, Time sync port	a, RS232 b, RS232 / RS485 / KBus c, IEC 61850 d, SNTP

2. RESTRICTED EARTH FAULT PROTECTION – HV REF

S.No.	Equipment	Specification
1	Name and country of Manufacturer	GE T&D India Limited
2	Manufacturer type and designation	P643 (Numerical) – Built in Diff Protection Main - 1
3	Maximum VA Burden	< 0.01VA
4	Operating time	
	i) Minimum	<25 ms
	ii) Maximum	<30 ms
5	No of contact make & carry for 0.5 sec and break type	All contacts
6	Whether contacts self-reset or hand reset.	Configurable
7	Contact ratings	
	i) Make and carry continuously	10A
	ii) Make and carry for 0.5 sec.	30A for 3 sec
	iii) Break resistive load and inductive load with 40m. sec. time current.	4 A for 1.5 s, 10000 operations (subject to the above limit for make and break, dc resistive load) 0.5 A for 1 s, 10000 operations (subject to the above limit for make and break, dc inductive load)
8	Setting Range (Earth fault unit)	
	a) Inverse Definite Minimum Time	2% to 400% of In
	b) High set inst. Unit	-
	c) Characteristic Angle	-

3. RESTRICTED EARTH FAULT PROTECTION – LV REF

S.No.	Equipment	Specification
1	Name and country of Manufacturer	GE T&D India Limited
2	Manufacturer type and designation	P141 (Numerical)
3	Maximum VA Burden	< 0.2VA
4	Operating time	
	i) Minimum	<25 ms
	ii) Maximum	<30 ms
5	No of contact make & carry for 0.5 sec and break type	All contacts
6	Whether contacts self-reset or hand reset.	Self-reset
7	Contact ratings	
	i) Make and carry continuously	10A
	ii) Make and carry for 0.5 sec.	30A for 3 sec
	iii) Break resistive load and inductive load with 40m. sec. time current.	4 A for 1.5 s, 10000 operations (subject to the above limit for make and break, dc resistive load) 0.5 A for 1 s, 10000 operations (subject to the above limit for make and break, dc inductive load)
8	Setting Range (Earth fault unit)	
	a) Inverse Definite Minimum Time	2% to 400% of In
	b) High set inst. Unit	-
	c) Characteristic Angle	-

4. OVERFLUX PROTECTION – HV & LV Side

S.No.	Equipment	Specification
1	Name and country of Manufacturer	GE T&D India Limited
2	Manufacturer type and designation	HV Side: P643 (Numerical) - Built in Differential Protection Main -1 LV Side: P643 (Numerical) - Built in Differential Protection Main -2
3	Rating (V/Hz)	110V, 50Hz
4	Principle of operation	Voltage to Frequency ratio
5	Setting Range	1.05 to 2 Pu
6	No of Stages in relay	4 Stages
7	No. of timers provided and range of time settings available.	0 to 6000 sec
8	Burden	< 0.06VA
9	Auxiliary relays as necessary to make scheme complete provided	Not applicable
10	No. and rating of protective and auxiliary relay contact	Not applicable

5. BACK UP DIRECTIONAL O/C & E/F PROTECTION

S.No.	Equipment	Specification
1	Name and country of Manufacturer	GE T&D India Limited
2	Manufacturer type and designation	P643 (Numerical) - Built in Differential Protection
3	Whether Numerical and have true RMS measurement.	Yes
4	Display type for HMI	LCD
5	Give the details of self monitoring (Hardware & software) and indication/ alarm facility on internal relay failure	Yes
6	- Current input (CT Secondary) - Whether selectable from front panel at site	1/5A selectable
7	Auxiliary Supply and its burden with permissible tolerance	110-250V DC, 11Watts
8	No. of poles	3 Poles
9	Current Setting range for Over Current element	80mA to 4A IDMT
10	Current Setting range for Earth fault element	80mA to 4A IDMT
11	- Type of characteristics available - Whether selectable from front panel at site	1, All IEC Curves 2, Selectable
12	High set current setting range for Over current	80mA to 32A High set
13	High set current setting range for Earth Fault	80mA to 32A High set
14	Time multiplier	0.025 to 1.2 TMS
15	Reset Ratio	Above 95%
16	Built-in Breaker Failure Protection - Current Setting range - Time range - No. of poles - Operating time - Resetting time - No. of O/P Contacts available for this feature.	Not Applicable
17	Burden at CT inputs	< 0.01VA
18	- No. of fault event can be stored - Type of data stored on fault	1, 512 Event 2, All Trip & Alarm events
19	Maximum duration for DR on each fault	10.5 Sec
20	No. of Binary inputs	24
21	No. of Binary outputs. (trip/ signaling)	16

22	Contact rating I. Make and carry continuously II. Make and carry for 0.5 sec. III. Break resistive load and inductive load with 40m sec. time constant IV. Whether self reset or hand reset	1, 10A 2, 30A for 3 sec 3, 62.5 Watts 4, Selectable.
23	Communication a) Type of port (front) b) Type of port (Rear) c) Comm. Protocol d) Time sync port	a, RS232 b, RS232 / RS485 / KBus c, IEC 61850 d, SNTP

6. SEF PROTECTION - HV

S.No.	Equipment	Specification
1	Name and country of Manufacturer	GE T&D India Limited
2	Manufacturer type and designation	P643 (Numerical) - Built in Differential Protection Main -2
3	Overcurrent unit setting range	
	a) Inverse Definite Minimum Time	8 – 400% of In
	b) High set inst. Unit	8 – 3200% of In
	c) Characteristic Angle	- 95 ° to +95 °
4	Earth fault unit setting range	
	a) Inverse Definite Minimum Time	8 – 400% of In
	b) High set inst. Unit	8 – 3200% of In
	c) Characteristic Angle	- 95 ° to +95 °
5	Minimum operation time for Over Current & Earth Fault Protection	IDMT curve operation time ±5% or 40ms whichever is greater

7. SEF PROTECTION – LV

S.No.	Equipment	Specification
1	Name and country of Manufacturer	GE T&D India Limited
2	Manufacturer type and designation	P141 (Numerical) - Built in LV REF Protection
3	Earth fault unit setting range	
	a) Inverse Definite Minimum Time	5 – 400% of In
	b) High set inst. Unit	5 – 3200% of In
	c) Characteristic Angle	- 95 ° to +95 °
4	Minimum operation time for Over Current & Earth Fault Protection	IDMT curve operation time ±5% or 40ms whichever is greater

C. BUSBAR & LBB PROTECTION

1. BUSBAR PROTECTION – DISTRIBUTED SCHEME

S.No.	Equipment	Specification
1	Name and country of Manufacturer	GE T&D India Limited
2	Manufacturer type and designation	P741 (Numerical) - Central Unit P743 (Numerical) - Peripheral Unit
3	Bus Bar protection Functions: 1. Min fault current pick-up range (Ik min) 2. Neutral current Detection range 3. Stabilizing factor (K) 4. Diff current Alarm S=setting range 5. Time Delay for (4) above 6. Isolator alarm time delay setting 7. Typical tripping time	1. 50mA to 30A 2. 10mA to 30A 3. 20 to 90% 4. 10mA to 500mA 5. 100ms to 600sec 6. 0 to 14000 secs 7. 13ms typical
4	Check Zone: 1. Min fault current pick-up range (Ik min) 2. Stabilizing factor (K) 3. CT Ratio matching range	1. 50mA to 30 A 2. 0 to 90% 3. UPTO 40 TIMES
5	Analog inputs (Bay or peripheral or Field Unit): 1. Maximum no. of Bays which can be connected with central unit 2. Current Rating 3. Thermal Ratings: Continuous For 10 s, Minimum 10xIn For 1 s, 100xIn 4. Auxiliary Supply	1. 28 bays 2. 1A/5A 3. Continuous – 4 times In. 30A for 3 secs 100A for 1 secs 4. Aux supply: 125 – 250V DC
6	Binary Inputs/ Outputs: 1. Operating Time 2. Max Operating Volt 3. Max Cont rating 4. Max make & carry 5. Max making power 6. Whether Binary O/P Reset Programmable 7. Breaking Current: Heavy Duty N/O Contact: Signaling Contact: 8. No. of I/P per bay unit: 9. No. of I/P for central unit: 10. Pickup current for I/p: 11. Operating Time for I/P: 12. Nos of Output _ Bay unit: 13. Nos of output _ Central Unit:	1. Contact operating time = 200micro secs 2. 300V 3. Continuous = 10A 4. 30A for 3 secs 5. 62.5W 6. Yes 7. 10A 8. 24 9. 8 10. <5MA 11. 7ms 12. 16 13. 8
7	Auxiliary Supply: 1. Input Voltage: 2. Load: (Bay Unit) (Central Unit) 3. Front plate signal 4. Switch	1. 125V to 250V DC 2. Bay unit = 22 to 32 W Central unit = 37 to 41 W 3. LEDs 4. NA
8	Optical Interface: 1. Number of cores 2. Core/ sheath diameter 3. Max permissible attenuation 4. Connector	1. Two Core patch chord. 2. 2MM DIA, Low Smoke Zero Halogen 3. 850nm 4. ST/ST
9	Event Recorder: It shall have event recording facility for minimum last 50 Operational / fault events.	1. 512 events
10	Disturbance Recorder: 1. Independent setting for pre-fault and post-fault period	1. 100ms to 10.5 secs 2. Comtrade

11	Local & Remote communication: 1. Serial interface for connecting a PC, either directly or via a modem. 2. System interface for connecting to a control system via IEC 61850. 3. System interface via IEC 61850 protocol for inter bay bus supports. 4. Time synchronization via IRIG-B / SNTP	1. RS232/USB 2. Fiber optic or RJ45 3. Fiber optic or RJ45 4. SNTP
12	Communication ports: • Front _ RS232 / RJ45 / Optical • Rear – Fiber optic / RJ45	yes
13	Maximum fault current for which 100% stability can be achieved	64 times In
14	Impedance type and operating characteristic	Low impedance type
15	Continuous supervision of CT secondary against open circuit	Yes
16	Architecture & interconnection of CT secondary against open circuit	Yes
17	Principle of CT ration error matching	CT error adjusted through pick up setting
18	Measure and tripping criterion	Numerical
19	HMI details	16X3 LCD display
20	Self supervision and diagnostic facility.	Yes
21	Measurements available	Yes
22	Whether bus bar image for each bay is formed and displayed in HMI	Busbar image can be seen in PC only
23	Redundant hardware available	Redundant communications ports available
24	Standard function available	Differential, CB fail, End zone
25	Optional functions available	Nils
26	Reset through a single push button	Yes
27	Future configuration and activation of new bays should be possible	Possible upto 28 bays
28	Filtering and evaluation of Analogue qty at bay level	Yes
29	Tripping to trip coil directly from Bay units	Yes
30	Connection and communication between Bay unit and Central unit	Through fiber optics
31	Blocking of zone in case of communication failure and annunciation thereof	Yes
32	Isolator integrity monitoring through software without any external relay and annunciation thereof	Yes
33	DR / Event function in CU as well as BU with non volatile buffer memory	Yes
34	DR sampling freq. And total duration	600 Hz and max 10.5 secs
35	Nos of events	512
36	Availability of Blind zone detection & CB failure feature	Yes
37	Differential current display of each zone	Yes
38	Continuous DC supervision	Through DC supervision relays
39	Central unit compatibility	28 bays
40	Availability of current reversal techniques for Bus Coupler bay	Yes

2. LOCAL BREAKER BACK-UP PROTECTION for ALL BAYS

S.No.	Equipment	Specification
1	Name and country of Manufacturer	GE T&D India Limited
2	Manufacturer type and designation	P442 (Numerical)
3	Setting Range	
	a) Current	Phase Under Current threshold for reset $I_{<}: 0.05 - 3.2 \times I_n$
	b) Time	0 – 10 Sec
4	Operating time	Less than 15 ms
5	Resetting time	Less than 15 ms
6	Operation indicator provided?	Yes, in the form of LED's
7	Thermal rating	Continuous: $4 I_n$, for 10 s: $30 I_n$, for 1 s: $100 I_n$
8	Whether relay have re-trip feature for tripping its own CB after initiation with a set time delay?	Yes
9	Communication	IEC 61850
10	Disturbance recording	Available. Configurable for specified inputs (8 analogue and 32 Digital)

Annexure-1 to GTP

- 1) Energy Meter
- 2) CMRI

POWER LINE CARRIER TERMINAL FOR SPEECH & DATA TRANSMISSION

Sr. No.	Technical parameters	System Particulars
1	Name of manufacturer & country	APPSIL & India
2	Type, model & Catalogue No.	ETL600-050-1
3	Type of modulation	Single Side Band with suppressed carrier & Single step frequency conversion with Direct Digital Synthesis (DDS)
4	Mode of transmission	Single Side Band with suppressed carrier
5	Carrier frequency range	40 to 500 kHz as per IEC 60495 Can be programmed for 24 to 1000 kHz
6	Nominal carrier frequency band in either direction of transmission	4KHz
7	Return loss within the nominal carrier frequency band	≥ 10 dB
8	Effectively transmitted VF band	200-3400 Hz
9	Return loss within the effectively transmitted voice frequency band	≥ 10 dB
10	HF oscillator details	Frequency Synthesizer Master Control Oscillator which derives all i.e. HF, AF.
11	IF oscillator details	No IF conversion. Its Direct Digital Synthesis.
12	Frequency difference between the VF input and VF output of a pair if terminals connected back to back for permissible ambient temperature and supply voltage variations.	2 Hz
13	Maximum HF amplifier output with single/multiple tone keying (peak envelope power).	50 W The output power may be decreased via user interface program (HMI) in steps of 1 dB
14	Nominal carrier frequency power (peak envelop power) at output terminals.	50 W
15	HF impedance at output of carrier terminals.	75 ohms.

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16	Stability of the carrier frequency	$\leq \pm 1$ Hz
17	Improvement S/N due to compander	10 dB
18	Whether carrier is suppressed or reduced during transmission of signal	Suppressed
19	Whether frequency locking between Tx/Rx provided.	Yes
20	Automatic gain control range and regulation	40 dB dynamic range
21	Level of spurious emission at (a) Edge of nominal carrier frequency band. (b) 4KHz away from nominal carrier frequency band. (c) 8KHz away from nominal carrier frequency band.	As per IEC 62488-2,2017 clause no. 5.8
22	Relative level at VF 4 wire terminating points. (a) Send leg (b) Receive leg	(a) -20 to +5 dBm programmable in steps of 0.25 dB-3.5 dB default (b) -20 to +10 dBm programmable in steps of 0.25 dB-3.5 dB default
23	Permissible limits for level variation with frequency relative to 800 Hz in a speech channel (without companders) transmitted over a pair of terminals connected back to back	As per IEC 60495
24	Level of telephone signaling channel(a) input level b) Output level	(a) Potential free contact, ≤ 500 Ohm. (b) Potential free contact rating 50mA/72V
25	Near and far end cross talk due to telephone signaling channel in a pair of PLC terminals (without companders) connected back to back.	≤ -50 dBm0p
26	Pulse distortion of telephone signaling when operated at signaling speed of 10 pps and with a mark to space ratio of	≤ 2 msec.

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	40/60 in PLC terminals connected back to back.	
27	Psophometric noise contribution of a pair of PLC terminals connected back to back.	≤ -50 dBm0p
28	Group delay distortion in the frequency band relevant to the transmission of protection signals.	As per IEC 62488-2,2017 clause no.6.7
29	Performance under noise condition. a. Noise generated within terminal. b. Additional noise introduced when terminals are connected back to back at repeater station. c. Noise bandwidth.	(a) ≤ -55 dBm0p (b) Negligible (c) 4 kHz
30	Power supply requirements. a. Voltage. b. permissible voltage variation. c Maximum current. d. Quiescent current	(a) -48V DC (b) +20%, -15% (c) 5.8A (d) 2.8A
31	Installation details	Housed in floor mounting steel cabinet
32	Insulation level	1KV
33	Meter provided on test panel, their range and purpose.	HMI Software Provided for Maintenance & Testing
34	Is the equipment suitable to work in dust laden atmosphere?	Yes, but not advisable.
35	Whether interior lamps with door switch is provided in cabinet?	Yes, but with a separate switch to operate them.
36	Overall dimensions(cabinet) a. Length mm. b. Width mm. c. Height mm	1800(H) X 730(W) X 530(D)
37	Weight	160 kg approx
38	Earthing detail of PLC cabinet	Copper earth bar is provided inside cabinet
39	Whether Tx/Rx loop-back facility is available for testing locally	Yes (Using HMI600 software)
40	Whether site tuneable ?	Yes (Using HMI600 software)

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(TECHNICAL)

FORM-I

FORMAT FOR BIDDERS' QUERIES

Date :24/03/2022

WORK DETAILS: : [220 kV GIS Package](#) for Panipat Refinery Expansion Project (P25) of M/s Indian Oil Corporation Limited (IOCL), India

BIDDING DOCUMENT: [SG/B269-999-EB-T-0020/22](#)

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
	PART/VOL.	PAGE NO.	CLAUSE NO.	SUBJECT		
1			3.3.3	220kV EXISTING GIS SS	GIS bus extension for 2 Nos New bay addition shall be under present scope or not.	2 Nos. GIS Bay extension is included under bidder's scope as per tender.
2			3.3.3	220kV EXISTING GIS SS	Is Existing Bus bar protection panel has already considered for 2 Nos New bay addition which are coming under present scope or Separate Bus bar protection shall be provided for present scope. Please confirm the make and model of existing bus bar protection panel drawings	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
3			3.3.3	220kV EXISTING GIS SS	Please provide Existing Overall Electrical layout (Plan & section) showing the present bay location.	The cut-outs are provided and indicated as Future bays as attached in the GIS building layout plan. Please consider the future bays as indicated in the GIS layout plan for installation of extension bays. For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
4			3.3.3	220kV EXISTING GIS SS	Please provide Existing GIS Earthmat Layout drawings. Is present scope bay earthmat shall be existing or bidder to extend the existing earthmat for present scope bays. Please confirm	Embedded earth mats in existing GIS substation flooring is taken care by others. Connectivity of 220kV GIS new extension bays and associated LCC & CRP with existing earthing system is included in bidder's scope. Only connection of the extension modules and other associated equipments to be done by the bidder as per OEM recommendations
5			3.3.3	220kV EXISTING GIS SS	As we understand that GIS EXTENSION NOT INVOLVING EXTENSION OF BUILDING (It means space allocated already for the present scope bays inside the GIS Building). Please confirm	Adequate space is available for extension of 2 nos. 220kV GIS bays i.e. one bay each on either side as well as for locating corresponding LCCs and CRPs. Extension of GIS building is not required.
6			3.3.3	220kV EXISTING GIS SS	Please provide the Existing GIS Busbar end piece module drawing for extension of existing GIS. Also please share that existing GIS plan and section layout	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
7			3.3.3	220kV EXISTING GIS SS	Please confirm the Existing online PD monitoring system Make and Model No.. Is there any augmentation activities in existing online PD monitoring system for present scope bays.	Online PD monitoring system shall also be provided for 2 nos extended bays. For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
8			3.3.3	220kV EXISTING GIS SS	Please confirm that Existing Illumination System details and whether available for future scope bays.	No additional illumination required for 2 Nos. additional 220 kV GIS bays and associated LCCs & CRPs in existing GIS substation.
9			3.3.3	220kV EXISTING GIS SS	Any noticeable hindrances or fouling (cross bracings/column position) in the present scope area in the GIS building. Please confirm. Also please share that existing GIS plan and section layout	These details shall be provided post order during detail engineering. For any additional details , please contact OEM mentioned in the tender.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
10	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Floor details in the GIS Building (RCC or PCC) in the present scope area.	These details shall be provided post order during detail engineering. For any additional details , please contact OEM mentioned in the tender.
11	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Please confirm that whether space is available in the existing GIS Building for present scope bays or not.	Adequate space is available for extension of 2 nos. 220kV GIS bays i.e. one bay each on either side as well as for locating corresponding LCCs and CRPs. Extension of GIS building is not required.
12	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Please confirm the existing Control Room Building Layout drawing , Indoor Trench Layout and Panel Arrangement Details.	These details shall be provided post order during detail engineering. For any additional details , please contact OEM mentioned in the tender.
13	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Please confirm the availability of Feeders at existing ACDB & DCDB for present scope of work in existing 220kV GIS SS. We assumed that feeders available for present scope bays.	Bidder to extend existing 415V AC and 110/220V DC supply for 2 no additional bays and associated LCC and CRP. Further details shall be provided post order during detail engineering. For any additional details , please contact OEM mentioned in the tender.
14	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Location of existing bus bar protection panel	These details shall be provided post order during detail engineering. For any additional details , please contact OEM mentioned in the tender.
15	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Existing Bus bar protection scheme (i.e centralized or distributed) and confirm the protection relay make and Model no.	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
16	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Please confirm the existing CRP Manufacturer name, existing relays are numerical IEC 61850 based or old conventional static / electromechanical relay?	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
17	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Please confirm whether existing Substation is SAS based (IEC 61850, BCU based) or Conventional Substation having old type control relay panels with RTU	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
18	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	In case of SAS based Substation, please confirm the SAS Make and ascertain the augmentation related works for present scope bays.	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
19	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	In case of RTU based Substation, please confirm the make of the existing RTU & the space availability for RTU extension by adding more cards for the present scope of work.	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
20	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	We are not envisaged any 110V/220V and 48 V battery/battery charger under present scope. We assumed that existing battery is sufficient to cater all the 2nos of new bays which are coming under present scope. Please confirm	Spare feeders shall be provided in existing GIS building SS-64 for extension bays only. However all required cabling, termination shall be in the scope of bidder including supply of all required materials.
21	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Please confirm that whether the Relay Panels are placed in SPR or Control Room Building.	These details shall be provided post order during detail engineering. For any additional details , please contact OEM mentioned in the tender.
22	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Please confirm the availability of space in existing control room/ SPR to place the CRP panel to be supplied under present scope.	The spare cut-outs are provided in the CRP room and is indicated in the GIS building layout diagram. Same may be considered for installation of CRP of extension panels. However any modification/alteration/increase in cut-out arrangement or any other works like erection, structural , loading, unloading, cabling, termination, loop checking, installation of new CRP panels shall be done by bidder.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
23	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Please provide information of Control room building details like number of floors and floor location for existing CRP, Switch board, ACDB & DCDB if existing control room building drawing s are not available.	Control room building is part of 220kV GIS substation in existing refinery. Bidder to extend existing 415V AC and 110/220V DC supply for 2 no additional bays and associated LCC and CRP. Further details shall be provided post order during detail engineering.
24	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	As we understand that no scope related to EHV cable support structure and their associated earthing under bidder scope. Please confirm	Bidder understanding is in order.
25	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	As we understand that 220kV EHV cable supply along with their termination shall be supplied by M/S IOCL as a free issues. EHV cable laying and routing for present scope bays shall be under bidder scope. Please confirm	Bidder understanding is not in order. Supply, laying and termination of 220kV cable is not in bidder scope however bidder shall provide cable routing for the same inside the package battery limit.
26	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	As we understand that 220kV EHV cable shall be laid buried. Please confirm	220kV EHV cable shall be laid in RCC trench.
27	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Please note that 2nos, 220kV line feeders through EHV cables are connected from existing 220kV GIS to new P25 GIS SS. Hence in this regard, we understand that 220kV Cables supply, laying, routing and termination on both side(P25 and Existing GIS) shall be under 220kV GIS existing contractor scope. Please confirm.	Bidder understanding is not in order. Supply, laying and termination of 220kV cable is not in bidder scope however bidder shall provide cable routing for the same inside the package battery limit.
28	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Please confirm the outdoor switchyard control room dimension as shown in tender SLD and also confirm there location. Is it will existing switchyard area?	Bidder query is not clear. Bidder to note that 220kV existing GIS substation in existing PR and 220kV new incoming gantry and associated substation in existing PR are 2 different substations. For details bidder to refer the tender documents.
29	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	Is outdoor switchyard control room shall be existing or under bidder scope. What equipments located in outdoor switchyard control room	Bidder reference of 220kV Existing GIS SS is incorrect. Bidder to note that new incoming gantry and associated substation / control room is included in bidder's scope as per tender.
30	Tender document part II	39	3.3.3	220kV EXISTING GIS SS	We understand that no present scope under bidder from the outdoor switchyard control room to PNCC-PPU3 as shown in SLD. Please confirm as our scope is limited upto the 33kV Breaker panel.	Bidder reference of 220kV Existing GIS SS is incorrect. Bidder understanding is partly correct for PNCC-PP3 interconnection as termination of owner's supplied 33kV power & associated control cables at bidder's equipment are included in bidder's scope including supply of termination kits.
31	Tender document part II	39	3.3.5	220kV EXISTING GIS SS	What is the purpose of SCAP panel and where it will be exactly located in MRSS-100.	Bidder to follow Tender document/ Technical Amendment
32	Tender document part II	39	3.3.8	220kV EXISTING GIS SS	As per spec, 2 Number of 220/33 kV, 60/75 MVA, ONAN/ ONAF, YNyn0, Z= 12.5%, Oil filled transformer with OLTC and RTCC shall be used. We understand that these 2 transformers shall be located in MRSS-100, P25 Area as shown in tender layout, Ground floor as a TIE Transformer. Please confirm	Bidder reference of 220kV Existing GIS SS is incorrect. Bidder understanding is not in order. These transformers shall be located in 95m x 95m plot area as per tender.
33	Tender document part II	39	3.3.20/3/3.21	220kV EXISTING GIS SS	Please confirm the existing SAS and ECS design/make/model no along with there drawings	For details of existing system refer Annexure-A attached herewith. For any additional details, please contact OEM mentioned in the tender.
34	Tender document part II	38	3.3.2	220kV outdoor switchyard	2 nos. 220 kV, 2000 Amps, 50 kA (3 Sec), Gas Insulated Outdoor type Isolating breaker panel with Local Control Cubicle and Separate control and relay panel complete with numerical relay, metering and protection panel. We understand that this is Hybrid GIS. Please confirm it. Also please let us know the where we will keep the Separate control and relay panel for this Hybrid GIS	This is not hybrid GIS. Bidder to follow tender documents. CRP shall be located in new gantry substation building.
35	Tender document part II	38	3.3.1	220kV outdoor switchyard	As we understand that Tri-vector meter for tariff metering shall be supplied by HVPNL. Please confirm	Bidder understanding is not correct. Bidder to follow tender document and provide tri-vector meter accordingly.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
36	Tender document part II	38	3.3.1	220kV outdoor switchyard	As per spec, PLCC system with wave traps & 48V DC System for both sending & receiving end shall be procured as part of this tender and sending end equipments shall be free issued to HVPNL end contractor. As we understand that 220kV CT, CVT, Metering CT, Metering CVT, WT, Isolator with E/S are under present scope. Please confirm Please let us know the Make/model/design of above equipments as per HVPNL standard design philosophy.	As per tender documents, interface as required with HVPNL, regarding equipment, components, their rating, their specification and for establishing to & from voice and data communication with HVPNL shall also be in scope of CONTRACTOR. Details of existing system, wherever required, shall be obtained from HVPNL by BIDDER.
37	Tender document part II	38	3.3.1	220kV outdoor switchyard	Please confirm the 220kV gantry width as per HVPNL standard design philosophy.	Refer reply at sr. no. 36 above.
38	Tender document part II	38	3.3.1	220kV outdoor switchyard	As we understand that bidder scope is limited to supply upto LA terminal at 220kV line side. Please confirm.	Bidder to note that the scope of works shall includes all job related to swtichyard construction works as per the scope of the tender. HVPNL shall only terminate the overhead conductor upto the point of connection which is normally the gantry tower of the switchyard. Any other works related to further connections and termination to the standard switchyard components as per scope of the tender shall be in the scope of bidder including supply of materials and services.
39	Tender document part II	38	3.3.1	220kV outdoor switchyard	As we understand that 220kV line is HTLS -AAAC type Conductor. Please confirm	Overhead Conductor type shall be HTLS -AAAC. The conductor size shall be finalised based on 2 nos. 220/66kV, Grid-B transformer ratings in MRSS-100.
40	Tender document part II	38	3.3.1	220kV outdoor switchyard	As per spec, Please note that OPGW system including all control panels and other equipment for receiving end (to be matched) with make/model at sending end at HVPNL switchyard) as per HVPNL standard design philosophy confirm the OPGW system . Hence please provide/share the details for OPGW system details at sending end so that accordingly we can consider at receiving end	Refer reply at sr. no. 36 above.
41	Tender document part II	38	3.3.11 and 3.3.12	220kV outdoor switchyard	Please provide the drawings/make/model of Fiber optic transmission system (FOTS) as per HVPNL standard	Refer reply at sr. no. 36 above.
42	Tender document part II	38	3.3.11 and 3.3.12	220kV outdoor switchyard	We understand that there will be no work scope on SLDC of HVPNL. Please confirm	Refer reply at sr. no. 36 above.
43	Tender document part II	43	3.4.1	FREE ISSUE EQUIPMENTS / ITEMS	We understand that following things are not under bidder present scope. Please confirm. 1) 220kV Cables, laying, excavations, routings, cable earthing and associated termination kit 2) 66kV Cables, laying, excavations, routings, cable earthing and associated termination kit 3) 33kV Cables, laying, excavations, routings, cable earthing and associated termination kit 4) 6.6kV Cables, laying, excavations, routings, cable earthing and associated termination ki	1. Bidder understanding is partly correct. Providing Cable routing within package battery limit is in bidder's scope. 2. Refer TA-01 for 66kV cable scope. 3. Bidder understanding is partly correct. Providing Cable routing & termination including supply of termination kits within package battery limit is in bidder's scope. 4. Refer TA-01 for 6.6kV cable scope.
44	Tender document part II	44	3.4.7	FREE ISSUE EQUIPMENTS / ITEMS	As we understand that only drawing preparation and installation of PA system is under bidder scope. PA system supply, Testing and commissioning shall be done by others. Please confirm.	Bidder understanding is partly correct . For Plant Communication system scope, bidder to refer tender documents including cl. No. 5.15.9 of SP-0020 attached with tender.
45	Tender document part II	44	3.4.8	FREE ISSUE EQUIPMENTS / ITEMS	As per spec, MV power and control cables from CONTRACTOR's equipment to ECS Panels shall be supplied, laid and terminated by CONTRACTOR. However please note that MV cables are not under bidder scope as per clause 3.4.1. Please confirm.	Bidder understanding regarding cl. No. 3.4.1 is incorrect. Bidder to follow tender documents.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
46	Tender document part II	44	3.5.1	INTERFACE WITH OWNER'S SYSTEM	As per spec, Incoming 220 kV overhead line from HVPNL substation up to incoming gantry of 220 kV outdoor switchyard in IOCL premises shall be laid and terminated by others. Hence we understand that incoming gantry along with incoming line side insulators /Shield wire are not under bidder scope. Please confirm	Bidder to note that the scope of works shall includes all job related to switchyard construction works as per the scope of the tender. HVPNL shall only terminate the overhead conductor to the gantry tower of the switchyard. Bidder to provide all necessary hardwares including line side insulators/sield wires for further connections and termination to the switchyard components. The construction of gantry towers, and other standard switchyard compoents as per the scope of the tender shall be in the scope of bidder including supply of materials and services
47	Tender document part II			Tender Layout- First Floor	We understand that 220kV GIS module, 66kV GIS and 6.6kV GIS Switchgear shall be kept in one floor (First floor) in MRSS-100 at P25 location. Please confirm	Bidder understanding is in order. However, 6.6kV switchboard is AIS as per tender document and not GIS. Final equipment layout shall be decided during detail engineering based on final dimension of equipments / panels .
48	Tender document part II			Tender Layout- First Floor	In tender layout of MRSS-100, there is a switchgear room in first floor. We understand that this room is dedicated fo 415 V LT boards(PMCC,DCDB,UPS DB etc). Please confirm.	Bidder understanding is in order. However, final equipment layout shall be decided during detail engineering based on final dimension of equipments / panels .
49	Tender document part II	44	3.5.3	INTERFACE WITH OWNER'S SYSTEM	We understand that MV cable along with its termination supply between 6.6kV/415V transformer and 6.6kV, 800 A IBP shall be under owner scope. Please confirm	Bidder understanding is not correct. For 415V MV cables and 6.6kV cables, bidder to refer tender documents & TA-01.
50	Tender document part II			Tender SLD	We understand that bidder scope is limited upto 66kV GIS module supply in MRSS-100. From 66kV GIS module to different Transformer interface shall be under owner scope. Please confirm.	Bidder understaning is not correct. Bidder to refer tender documents and TA-01.
51	Tender document part II	736	5.6.11	UPS SYSTEM	Please confirm the UPS rating for MRSS-100 at P25	UPS rating shall be worked out by bidder based on load requirements including owner's load requirement as defined in tender documents.
52	Tender document part II	35	2	POWER SYSTEM DESCRIPTION	Please confirm the DG rating for MRSS-100 at P25	DG for MRSS-100 is not applicable. Owner will provide a feeder from owner's emergency switchboard at 6.6kV Voltage level. Further distribution of emergency load as defined in tender shall be in bidder's scope.
53	Tender document part II	Page No 139	Clause No. 1, Scope of supply/work	Requirement of Earthworks	As per scope of work clause no-1 " Entire area within the scope limit area are already graded upto FGL 238.32m above MSL. Package contractor shall further raise the grading level to achieve level required for providing the pavement. " We understand that Land development is not in Bidders' scope. Kindly confirm.	Graded site shall be handed over to contractor up to FGL 238.32m above MSL. As mentioned in clause.
54	Tender document part II	Page No 11	Clause No. 6.2	Construction of pile foundation	"Pile shall be installed by other agency as per the pile lay-out drawing provided by the successful bidder." As per above clause it is not clear whether construction of pile foundation is in bidders's scope or not. In case pile foundations are adopted due to functional/loading requirements, kindly confirm that construction of pile foundation is in the scope of package contractor.	Construction of piles is in other's scope as per the pile layout submitted by bidder
55	Tender document part II	Pge no -35 & 36	Main substation building MRSS- Plan & section drawing	Expansion Joint in Main substation building MRSS- 100	As per building plan given, there is no expansion joint provided along width having dimension of 56 m however along length expansion joints are provided. We understand that there will be no additional temperature forces to be induced while designing .Kindly confirm.	Same shall be discussed and finalised during the meeting
56	Tender document part II	Pge no - 38	Main substation building MRSS- Plan & section drawing	Second floor plan & section	In drawing it is mentioned as third floor plan whether in title block it is written as second floor plan and section. We understand that it is second floor plan as per title block, Kindly confirm.	It is second floor paln as per title block

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
57	Tender document part II	Page no 141 of Part-2 & Pge no - 37 of Part-3	Scope drawing of 220kv GIS package	Box-culvert	From scope drawing of 220 kv GIS package it is noted that construction of box culvert is envisaged in approach road connecting to main substation building and it is mentioned as to be done By Others , while as per scope of work given in part-2 any culverts (pipe culvert / RCC Box culvert) required is to be provided by package contractor. Whether the construction of Box culvert is in bidders' scope, Kindly confirm.	As per Scope drawing no B269-999-81-41-14561, Bidder to provide approach roads & box culvert under road crossings witin Battery Limit.
58	Tender document part II	Page no 768 of Part-2 & Pge no - 37 of Part-3	Scope drawing of 220kv GIS package	Chain link fencing	As per scope drawing of 220 kv GIS package, chain link fencing is required around MRSS building and around proposed switchyard area in existing Panipat refinery. As per engineering design basis for civil, structure & Architecture work given at Page no 768 of Part-2, Fencing/compound wall is existing. Kindly confirm that it is existing or in current scope of package contractor	As per engineering design basis for civil, structure & Architecture work given at Page no 768 of Part-2, Fencing/compound wall is existing. clause for Compound wall and fencing in Engineering desing basis is for overall plant. Bidder to provide fencing wherever required for GIS & Switchyard package works.
59	Tender document part II	Pge no - 37	Scope drawing of 220kv GIS package	Approach roads	As per scope drawing of 220kv GIS package, all the work outside the scope battery limit are mentioned as to be done by others. While as per notes of the same drawing construction of "All approach roads from main road to battery limit shall be provided by package contractor" . Kindly clarify that construction of approach roads is in bidders' scope or not.	As per Scope drawing no B269-999-81-41-14561, Bidder to provide approach roads & box culvert under road crossings witin Battery Limit.
60	General				As per site visit there is requirement of Cable rack/ UG cables/ cable trench to establish connection between existing switchyard and new switchyard. Please confirm it is in bidders' scope or not. If it is in bidders' scope then whether it will be cable rack/ UG cables/ cable trench, kindly confirm.	In bidders scope. Same shall be the part of detail engineering
61	Tender document part II	56 of 79	B269-999-16- 50- SP-0020, 5.14.1	Fire Fighting System	The Fire Detection & Alarm System to be considered within battery limit. Further integration to Plant Control Room and Fire Station shall be in scope of client	Bidder understaning is partly correct. As per cl. no. 5.14.12 of doc. no. SP-0020, bidder shall be responsible for integration of this fire alarm system with the existing FA system in nearby substation. Modification & updation of graphics in Main Fire station in existing refinery for the bidder supplied system shall also be in bidder's scope
62	Tender document part II	56 of 79	5.14.6	Fire Fighting System	Testing & Commissioning of Fire detection & alarm System shall be in scope client as the same is Free Issue Item	T&C of FIM FA system only shall be done by others.
63	Tender document part II	57 of 79	5.14.12	Fire Fighting System	Please provide Existing fire alarm system make/type & other details at Substation-63	The integration of switchyard FA system shall be with the existing FA system provided in 220 KV GIS building (SS-64) or SS-28 FA system or PX Control room. The details of existing system is attached as Annx-A. Additional interfacing hardware in exsiting DGFAP panels shall be provided by bidders including connectivity from new GIS to SS-64/PX control room. All required cabling, termination from the existing DGFAP system to the gantry location shall be in the scope of the bidder.
64	Tender document part II	13 of 16	B269-999-81- 41- SOW-0020	Fire Fighting System	Please clarify that Spray & Hydrant System header is common or Separate.	Individual Tapping point shall be considered
65	Tender document part II	4 of 13	B269-999-81- 41- EDB-1002, 3.1, f	Fire Fighting System	We understand that Clean Agent System & CO2 flooding System is not envisaged for this tender. Please confirm.	Scope of fire protection system doc no.B269-999-17-44-SOW-5000 & B269-999-16-50-SP-0020 shall be applicable

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
66	Tender document part II	General		HVAC System	We understand that HVAC System will not be integrated with plant control Room. Please confirm.	For HVAC system,Bidder to refer the clause no. 1.11 of Job specification of SMED (DOC.NO. B269-999-80-43-SP-0020) attached with tender which is appended below for ref. "1.1 The controls / indicators which are required to be connected to remote control room (DCS) shall be terminated in a junction box (with terminal strip) or local panel (located at the edge of skid) as applicable."
67	Tender document part II	38	3.3.2	P25 GIS	Please note that as per tender SLD, 220kV GIS bays is 16 nos. Hence we are considering the same as per tender SLD	Bidder to follow tender documents.
68	Tender document part II	94	5.22.20	EARTHING	As per spec,Minimum size of the main earth grid shall be 100 x 12 for Substation. Please clarify what is meaning of 100x12	100 x 12 mm GI earth strip. However, the exact details of earthing conductors such as earth rod , flat, its material, size etc. shall be worked out by bidder during detail engineering for review / approval by Owner/EIL.
69	Tender document part II	94	5.22.15.5	EARTHING	Please confirm the earthmat shall be laid on cable cellar FGL level as well as GIS floor both or we have to provide only one equipotential eartmat on GIS floor only which same shall be connected with existing earthmat of plant area	The earth mat details shall be finalised during detail engineering meeting requirements of code/standards & statutory requirements as per tender.
70	Tender document part II	94	5.22.12	EARTHING	Please confirm that earthing of present new GIS area (125*56)shall be standalone design with meeting all earthing step, touch and resistivity value	Yes
71	Tender document part II	94	5.22.10	EARTHING	Is outdoor switchyard earthing shall be under present scope or same is existing. Only We have to provide riser connection with outdoor switchyard equipments.	Complete earthing of outdoor switchyard including associated substation is in scope of bidder as per tender documents.
72	Tender document part II	94	5.22.10	EARTHING	Please confirm the outdoor switchyard area soil resitivity values for earthing design	Soil resistivity test shall be conducted by bidder in MRSS-100 and outdoor switchyard area and report shall be submitted to EIL/owner. Earthing system design shall be finalised accordingly.
73	Tender document part II	94	5.22.18	EARTHING	What is meaning of Separate clean earth system	Requirement of clean earth system shall be finalised during detail engineering based on equipment/ system OEM recommendations.
74	Tender document part II	38	3.3.2	220kV outdoor switchyard	Is lightning protection required for outdoor switchyard control room. Please provide the size of outdoor switchyard control room	Complete lightning protection system meeting requirements of relevant codes and standards as specified in tender documents is included in bidder's scope including outdoor switchyard area and associated buildings.
75	Tender document part II	38	3.3.2	220kV outdoor switchyard	Please provide the AC -DC feeder source for the outdoor switchyard control room. Do we have to consider ACDB and DCDB seperately. Also pleae provide the feeding point of these panels	2 nos. 415V Normal supply feeders & 2 nos. 415V Emergency supply feeders from nearby existing substation. The feeders shall be made available from either of the sub-stations SS-28/SS-63/SS-64 located in the vicinity of the proposed gantry location. However all required cabling, termination shall be in the scope of LSTK bidder including supply of all required materials. All further downstream distribution including ACDB, LDB, PDB, DCDB, battery, charger etc. are included in bidder's scope.
76	Tender document part II	38	3.3.2	220kV outdoor switchyard	We understand that ,outdoor switchyard control room have 220kV/33kV breaker panel and HVPNL line breaker panel. Please confirm	220kV GIS bays are outdoor type while 33kV GIS isolation breaker panels is indoor type inside new gantry substation/control room.
77	Tender document part II	38	3.3.2	P25 GIS	is EHV cable shall be buried or through trench it will come inside the cable cellar and will connect to 220kV GIS	EHV cable shall be through RCC trench outside as well as inside cable cellar in MRSS-100.
78	Tender document part II	38	3.3.1	220kV outdoor switchyard	Please confirm the Metering room size which will carry metering panel for HVPNL line. Do AC requirment of this room	As per tender documents, interface as required with HVPNL, regarding tariff metering is in scope of CONTRACTOR. Bidder will coordinate with HVPNL and provide the metering room accordingly.
79	General Query				Do bidder require Insulation Co-ordination Study. Please confirm.	Yes, bidder to follow the tender documents.
80	General Query				At 220kV Existing Substation end, LA shall be inside or Outside of the Switchyard. Please confirm.	For incoming 220kV gantry area, outdoor LA shall be within 95 mtr. x 95 mtr. plot area in bidder's scope.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
81	General Query				As per site survey, we understand that double circuit line will come outside the IOCL existing ss area from HVPNL end. What is the distance between IOCL Premises to HVPNL end. Please provide.	Bidder to note that the scope of works shall includes all job related to switchyard construction works as per the scope of the tender. HVPNL shall only terminate the overhead conductor upto the point of connection which is normally the gantry tower of the switchyard. Any other works related to further connections and termination to the standard switchyard components as per scope of the tender shall be in the scope of bidder including supply of materials and services.
82	General Query				Please provide list drawings which has to be approved.	Query is not clear. Bidder to follow tender documents including vendor data requirements attached with tender.
83	General Query				We understand that there is no underground facility and no any diversion, re-routing, dismantling, handling etc. Please confirm.	Bidder to follow tender documents.
84	General Query				Please provide Mandatory and O&M spare list. Also, Please confirm the warranty period for these.	Bidder to follow tender documents.
85	General Query				We understand that Free issue item store, watch & ward, insurance is not in bidder scope. Please confirm.	Bidders understanding is not in order
86	General Query				We understand, to being LSTK contract, Scrap/unused material after the project completion Contractor shall be allowed to carry out without penal rates.	Bidder to follow tender requirements
87	Part-3	Page No 11	Clause No. 6.2	Pile foundation	We understand that following items of pile foundation shall be in bidders' scope: 1. Excavation for pile caps 2. Pile head chipping 3. PCC of pile cap & complete construction above PCC Please confirm our understanding.	Bidder understanding is correct.
88	Part-3	Page No 11	Clause No. 6.2	Pile foundation	We understand that in case pile foundations are required, there will be no deduction in cost of foundation works for differential volumes of pile cap & isolated/combined/raft foundation. Please confirm our understanding.	Bidder's query is not clear. Please follow tender document.
89	Part-3	Pge no - 37	Scope drawing of 220kv GIS package	Regarding dismantling works in proposed area in existing Panipat refinery	We understand that dismantling (of pedestals, trenches, foundations etc.) till 1.5m below ground level shall be done by owner so that there is no interference of existing structures with upcoming facilities. Please confirm our understanding.	Dismantling within battery limit is in bidder's scope
90	General				We understand that 2 bay extension are to be added in upcoming substaion being constructed by BHEL. Therefore no drains & roads shall be required under this scope of work. Please confirm our understanding.	Bidder to follow the Bid Requirements
91	Tender document part II	39	3.3.3	220kV-EXISTING GIS-SS	We understand that, there is no scope of related to Fire Fighting System, HVAC System & Crane for Bay Extension at BHEL End. Please confirm.	Bidder to follow Bid document

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
92	Tender document part II, B269-999-16-50-SP-0020	57 of 79	5.14.11	220kV outdoor switchyard	As per referred clause & as per discussion in pre-bid meeting we understand that following: 1. FIM quantity mentioned in referred clause is only for SS-100. Please confirm. 2. For Existing 220KV Substation, design, Installation & Supply the fire Detection & Alarm System for 40mX30m Substation Building shall be in bidder's scope. Please confirm. 3. Please provide the Existing Fire Alarm System Make & Details/drawings. 4. Our Scope is limited to 95X95 m Plot area, Further cabling & Interfacing with Existing System/Fire Station/ any other Substation shall be in client scope. Also, Ensuring provision/spare loop in Existing Fire Alarm System for Interface shall be in Client scope.	1. Bidder understanding is in order. 2. Bidder understanding is in order. However, 220kV existing(ongoing) GIS substation is different from new incoming gantry substation. The extension of existng FA system from PX Control room nearby shall be intimated during detailed engineering stage. The details of existing system is already provided. Additional interfacing hardware in exsitng DGFAP panels shall be provided by bidders including connectivity from new GIS to SS-64/PX control room. All required cabling, termination from the existing DGFAP system to the gantry location shall be in the scope of the bidder. 3. Details of existing FA system in /PX Control room/shall be provided IOCL for providing matching FA system in new gantry switchyard and substation. 4. Bidder to follow tender documents.
93	Tender document part II, B269-999-16-50-SP-0020			Scope Clarification for Substation 100	We understand that, our Scope of Fire Detection & Alarm System is limited within battery limit for Substation 100. Further integration to Plant Control Room and Fire Station or any other substation shall be in scope of client. Please confirm	Bidder understanding is not in order. Bidder to follow tender documents.
94	Tender document part II, B269-999-16-51-SP-0020	5 of 8	4	Scope Clarification for Substation 100 & 220KV Outdoor Switchyard	We understand that Gas Detection system shall be considered only at the inlet of HVAC Duct. Please confirm.	Bidder understanding is not in order. Bidder to follow tender documents.
95	Tender document part II, B269-999-17-44-SOW-5000 & B269-999-16-50-SP-0020	3 of 3 & 9 of 79	3.3.1 & 3.3.6 to 3.3.8, 3.4.6, 5.14	Scope Clarification for Substation 100 & 220KV Outdoor Switchyard	As per referred clause , we understand that, following Fire Protection System shall be considered under present scope. 1. Hydrant System (Indoor & Outdoor) 2. Nitrogen Injection Fire Protection System (NIFPS) along with HVWS based fire fighting system for 4 Number of 220/66 kV, 100/125 MVA, 2 Number of 220/66 kV, 40/50 MVA, ONAN/ ONAF & Number of 220/33 kV, 60/75 MVA, ONAN/ ONAF. 3. Auto-actuated High velocity water spray system shall be provided for transformer (rating more than equal to 10 MVA/Oil storage more than 2000 litre.) 4. First aid fire fighting equipment's (Hose reel & Fire Extinguisher). 5. Only Design & Installation of Fire Detection & Alarm System for Substation-100. Supply shall be by client, except Cables. Testing & Commissioning of Fire detection & alarm System shall be in scope client as the same is Free Issue Item. Please confirm 6. Design, Supply, Installation, testing & commissioning for Substation Building at 220KV Outdoor Switchyard. Any other type of Fire protection System shall not be envisaged for this tender. Please confirm.	1. Bidder to follow tender documents... 2. Bidder understanding is in order. 3. Bidder to follow tender documents. 4. to be replied by G. Civil. 5. Bidder understanding is partly correct. Bidder to refer tender documents including cl. No. 5.15.9 of SP-0020 attached with tender. 6. Same is in scope of bidder. Bidder to follow tender documents.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
96	Tender document part II, B269-999-16-50-SP-0020	57 of 79	5.14.12	Also contractor shall be responsible for integration of this fire alarm system with the existing FA system in nearby substation-63. Modification & updation of graphics in Main Fire station in existing refinery for the vendor supplied system shall also be in contractor's scope.	As per, referred clause, Integration of Fire Alarm System with SS-63, shall be in contractor Scope, however as per discussion in pre bid meeting our scope is limit within battery limit of SS-100 & 220KV outdoor Switchyard only. Please clarify the scope. If any such interface needs to be done, then please provide Existing fire alarm system make/type & other details of Substation 63. Please clarify the scope also.	Details of existing FA system in PX Control room is attached as Annx-A. Additional interfacing hardware in exsiting DGFAP panels shall be provided by bidders including connectivity from new GIS to SS-64/PX control room. All required cabling, termination from the existing DGFAP system to the gantry location shall be in the scope of the bidder.
97	Tender document part II, B269-999-81-41-EDB-1002	4 of 13	1.3.00	Engineering Design Basis for Fire Protection System	We understand that, the Design Basis document is General document, as the lot points are mentioned in this document, which is not even applicable for this tender. Hence will follow the design basis for applicable part only. Please Confirm.	Bidder understanding is correct.
98	Tender document part II, B269-999-81-41-EDB-1002	4 of 13	1.3.00	Engineering Design Basis for Fire Protection System	We understand that, Clean Agent System, Co2 Flooding System, Panel Gas Suppression System, Foam System, Gas Detection System for any room (Except HVAC Duct inlet), MVWS System, Water Mist System shall not in envisaged for this tender. Scope of Fire Protection System shall be strictly as per B269-999-17-44-SOW-5000 & B269-999-16-50-SP-0020 only, as mentioned in above point no 5.	Scope of fire protection system doc no.B269-999-17-44-SOW-5000 & B269-999-16-50-SP-0020 shall be applicable
99	Tender document part II, B269-999-17-44-SOW-5000	3 of 3	1.1.1. a	Tapping Point	Please clarify that Spray & Hydrant System header is common or Separate.	Individual Tapping point shall be considered
100	Tender document part II,			General	We understand that HVAC System will not be integrated with plant control Room. Please confirm.	For HVAC system,Bidder to refer the clause no. 1.11 of Job specification of SMED (DOC.NO. B269-999-80-43-SP-0020) attached with tender which is appended below for ref. "1.1 The controls / indicators which are required to be connected to remote control room (DCS) shall be terminated in a junction box (with terminal strip) or local panel (located at the edge of skid) as applicable."
101	BOQ		66kVGIS		As per BOQ we understand that, total 8 line bays and 49 transformer bays in present scope. SF6 to Air bushing termination shall be considered for all line bays Double run cable termination shall be considered for tie transformer feeder bays. Single run cable termination shall be considered for all other transformer bays Vt shall be considered for line bays SA shall be considered for transformer bays Please confirm.	Regarding no. of bays, bidder to refer feeder details data sheet and SLD. 66kV GIS Incomer bay connection is through GIBD i.e. SF6 to SF6 termination. Bidder understanding is correct for no. of runs of cables for tie tranformer and other tranformer bays. Bidder understanding is partly correct. For VT & SA , refer respective hardware datasheet, feeder list & other documents attached with tender.
102	BOQ		220kV GIS			
			SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - TRANSFORMER GIS BAY MODULE (EXTN.)		As per our understanding, Single run (per phase) cable head termination shall be considered for both bays. SA shall be considered in GIS scope. VT shall not be considered for transformer bays. Please confirm.	Bidder understanding is not correct. Bidder to refer TA-01 for revised cable sizes. For VT & SA , refer respective hardware datasheet, feeder list & other documents attached with tender.
103	BOQ		220kV GIS			
			SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - TRANSFORMER GIS BAY MODULE (EXTN.)		As per our understanding, Single run (per phase) cable head termination shall be considered for both bays. SA shall be considered in GIS scope. VT shall not be considered for transformer bays. Please confirm.	Bidder understanding is correct. Bidder to follow the tender document.
104	BOQ		220kV GIS			

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT		BIDDER'S QUERY	EIL/IOCL REPLY
		SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - TRANSFORMER GIS BAY MODULE (EXTN.)	Please provide the cross sectional drawing with following details of existing 220kV GIS since we need to design suitable adapter for connection with our GIS 1) PCD of bus-bar flange 2) Height from floor level to lower phase of bus-bar 3) Phase to phase distance @ bus-bar 4) Distance between bus-bar 1 and bus-bar 2 5) Diameter of bus-bar enclosure 6) Existing spacer flange diameter, bolt size 7) Gas pressure for GCB/other compartments	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender. Extension bays shall be of same make as existing.
105	BOQ	220kV GIS		
		SUPPLY- GIS : 220KV, 50KA FOR 3S, OUTDOOR GIS ISOLATING BREAKER BAY	Please provide the bay configuration and details of termination of isolating breaker bay. As per our understanding, SF6 to air bushing termination shall be considered at incoming side and Single run (per phase) cable head termination shall be considered at outgoing side. VT shall not be considered only at incoming end SA shall not be considered for line bays. Please confirm.	Bay configuraion shall as per feeder list, hardware data sheet & other documents attached with tender/TA-01. 220kV isolating outdoor GIS breaker panels at new gantry area shall have cable in & cable out connections. (Supply & termination of 220kV cable is not in bidder's scope.) For VT & SA , refer respective hardware datasheet, feeder list & other documents attached with tender/TA-01.
106	BOQ	220kV GIS		
		SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - SF6 TO AIR BUSHING/ CONNECTION	Please clarify the requirement of SF6 to air bushing termination for bus bar. Whether bushing termination shall be considered at one end or both ends of busbar-1 & 2. Please provide the number of SF6 to Air bushing need to be considered in present scope.	Query is not clear. Reference of SF6 to air bushing is also not clear as same does not match with the SP formats. Bidder to follow tender requirement.
107	BOQ	220kV GIS		
	Page no. 35 of 114	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - EARTHING MATERIALS INCLUDING HIGH FREQUENCY EARTHING, IF APPLICABLE	We would like to inform you that GIS manufacturer will provide only earthing terminals at GIS. Sub station mat earthing terminal, substation earth mat and connection between GIS earthing terminal and sub-station earth mat riser terminal associated conductor, clamps, joints etc shall be out of GIS manufacturer scope.	Bidder understanding is not in order. Bidder to follow tender requirements as complete earthing shall be done by bidder.
108	BOQ	220kV & 66kv GIS		
	Page no. 35 of 114	CT & VT parameters	Please kindly provide the CT parameters (accuracy class, knee point voltage, max CT secondary winding resistance, burden) based on sub-station protection system requirements, calculation of which is not in GIS manufacturer scope. Please provide rated burden of VT cores.	Bidder understanding is not in order. CT and PT parameters and rating shall be submitted by bidder post order meeting tender requirements for review/ approval by Owner/ EIL.
109	Specification for EHV gas insulated switchgear 6-51-0066 Rev.1	6.1 Circuit Breakers		
	Page 12 of 27	Pole discrepancy tripping..... opening of contacts	We wish to inform that as per OEM standard type tested design 72.5kV circuit breaker, is three phase encapsulated type and three phases are gang operated with a common motor charged spring operated mechanism. Hence "pole discrepancy" is not applicable.	Noted. Bidder to follow tender documents.
110	Specification for EHV gas insulated switchgear 6-51-0066 Rev.1	6.1.6 Operating mechanism		
	Page 13 of 27	Circuit breaker shall be operated..... combination of these	Circuit breaker with operating mechanism of spring/spring type is considered to be of highest reliability to the system, as compared to any other mixed actuating medium like spring actuated with hydraulic medium etc.. Accordingly our offered operating mechanism of circuit breaker meets the intent of the specification fully.	Noted. Bidder to follow tender documents.
111	Specification for EHV gas insulated switchgear 6-51-0066 Rev.1	6.2 Disconnectors & Earthing Switches		
	Page 15 of 27	Disconnector shall also be able to make and break rated bus transfer current at rated bus transfer voltage which appears during transfer between bus bars in accordance with Annexure —B of IEC: 62271-102.	We wish to inform that the rated bus-transfer current switching capacity as per IEC 62271-102, shall be 1600A.	Noted. Bidder to follow tender documents.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT			BIDDER'S QUERY	EIL/IOCL REPLY
	Page 15 of 27		Disconnectors and Earthing switches shall be of single pole, group operated type, installed in the switchgear to provide electrical isolation with one motor operated mechanism per three poles.	As per our OEM confirmation, The type tested design disconnecter and earth switches shall be single pole group operated with a common gang operating mechanism for three poles.Please confirm.	Noted. Bidder to follow tender documents.
112	Specification for EHV gas insulated switchgear 6-51-0066 Rev.1 Page 18 of 27		6.4.8 Local alarm and annunciation The following minimum number of abnormmal condition shall be annunciated Over pressure for each gas compartment of the bay.	We wish to inform that as per OEM standard design all compartments/modules are with same pressure, hence over pressure alarm is not applicable. Please confirm.	Bidder to follow tender documents
113	Specification for EHV gas insulated switchgear 6-51-0066 Rev.1 Page 21 of 27		6.6 Current Transformers For numerical relays for protection class and metering class	Please be informed that GIS CT will be suitable for protection and metering functions, however protection core and metering core will not be the same. Please confirm.	Noted. Bidder to follow tender documents.
114	Specification for EHV gas insulated switchgear 6-51-0066 Rev.1 Page no. 24 of 27		6.13 Voltage Detectors Each outgoing & incoming bays and main bus bars shall include capacitive type voltage detectors for each phase to indicate phases "ALIVE". The unit shall also be suitable for interlocking of earthing switches	We wish to inform that, capacitive voltage detector is not in GIS manufacturer scope. We will provide GIS electromagnetic type VTs on bus-bars and line feeder bays for voltage detection. If VTs are not applicable, in incoming/outgoing feeder bays voltage detection device shall be included in cable termination kit and shall be in cable contractor's scope	Bidder understanding is incorrect. Bidder to follow tender documents.
115	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2193 of 3674	6.5.1 6.5.1 Separate Control Relay Panel (CRP) for each bay shall be supplied to facilitate control of circuit breakers, disconnectors, earth switches and metering, protection etc. 6.5.2 CRP shall be free-standing floor mounted type panel and shall be located either in GIS hall or in a separate room from GIS.	We understand that GIS and CRP are not required to be sourced from same make - please confirm.	Bidder's understanding is correct regarding make. GIS OEM shall be fully responsible for interfacing and compatibility with the offered CRP.
116	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2181 of 3674	5.1.3 Gas enclosures shall be designed and fabricated to comply with the requirements of the applicable pressure vessel codes to which it is subjected in service (ASME/ CENELEC code for pressure vessel).	Please confirm that since material codes are country based codes, for presure vesssel code , GIS OEM may follow KS-D6008 with Equivalent EN code (ENAC-42100). Also GIS OEM may conduct all pressure test for enclosures as per Cl. 6.103-IEC 62271-203:2011. Kindly confirm the same.	Bidder to follow tender document.
117	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2182 of 3674	5.2.4 It shall be generally possible to remove a circuit element (breaker, disconnect switch etc), without removing another element.	As per GIS OEM design concept, interrupter assembly of the circuit breaker may be removed without removing another element. Kindly confirm the same.	Bidder to follow tender document.
118	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2182 of 3674	5.2.6 All special tools & tackles required for erection & maintenance of GIS & GIBD shall be provided by the vendor.	Please kindly note that GIS special tools are not mentioned in the technical specification. However if required kindly let us know the list of special tool for this project.	Special tools & tackles as required, shall be supplied by bidder. Bidder to follow tender document.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
119	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2193 of 3674	6.4.8 d) iv)	Over pressure for each gas compartment of the bay.	Please note that OEM may provide gas density monitor with three stages as mentioned below: 1. Gas Refill level:-Alarm-I 2. SF6 low level-Alarm-II & 3. Zone Trip level/Breaker Block level GIS OEM may not envisage Overpressure alarm level. Kindly accept the same. In offered GIS, for over pressure, alarm/annunciation is not applicable, rupture discs are provided. Kindly accept.	Bidder to follow tender document.
120	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2201 of 3674	7.1	Vendor shall have valid type test certificates to verify the making and breaking capacity of the switching devices & other primary components and other test certificates as per relevant IEC standards.	Please confirm whether type test certificates of the parent company (of the similar design that will be manufactured in India) of GIS OEM will be acceptable or not?	Bidder to follow TA-1
121	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2182 of 3674	5.3.2 b)	The bus bar enclosure shall be sectionalised in a manner that maintenance work in any section of bus bar can be carried out by isolating and evacuating that small section and not the entire bus. For fault in one bus bar & disconnect compartment, at the maximum the adjacent feeders are permitted to be out of service during maintenance and repair. However the complete healthy bus / other bus shall remain operational for double bus GIS.	The Service continuity for GIS may be ensured by appropriate sequence and location of feeders and by providing suitable gas compartment partitioning, additional gas buffer compartment, additional isolating links etc. as shown in Fig F.6 of IEC 62271-203. Please confirm.	Bidder to comply to Cl. 5.3.2. The same will be reviewed during detail engineering. Bidder to follow tender document.
122	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2183 of 3674	5.5.1	Expansion joints / flexible connections shall be provided in each metal enclosure and conductors to absorb the actual or relative thermal expansion and contraction of the bus bar & equipments as well as structures resulting from variations of temperature of the switchgear equipment.	Expansion joints/flexible connections are being offered in line to the standard practice of the OEM based on their design. The same is widely accepted by all Central and State Utilities. Please confirm if the same is acceptable.	Bidder to follow tender document.
123	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2185 of 3674	5.11.3	The exterior surface finish of switchgear paint shade shall be RAL-7032 unless specified otherwise.	Generally, the paint shade offered by OEM is based on their general practice. The paint shade for equipment offered by GIS OEM may be RAL-7038 (Agate Gray), the same is widely accepted by all utilities. Please confirm if the same is acceptable.	Bidder to follow tender document.
124	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2189 of 3674	6.1.6 (b) iii.	For all HV Variable frequency drive feeders, breaker shall be additionally provided with under voltage release. However, in case it is not possible to provide under voltage release in the standard design, as an alternative, one shunt trip coil shall be suitable for DC control supply while second shunt trip coil shall be suitable for external AC control supply. The control supply voltage level shall be as specified in datasheet.	Design offered by GIS OEM may be with trip coils suitable for DC only. Please confirm if the same is acceptable.	Bidder to follow tender document.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
125	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2196 of 3674	6.6.4	The CT secondary terminals shall be brought outside the EHV enclosures through a bushing of 1.1kV class and mounted in accessible terminal box. All secondary leads shall be wired to shorting type terminals on the terminal strip in the local control cabinet of each breaker bay. All terminals shall be shrouded with plastic covers to prevent accidental contact.	GIS OEM understands that, Secondary CTs outside the gas compartment are acceptable. Secondary CTs outside the gas compartment has below listed advantages :- 1. No contamination of CT-insulation by SF6-decomposition products. 2. No need for CT secondary terminals to be brought outside the EHV GIS enclosures through a bushing of 1.1 kV class and to ensure gas-tight feed of the secondary terminals, as in long it may become susceptible to gas leakages. Please confirm if the same is acceptable.	Bidder to follow tender document.
126	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2182 of 3674	5.3.1	The service continuity for GIS shall be ensured by appropriate sequence & location of feeders and by providing suitable gas compartment partitioning, additional gas buffer compartment, additional isolating links etc.	Please confirm whether buffer gas compartment is required in between two adjacent bays and between bus-side disconnecter & circuit breaker.	Same is required. Bidder to follow tender document.
127	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2197 of 3674	6.10	SF6 Gas Monitoring Devices and Alarm Circuits	We understand that any portable or online continuous partial discharge monitoring system is not required to be provided for 220/66kV GIS of subject project - please confirm.	Bidder understanding is not correct. Bidder to follow tender document.
128	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2192 of 3674	6.4.4	Two (2) numbers of 415V, TPN, 50 Hz, power supply feeders will be provided by Owner at one location in the LCC for complete switchgear. Further power supply distribution for each LCC and to CRP shall be done by vendor.	We understand that subject clauses are not applicable for subject project - please confirm.	Bidder understanding is partly correct. 415V Power supply system in MRSS-100 shall be by bidder. However, 415V incoming supply feeder for Incoming Gantry substation shall be provided by Owner.
		2193 of 3674	6.4.5	Two (2) numbers of DC supply feeders will be provided by Owner at one location in the LCC for complete switchgear. Further DC power supply to each LCC and to each CRP shall be done by vendor.		Bidder understanding is correct. DC Power supply system in MRSS-100 & Incoming Gantry substation shall be by bidder.
129	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2198 of 3674	6.11.1	Portable SF6 gas handling & processing unit suitable for evacuating, liquefying, evaporating, filling, drying and purifying SF6 gas during the initial installation, subsequent maintenance and future extension of GIS shall be provided. The cart shall be equipped with rubber wheels and shall be easily manoeuvrable within the building.	We understand only one no. Portable SF6 gas handling & processing unit to be supplied for subject project - please confirm.	1 nos. such device shall be considered for 220kV GIS/66kV GIS at MRSS-100. Compatibility of this common unit in all respect shall be ensured by bidder for suitability for 220kV GIS as well as 66kV GIS. 1 nos. such device shall be considered for Outdoor 220kV GIS and 33kV GIS at incoming Gantry Substation. Compatibility of this common unit in all respect shall be ensured by bidder for suitability for 220kV GIS as well as 33kV GIS.
130	Tender Doc Part-3 220kV GAS INSULATED SWITCHGEAR DATASHEET B269-999-16-50-DS-0031 , Rev C & 66kV GAS INSULATED SWITCHGEAR DATASHEET B269-999-16-50-DS-0032, Rev-B	1647 of 3674 & 1652 of 3674	D.3	SF6 Gas monitoring system	We would like to inform you that, as per the Datasheet, SF6 gas monitoring system is required. Against the requirement GIS OEM may consider Gas density monitoring system which shall be considered one for each separate Gas tight compartment. Kindly confirm the same.	Bidder to follow the tender document.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
131	Tender Doc Part-3 220kV GIS DATASHEET B269-999-16-50-DS-0036-Rev B Sheet 1 of 1	1656 of 3674	-	Typical GIS Bay	We would like to inform you that, as per the mentioned drawing, GIS type Surge Arrestor and GIS Type Voltage transformer is shown. However in the received overall SLD, requirement for GIS type SA and VT is not given. Kindly clarify for what bays the SA & VT to be considered in GIS scope. Kindly clarify the same.	Surge arrestors and VTs shall be provided as shown in tender document including hardware data sheets. Bidder to follow tender document.
132	Tender Doc Part-3 220kV GIS DATASHEET B269-999-16-50-DS-0038-Rev B Sheet 1 of 1	1661 of 3674	-	Typical GIS Bay	We would like to inform you that, as per the mentioned drawing, GIS type bus coupler typical is shown. However please note the placement for CT core is considered in between Bus side Disconnecter and Bus connection, which is not the industry practise. GIS OEM may consider the CT core position in between the Bus side disconnecter and circuit breaker. Kindly confirm the same.	The same shall be decided during detail engineering meeting other requirements specified in the tender document.
133	Tender Doc Part-3 220kV GIS DATASHEET B269-999-16-50-DS-0038-Rev B Sheet 1 of 1	1661 of 3674	-	Typical GIS Bay	We would like to inform you that, as per the mentioned drawing it is understood that the typical GIS bay shall be followed for bays under substation HV100103GS & HV100111GS. However we request you to kindly provide clarification on which typical GIS bay descriptions are to be followed for what bays as per SLD. Also please mention CT and VT data in detail parameter. Kindly clarify the same.	Subject hardware data sheet is applicable for 220kV GIS i.e. HV100103. CT ratio are indicated at corresponding feeder details data sheet (-DS-0034). Other parameters shall be decided meeting the tender requirement & same shall be reviewed during detailed engineering.
134	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2198 of 3674	-	General	We would like to inform you that, in the tender data, the requirement for the PDM system & UHF sensors is not mentioned. Please clarify whether portable PDM along with UHF sensors is required or not. Kindly clarify the same.	Same is required for 220kV as well as for 66kV GIS as specified in the tender document. Bidder to refer cl. No. 5.7.9.18 of scope of work & job specification (SP-0020) and other relevant documents included in the tender..
135	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2185 of 3674	5.11.4	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.	We would like to inform you that, as GIS is shipped/transported at site completely painted as per the OEM Painting Specification, hence additional painting or final touch up is not required at site. Kindly accept the same.	Bidder to follow tender document.
136	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2185 of 3674	5.11.7	Gas monitoring and service piping including all fittings and accessories shall be made of copper, brass or stainless steel.	We would like to inform you that, for standard GIS design of OEM, all the Gas Monitoring devices are mounted on GIS itself using Gas valves. The material for the gas valves shall be as per the manufacturer design. Also GIS of OEM does not require any piping arrangement for Gas monitoring devices as they are located such that, they are visible & accessible. Kindly accept the same.	Bidder to follow tender document.
137	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2186 of 3674	5.12.7	All inter-panel control wiring within each shipping section shall be done at vendor works. The inter-panel wiring shall be taken through sleeves or suitable grommets. For inter-panel wiring between the shipping sections, wires in rolls of the required length, connected at one point, shall be supplied with the panel by vendor for connection at site.	We would like to inform you that, GIS of particular OEM has standalone type LCC. Hence if inter-panel control wiring within each shipping section shall be done at vendor works, it will be required to cut the cables before actual installation at site, which is not feasible. As per practise of subject GIS OEM, OEM shall provide cable drum from which they can use suitable length of cable as required, the same is general industry practise. Kindly accept the same.	The execution part shall be taken care by the bidder. Bidder to follow tender document.
138	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2189 of 3674	6.1.6 a) iii.	The mechanism shall be such that the failure of any auxiliary spring will not prevent tripping and will not cause trip or closing operation of the power operating devices..	We would like to inform you that, there is no such thing as "Auxiliary Spring" in GIS. By the clause in the specification we understand that, mechanism shall be such that in case failure in "Auxiliary Power Supply", mechanism shall be able to make one O-C-O operation from the stored energy in the spring. Kindly confirm our understanding.	This will be reviewed during detail engineering. Bidder to follow tender document.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
139	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2190 of 3674	6.1.6 e) iv.	When closing springs are discharged after closing a breaker, closing springs shall automatically be charged for the next operation and an indication of this shall be provided in the LCC.	We would like to inform you that, when closing springs are discharged after closing a breaker, closing springs shall automatically be charged for the next operation and an indication of this shall be provided in the CB Mechanism itself. The indication in the mechanism is easily visible from floor level. Request you to accept the same.	Bidder to follow tender document.
140	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2191 of 3674	6.2.4	Two independent earthing pads each with flexible copper braids and suitable connectors for the specified size of earth conductor lead shall be provided at the hinge end of the earthing switch.	We would like to inform you that, as per standard GIS design of particular OEM, the flexible copper braid from the earthing switch is not required. The GIS earthing switch pad are connected to GIS enclosure and the enclosure is earthed using copper plate or wire from GIS Baseplate to nearest earth point.	This will be reviewed during detail engineering. Bidder to follow tender document.
		2192 of 3674	6.2.5 d)	All portions of the earthing switches and operating mechanism required for connection to earth shall be connected together utilizing copper conductor.	Kindly note the same.	
141	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2193 of 3674	6.4.7	An isolating switch for disconnection of power supply, open/close push buttons, magnetic contactor with thermal overload relays and HRC link type fuses for short circuit protection shall be provided in LCC for each individual motor of CB, disconnecter and earth switch.	We would like to inform you that, particular GIS OEM may provide MCB instead of HRC link type fuses for short circuit protection in LCC for motor of CB. HRC link type fuses are Type 1 protection device hence can not be used again. However MCB is Type 2 protection device and hence can be used again which is adavnatgeous over fuses. Kindly accept our proposal.	This will be reviewed during detail engineering. Bidder to follow tender document.
142	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2195 of 3674	6.5.10 iv	Disconnecter/ earth switch motor overload (one per each bay)	We would like to inform that, DS,ES and FES contacts proper closing and opening is checked and verified at factory, routine testing which is controlled with provided limit switch in DS,ES and FES mechanism. Limit switch control the overrun of motor and operating time. Being a complete mechanical arrangement, the design is completely secure and chances of overrun of motor is negligible. Hence GIS OEM have not proposed any overload relay. Kindly accept the same.	Bidder to follow tender document.
143	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2182 of 3674	5.3	The service continuity for GIS shall be ensured by appropriate sequence & location of feeders and by providing suitable gas compartment partitioning, additional gas buffer compartment, additional isolating links etc.	As per specification, adjacent feeders are allowed to be out of service. We need clarity on buffer module placement in GIS. In last year pre-bid replies also, HRRL had clearly mentioned that buffer modules were required only between busbar & CB and not in between bays. Please confirm if same will hold good for this tender.	Same is required. Bidder to follow tender document.
144	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR STANDARD SPECIFICATION No. 6-51-0066 Rev. 1	2187 of 3674	5.14.5	Bus VT Miniature Circuit Breaker (MCB) ON auxiliary contacts and under voltage relay contacts shall be monitored in the interlocking scheme to confirm the dead bus condition.	As per Spec, MCB is required in VT. We request acceptance of MCB for PT in LCC - please confirm.	This will be reviewed during detail engineering. Bidder to follow tender document.
145	B269-999-16-50-SP-0020 Rev C		3.3.13	Note that Internal Arc Classification (IAC) rating of switchboard shall be 40 kA for 0.2 sec	40kA Internal arc rating is too high for 33kV Switchgear. We request IOCL/EIL to kindly consider the same as 25kA.	Bidder to follow tender document.
146	Datasheet - B269-999-16-50-DS-0071		Notes SI no 1	Internal Arc classification for HV switchboards shall be 40kA for 0.2sec		
147	B269-999-16-50-SP-0020 Rev C		5.8.5	Validity of Short Circuit Withstand Capacity & temperature rise — 5 years	(i) As per CEA guidelines issued in May 2020, validity period of type test reports for circuit breakers has been increased to 10 years. (ii) And As per guidelines by Ministry of Power, the validity of type test reports expiring during pandemic have been extended till 30/09/2022. We request IOCL/EIL to consider type test report validity accordingly.	Bidder to follow tender document.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
148	Part B: Structural (Document No. B269-999-81-41-SOW-0020 Rev B)	877 of 3674	1.0 (g)	Piling Works	The construction of Piles (except design, cutting and constructions Pile heads) is in IOCL's scope. Please confirm	Bidder understanding is correct,
149	First Floor Plan and Section of Substation-100	1636 of 3674	Dwg. No. 02407 Rev. B	Eot Crane	The span of EOT Crane is 21 m. It is proposed to reduce the span of EOT crane to 14 m and provide row of columns in Grid F so as to reduce the size of columns and beams for GIS Hall. Please confirm	Bidder to follow Tender specification.
150	Plan and Section of Substation Switchyard	1641 of 3674	Dwg. No. 02511 Rev. A	RCC Slab over EHV Power Transformers.	The span of 20 m x 20 m is too large for RCC slab. It is proposed to provide structural steel shed over all transformer areas including Main Substation as mentioned in cl. No. 1.1 (c) of Part A: Architectural (Document No. B269-999-81-41-SOW-0020 Rev B) and already provided over Transformers in the Refinery area. Please confirm	Electrical to reply if steel shed is acceptable.
151	Part A: Architectural (Document No. B269-999-81-41-SOW-0020 Rev B)	873 of 3674	1.1 (c)	Buildings	All the Buildings (GIS and Substation Switchyard) shall be of RCC frame structure with brick masonry wall. Please confirm.	Bidder understanding is correct,
152	Part B: Structural (Document No. B269-999-81-41-SOW-0020 Rev B)	879 of 3674	2.0 (f)	Grade of steel for substation structures	It is understood that the substation Lattice Structures (Tower, Gantry and Equipment support) shall be of grade E350 BR. Please confirm.	Bidder understanding is correct,
153	B269-999-16-50-DS-0031 & (B269-999-16-50-DS-0032)	1650 of 3674	Notes	Following equipments shall be supplied along with GIS: a) SF6 Gas Leakage Detector b) Gas Filling and Evacuation Cart c) SF6 Gas Analyser	Following items are repeated in 220kV GIS, 66kV GIS as well Engineering Design Basis and in Spares (B269-999-16-50-SL-0020 Rev C). Please clarify total number of requirements for the project. a) SF6 Gas Leakage Detector b) Gas Filling and Evacuation Cart c) SF6 Gas Analyser X) Portable Partial Discharge Monitoring System	Refer Technical Amendment -01
154	B269-999-16-50-DS-0031 & (B269-999-16-50-DS-0032)	1650 of 3674	Notes	3 Following equipments shall be supplied along with GIS: e) Online SF6 Gas filling system	e) Please confirm if Online SF6 Gas filling system is required for 2 numbers outdoor GIS & 2 numbers GIS Extension bays also in addition to 220kV & 66kV Indoor GIS under existing scope	Refer Technical Amendment -01
155	B269-999-16-50-EDB-1001	1487 of 3674	6.0 SPARE PARTS	Engineering Design Basis (Electrical): 2.5 Power cable termination kit - 2 numbers	Please clarify if spare GIS to XLPE module are need to be offered under spares or not. We understand scope matrix of GIS to Cable Termination is as per IEC, please confirm. GIS end shall be supplied by us and cable termination shall be supplied by others.	Bidder to follow tender document.
156	B269-999-16-50-SP-0020	809 of 3674	5.7.15.4	Online Partial Discharge(PD) monitoring system for both indoor & outdoor GIS	Please confirm Online Partial Discharge(PD) monitoring system is required for (1.) 220kV Indoor GIS of MRSS-100, (2.) 220kV Outdoor GIS Bays, (3.) 66kV Indoor GIS Bays. (4.) Further for 2 nos. 200kV GIS Extension Bays, if standalone online Partial Discharge(PD) monitoring system is required or interfacing is to be done with existing system	Refer Technical amendment -01 (Electrical).
157	B269-999-16-50-DS-0034	1660 of 3674	Sr. 20	Transformer Feeder (Spare) 50 MVA Rating	Not located in SLD, please clarify scope	Key SLD is indicative only. Bidder to refer feeder details data sheet attached with tender document.
158	B269-999-16-50-SP-0020 Rev C	779 of 3674	3.3.3	Extension by addition of 2 Number transformer feeder bays in existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear with Local Control Cubicle and Separate control and relay panel complete with numerical relay, metering, protection and synchronization panel. Other details shall be shared with successful bidder.	We have considered Separate manufacturer for (1.) GIS & LCC and (2.) Control & Protection Panels. Please confirm	Bidder's proposal is not acceptable. Bidder to offer GIS, LCC & CRP panel of same make as existing.
159	B269-999-16-50-SP-0020 Rev C	800 of 3674	5.7.4	The offered GIS equipment and components shall conform to the type tests as per IEC 62271-203. CONTRACTOR to ensure at the time of order placement that copies of valid type test certificates for tests conducted on identical design of offered equipment is available. In case of non-availability of type test certificates, same shall be conducted without any cost and time implication to Owner/ EIL.	Please clarify if time bound validity is applicable for 400kV GIS or one time Type Test shall be valid till any design change	For 220kV/66kV/33kV GIS as envisaged in this tender, type tests shall be considered valid till any design change.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
160	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	779 of 3674	3.3.13	2 Nos. of 33 kV, 1000 Amps, 31.5 kA (1 Sec), Isolating Breaker Panel complete with power cable termination kits, numerical relay, metering and protection as per enclosed specification and datasheet for installation in existing SS-63 in exiting refinery area. Note that Internal Arc Classification (IAC) rating of switchboard shall be 40 kA for 0.2 sec.	i) We understand that 33kV HT switchgear in 33kV switchgear building (40mx30m) indicated in Substation (Switchyard) Plan and Section Dwg. No. B269-000-81-41-02511, Rev-A is 33kV GIS as per EDB clause 5.6.2. – Please confirm. ii) However please note that Clause 3.3.13 of Scope of Work (Electrical) and Price Schedule SP-4 Clause 1-A-1e) mentions 33 KV, 1000A, 31.5 kA (1 Sec), Air Insulated Isolating Breaker Panel. Please confirm following regarding 33kV IBP a) Please confirm whether 33kV AIS IBP is included in subject contract scope. b) If yes, then please confirm its location – in existing SS-63 or in new 40mx30m 33kV switchgear room located in 95mx95m area in line with Key SLD 220kV GIS package. iii) Request to please also provide line item for 33kV GIS (located in new 40mx30m building) in Price Schedule SP4 and SP-5 as same is not available in price schedule.	(i) Bidder's understanding is correct.
161	Tender Doc Part-2 Engineering Design Basis (Electrical) B269-999-16-50-EDB-1001 Rev No. 0	1472 of 3674	5.6.2 (2)	5.6.2 HV SWITCHBOARD Type of switchgear : Gas insulated for 33kV/ Air Insulated for others.		(ii) (a) 33kV, 1600A, 40kA GIS shall be considered instead of HV AIS. Bidder to follow TA-01. (b) 2 nos. 33kV GIS Isolation breaker panels shall be located at gantry substation located within (95x95) mtr. plot area & not in SS-63. (iii) To be incorporated along with Technical Amendment and necessary changes will be made in revised SOP.
162	Tender Doc Part-1 PART-II: PRICE PART ENQUIRY No: SG/B269-999-EB-T- 0020/22 FORM SP-4, Rev.0	736 of 3674	1-A-1e)	33 KV, 1000A, 31.5 kA (1 Sec), Air Insulated Isolating Breaker Panel with Vacuum Circuit Breaker, CT, PT, Surge Arrestor and Numerical Relays, IAC Rating 31.5 kA (1Sec.) in 220kV Switchyard Gantry S/S in existing PR.		
163	Tender Doc Part-3	1629 of 3674	-	Key SLD 220kV GIS - Dwg. No. B269-999-16-50-00200, Rev-C		
164	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	775 of 3674	2	A separate EPMC has been envisaged for feeding plant emergency loads. EPMC will be fed via 1 no. 6.6/0.433 kV distribution transformer and through DG to provide reliability in the system.	i) We understand that subject EPMC pertains to new 220/66kV GIS MRSS-01 of P25 project and not to Substation (Switchyard) in existing refinery area – please confirm. ii) "through DG" – we understand that this DG shall be P25 area DG in customer scope and cabled feeders shall be provided by M/s. EIL/IOCL to EPMC in new 220/66kV GIS building – please confirm.	(i) Bidder's understanding is correct. Bidder to follow tender. (ii) Bidder's understanding is partly correct. However, Termination of owner's cables at bidder's equipment shall be by bidder along with supply of termination kits .
165	Tender Doc Part-3	1629 of 3674	-	Key SLD 220kV GIS - Dwg. No. B269-999-16-50-00200, Rev-C	We understand that Supply, Laying, T&C and Civil Works (including construction of cable trenches and racks/trays) of 220kV Cables between 2 nos. New bay addition in Existing 220kV GIS (CGL make) in existing Switchyard Substation to 2 nos. new 220/33kV, 60/75MVA Transformers located in 95mx95m area is in M/s. EIL/IOCL scope and not in bidder scope- please confirm.	Bidder's understanding is partly correct within owner's battery limit area. All civil works inside package battery limit shall be carried out by bidder.
166	Tender Doc Part-3	1629 of 3674	-	Key SLD 220kV GIS - Dwg. No. B269-999-16-50-00200, Rev-C	We understand that inter-connection between 220kV Isolators in outdoor Potyard and 220kV Outdoor GIS LIB (02 nos.) shall be by overhead conductor only - please confirm.	Bidder understanding is correct. Bidder to refer cl. No. 3.3.2 of SP-0020 attached with tender documents.
167	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	778 of 3674	3.3.1	HTLS -AAAC type Conductor & related connectors, clamps etc.	i) Please clarify type of conductor to be used for connection to 220kV overhead line. ii) We understand that HTLS type conductor is not required since incoming 220kV line from Mundh S/S is mentioned ACSR Zebra in EDB (Electrical). iii) Also please specify the Power intake in MVA from Grid (ie HVPNL Mundh S/S).	220kV Incoming gantry overhead conductor for Grid-B shall be HTLS-AAAC type. Same shall be sized by 220 kV GIS contractor for 400 MVA power rating based on 2x 160/200 MVA transformer rating. Termination of 220kV incoming overhead lines to 220kV GIS package contractor incoming gantry in 95x95m plot area shall be by HVPNL. Further connectivity to LA, CT, PT etc shall be in the scope of 220kV GIS package contractor.
168		795 of 3674	5.3.4.3	Contractor shall design the switchyard based on the actual calculation for various hardware equipments, however the minimum sizes of various hardware equipments shall be as follows:- ☐ ACSR conductor: HTLS -AAAC		
169		1454 of 3674	5.2 (2.4)	Type /size of conductor/ cable size : ACSR / ZEBRA CONDUCTOR		
170	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	796 of 3674	5.3.19	Contractor to ensure that valid type test certificates as per IS/ IEC and ITP attached is available with manufacturer for offered design of outdoor switchyard equipment. In case of non-availability of type test certificates same shall be conducted without any cost and time implication to Owner/ EIL.	Please confirm if CEA guidelines are to be followed for duration of validity of type test reports for GIS, EHV cable terminations and other outdoor equipments.	Bidder to follow tender document & TA-01.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
171	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	786 of 3674	4.2.3	CONTRACTOR to consider 250 kVA of Owner's load for sizing of distribution transformer for 415V PMCC. This does not include any spare capacity or design margin.	Please furnish the list of plant loads (motor feeders) to be connected to 415V PMCC.	For revised requirements, refer TA-01.
172	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	779 of 3674	3.3.14	2 Nos. 6.6 kV, 800 Amps, 40 kA (1 Sec), Isolating breaker panel with earthing truck, lifting truck (wherever applicable) complete with numerical relay, metering and protection as per enclosed specification and datasheet. Note that Internal Arc Classification (IAC) rating of switchboard shall be 40 kA for 0.2 sec.	Please confirm location of 6.6kV IBP (02 nos.) panels.	As per tender scope, 6.6kV IBP shall be located in MRSS-100.
173	Tender Doc Part-2 Engineering Design Basis (Electrical) B269-999-16-50-EDB-1001 Rev No. 0	1450 of 3674	3.0 (5)	Canopy shall be provided for all outdoor equipments except transformers and Capacitor Banks.	We understand canopy is not applicable for 220kV potyard AIS equipment for connection to Grid Lines and it is applicable only for 220kV Outdoor GIS LIB - please confirm.	Bidder understanding is partly correct for EHV outdoor AIS such as CT, PT, LA, isolators etc. However additional canopy shall be provided for outdoor LIB, JB's, control panels etc.
174	Tender Doc Part-3	1636 of 3674	-	Substation 100 MRSS First Floor Plan and Section - Dwg. No. B269-000-81-41-02407, Rev-B	Please confirm if width of 220/66kV GIS Hall can be further reduced as per actual requirement during detailed engineering.	As per tender, the size of building and rooms shown are the minimum. Refer note 15 of doc. No. B269-000-81-41-02407 in this regard.
175	Tender Doc Part-1 PART-II: PRICE PART	736 of 3674	FORM-SP-4, Rev.0	6) Bidder to ensure that total of percentage indicated against all the item below (Sl. No. 1-A-1 (a) to 1-A-1 (j)) shall be 100%	We understand that subject clause to be read as ".....item below (Sl. No. 1-A-1 (a) to 1-A-1 (<u>ag</u>)) shall be 100%" - please confirm.	Shall be incorporated in revised SOP
176	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	776 of 3674	3.2.8	Design and engineering of Fiber optic transmission system and cyber security system for the entire network as per requirement of GOI, CEA guidelines and HVPNL.	i) Please explain meaning of "Fiber optic transmission system" as same is not clear from Tender documents - is it OPGW / Fiber Optic Terminal equipment ? ii) We understand that "Fiber optic transmission system" shall not be in scope of subject tender - please confirm.	As per tender, receiving end FOTS/OPGW system along with its integration as per cl. No. 3.3.12 of doc. (SP-0020) is included in bidder's scope.
177	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	776 of 3674	3.2.8	CONTRACTOR shall also design system for implementation of load trimming scheme, availability based tariff metering arrangement and SCADA interface for integration with HVPNL.	i) "load trimming scheme" - Please clarify meaning of "load trimming scheme" as same is not clear from Tender documents. ii) We understand that "load trimming scheme" shall not be in scope of subject tender - please confirm.	This will be part of load shedding scheme for which interface at MRSS-100 end shall be taken care by the contractor as per HVPNL requirements including tariff metering and FOTS, PLCC interface.
178	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	777 of 3674	3.2.15	Calculation of requirement of IOs for ECS Interface Panels (transducer panel, Dummy panel, Interposing relay panel) and ECS RTU Panels etc. for interface of 220 kV GIS substation package with client's ECS System.	Please provide typical IO list for 66kV GIS also.	Bidder to follow doc. No. (-DS-0054) attached with tender and Technical Amendment-01
179	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	777 of 3674	3.2.18	3D Modeling shall be done for substation buildings and switchyard area consisting of all the equipment like FA system, HVAC/VAM (including ducts), equipment layout (panels and transformers), outdoor switchyard equipment, etc. to avoid fouling of various systems and subsequent re-work. Also, cable tray and cable trench design in cable cellar and cable trench from switchyard to substation shall be reviewed in 3D model.	i) We understand that 3D modelling is not required to be provided for 220kV or 66kV GIS - please confirm. ii) Request to delete "cable trench from switchyard to substation" since same not in bidder scope.	3D modelling shall be done by bidder as per tender document. Cable trench from switchyard to substation is for cable trench within 95m x 95 m plot area which is included in bidder's scope. Trench between outdoor switchyard and MRSS-100 outside battery limit is excluded from bidder's scope.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
180	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	780 of 3674	3.3.20 & 3.3.21	3.3.20 Modification of existing SAS & ECS system interface for incorporation of extension panels for existing GIS, including all hardware & software required as per existing systems design make / model. 3.3.21 Modification of existing SAS & ECS system interface in existing substation SS-63 for incorporation of 33kV Isolation breaker panels, including all hardware & software required as per existing systems design / make / model.	i) Please confirm make & model of existing SAS & ECS system in existing substation SS-63. ii) We understand that supply & I&C of "33kV Isolation breaker panels" is not in BHEL scope in subject tender - please confirm.	SAS system for MRSS-100 and new gantry substation is new and is in bidder's scope. ECS system in MRSS-100 is also new but in Other's scope. For ECS interface in bidder's scope refer tender document/ Technical Amendment. For 220kV bays extension in existing substation, ECS interface with existing ECS is in bidder's scope as per tender document/ Technical Amendment. For ECS system in new gantry substation and its corresponding interface, bidder to refer tender document/ Technical Amendment.
181	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	809 of 3674	5.7.15.4	Online Partial Discharge(PD) monitoring system for both indoor & outdoor GIS	Please confirm whether Online PD monitoring system is required to be provided for 66kV GIS also.	Yes, same is required to be provided for 66kV GIS also as per tender document.
182	Tender Doc Part-3 Suppliers List for P25 Project Doc No. B269-999-16-50-OD-0020 Rev. C	1927 of 3674	-	Suppliers List for P25 Project	~~i) Please provide vendor list for 66kV GIS applicable for P25 project. ii) Please also provide vendor list of 33kV GIS as per EDB (Electrical) clause 5.6.2 as only 33kV HT VCB vendor list is available in Tender documents.~~	~~66kV GIS make shall be selected based on proven track record and references of past supplies, refer Technical Amendment. For 33kV GIS make refer Technical Amendment.~~
183	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	779 of 3674	3.3.12	Fiber optic transmission system (FOTS) for interface with HVPNL for voice and data communication. FOTS shall be as per HVPNL requirements. Integration with HVPNL is required for implementation of Load trimming scheme, availability based tariff metering arrangement capable of measuring four quadrant reactive energy along with AMR facility with integration to control center, establishment of SCADA interface with real time data visibility to SLDC and all communication and protection through OPgW.	i) FOTS shall be as per HVPNL requirements" -- please clarify HVPNL requirements" as same is not clear from TS.	In order to fulfil HVPNL's interface requirements, Bidder shall co-ordinate with HVPNL and take care the interfaces accordingly..
184	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	783 of 3674	3.4.2 , 3.4.4	3.4.2) 220 kV termination kits for GIS shall be supplied by others. Termination of 220 kV Cables at 220 kV GIS end shall be done by others. 3.4.4) 66 kV termination kits for GIS shall be supplied by others. Termination of 66 kV Cables at 66kV GIS and at 66/33 kV transformer end shall be done by others.	We understand that both male & female parts of 220kV & 66kV terminations shall be supplied by others and GIS manufacturer to only provide socket for the terminations in GIS enclosure - please confirm.	Bidder's understanding is in order for 220kV cable terminations. For 66kV cables and cable terminations, bidder to refer Technical Amendment-01.
185	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	784 of 3674	3.4.7	Plant communication equipments for 220 kV GIS switchyard and substation buildings shall be supplied by Owner. Preparation of PA layout and installation of Plant communication devices in switchyard and substation building as per approved layout including PA system cabling is in scope of CONTRACTOR.	Please provide tentative BOQ of "Plant communication equipments for 220 kV GIS switchyard and substation buildings" in owner scope for estimation of installation (in bidder scope) of same.	For MRSS-100, bidder to follow cl. No. 5.15.9 of doc (SP-0020) attached with tender. For PA system in new Gantry substation, bidder to follow Technical Amendment-01.
186	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	795 of 3674	5.3.2	Total area available for installation of outdoor switchyard along with the substation cum control room is 95m x95m. Substation cum control room shall be located towards east side of this plot area however exact location shall be finalised during detailed engineering in consultation with owner.	We understand as per site visit that 220kV AIS bays, 220kV outdoor LIB, 220/33kV Transformers and 33kV switchgear building shall be located at site presently occupied by existing 132kV AIS sub-station. We understand that entire dismantling of existing 132kV AIS Sub-station shall be carried out by IOCL/EIL and fully cleared/levelled land, free of any encumbrances, shall be provided to bidder.	Graded land free from all encumbrances shall be provided to bidder.
187	Tender Doc Part-3 Drawings	1638 of 3674	-	MRSS-100 - Second Floor plan & section	"Third Floor Plan" indicated in Drawing - we understand that same shall be "Second Floor Plan" only and building shall be double storied only - please confirm.	Bidder's understanding is correct.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
188	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	795 of 3674	5.3.2	Total area available for installation of outdoor switchyard along with the substation cum control room is 95m x95m. Substation cum control room shall be located towards east side of this plot area however exact location shall be finalised during detailed engineering in consultation with owner.	i) We understand as per site visit that 220kV AIS bays, 220kV outdoor LIB, 220/33kV Transformers and 33kV switchgear building shall be located at site presently occupied by existing 132kV AIS sub-station. We understand that entire dismantling of existing 132kV AIS Sub-station shall be carried out by IOCL/EIL and fully cleared/levelled land , free of any encumbrances , shall be provided to bidder. ii) We understand that zero date shall start for bidder from date of handover of clear levelled land free of any encumbrances - please confirm.	1. Graded land free from all encumbrances shall be provided to bidder. 2. Tender conditions shall be followed by the bidder.
189	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	795 of 3674	5.3.3	Cable trenches/ trays from switchyard to substation and within switchyard and substation is in CONTRACTOR scope.	We understand that "Cable trenches/ trays from switchyard to substation" not in bidder scope since 220kV cable on trestle between 220kV LIB & Existing GIS and 220kV GIS in MRSS-100 not in bidder scope – please confirm.	Cable trench from switchyard to substation is for cable trench within 95m x 95 m plot area which is included in bidder's scope. Trench between outdoor switchyard and MRSS-100 outside battery limit is excluded from bidder's scope.
190	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	795 of 3674	5.3.8	Solid Core insulators shall be provided for supporting the ACSR Conductors.	We understand that BPI's are not required to be provided to support ACSR conductors in 220kV Potyard – please confirm.	Details shall be finalised by contractor during detail engineering meeting requirements of tender document.
191	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	783 of 3674	3.4.1 , 3.4.3	3.4.1 220 kV Cables shall be supplied and laid by others. 3.4.3 66 kV cables shall be supplied and laid by others.	Please provide 220kV & 66kV cable size for considering appropriate size of cable termination enclosure of 220kV & 66kV GIS.	Bidder to refer tender document/Technical Amendment-01.
192	GENERAL	-	-	Hoist	Please confirm requirement of Hoist if any in new 33kV switchgear room to be located in existing 132kV switchyard plot area in PR complex.	Bidder to consider material handling equipment as per cl. No. 3.0 of doc (80-43-SOW-0020)
193	GENERAL	-	-	Auxiliary Feeder SLD	Request to please provide tentative Auxiliary Feeder SLD of PMCC/MCC/EPMC for estimation purpose.	Bidder to finalise the feeder quantities meeting requirements specified in the tender. For owner's usage feeder requirement, bidder shall refer tender/Technical Amendment-01.
194	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	796 of 3674	5.4	5.4 EHV GAS INSULATED BUSDUCT (GIB) FOR 66kV	Please confirm 66kV GIB shall be three phase encapsulated type only	Bidder to refer Note-5 of Cl. 5.7.1 of EDB and provide the phase separated, SF6 insulated type GIBD.
195	GENERAL	-	-	Tie Transformer	Please confirm MVA rating of Tie Transformer in owner scope to be located in P25 area MRSS-100 220kV GIS building.	Tie transformers are not envisaged in subject tender. However, feeder for the same shall be considered as per feeder list attached with tender.
196	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	803 of 3674	5.7.9.21	5.7.9.21 Refer clause 5.6 of 6-51-0066, following shall also be complied i. The corona rings/ stress shields for the control of electrical field in the vicinity of the isolation gap shall be provided by the GIS manufacturer.	We understand that Corona Rings not required for 220kV or 66kV GIS - please confirm.	To be reviewed during detailed engineering which shall include 220kV outdoor GIS isolating breaker panel meeting tender requirement & statutory guidelines
197	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	812 of 3674	5.8.16	The 33kV IBP will receive power from step down power transformer and shall fed to downstream switchboard installed in client's PNCP Plant.	Please confirm that supply / laying / commissioning of 33kV cable from 33kV IBP to IOCL PNCP plant is not in bidder scope.	Bidder's understanding is partly correct. As per tender, termination of 33kV cable along with termination kit is in scope of bidder.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
198	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	820 of 3674	5.11.25	SAS Tag Number : Existing For Equipment : 33 kV IBPs Remarks : Extension of existing system for incorporation new bays to be done.	Please provide details of existing 33kV SAS.	SAS of incoming gantry substation including 220kV Outdoor GIS bays and 33kV Indoor GIS IBPs etc. is in scope of bidder. For interfacing of this SAS with upstream system, bidder to refer Technical Amendment-01.
199	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	824 of 3674	5.11.25	DISCHARGE DUTY REQUIREMENTS FOR OWNER'S LOAD: DC System for Critical Lighting : 110V	Please confirm whether DC System for Critical Lighting shall be 110V or 220V.	As per tender, same shall be 220V. Bidder to follow tender.
200	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	824 of 3674	5.11.25	Plant communication devices (i.e. Master call station, Operator Call station, Field Call Station, Loudspeaker, beacon lamp, etc.) shall be supplied by Owner as free issue items (FIM) and quantities of same are as mentioned elsewhere in the tender. In case quantity required by CONTRACTOR is more than the indicated FIM, contractor shall supply the additional quantity without any time & cost implication. The make of these additional equipment/ devices shall be of identical make, type & model no. as that of the free-issued equipment/devices.	i) "Plant communication devices (i.e. Master call station, Operator Call station, Field Call Station, Loudspeaker, beacon lamp, etc.) shall be supplied by Owner as free issue items (FIM) and quantities of same are as mentioned elsewhere in the tender" - Quantities of FIM Plant communication devices not available in Tender documents. Request to provide same. ii) "The make of these additional equipment/ devices shall be of identical make, type & model no. as that of the free-issued equipment/devices." - Please confirm make of FIM Plant communication devices.	i) Bidder to refer cl. No. 5.15.9 of doc (-SP-0020) attached with tender for FIM quantity. ii) Same shall be informed during detailed engineering stage.
201	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	834 of 3674	5.22.18	Separate clean earth system shall be provided for Numerical relays, SAS & ECS in Substation.	Please confirm whether clean earth system means separate electronic earthing pits.	Yes. Bidder to follow tender.
202	Tender Doc Part-2 SCOPE OF WORK & JOB SPECIFICATION (ELECTRICAL) Doc No. B269-999-16-50-SP-0020 Rev C	844 of 3674	6.2	Power system study shall be carried out in latest version of ETAP. CONTRACTOR shall furnish the native file of ETAP after carrying out the preliminary study and also along with the final report.	Power System study shall be carried out by BHEL in PSSE / PSCAD . Please confirm.	Deviation is not acceptable. Bidder to follow tender document/ Technical Amendment-01.
203	Tender Doc Part-3 Overall Plot Plan Doc No. B269-999-17-44-00001 Rev 3	1630 of 3674	-	Dismantling	i) We understand that removal/dismantling of all existing equipment/ structures/ vegetation / sludge pit shall be carried out by IOCL/EIL in P25 area and fully cleared/levelled land , free of any encumbrances , shall be provided to bidder. ii) We understand that zero date shall start for bidder from date of handover of clear levelled land free of any encumbrances in P25 area for MRSS 100 substation building - please confirm.	1. Graded land free from all encumbrances shall be provided to bidder. 2. Tender conditions shall be followed by the bidder.
204	GENERAL	-	-	33kV Cable	We understand that any supply / laying / testing & commissioning / civil works of 33kV cable incomer to existing SS-63 building 33kV LIB (if any in bidder scope) shall be in IOCL/EIL scope only - please confirm.	33kV power supply from SS-63 is not applicable. Bidder to refer tender document/Technical Amendment-01.
205	Tender Doc Part-3	1629 of 3674	-	Key SLD 220kV GIS - Dwg. No. B269-999-16-50-00200, Rev-C	We understand that Supply, Laying, T&C and Civil Works (including construction of cable trenches and racks/trays) of 33kV Cables between 2 nos. new 33kV IBP to 2 nos. new 220/33kV , 60/75MVA Transformers located in 95mx95m area is in M/s. EIL/IOCL scope and not in bidder scope- please confirm.	Bidder's understanding is incorrect. Bidder to refer tender document/Technical Amendment-01.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
206	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR Doc No : 6-51-0066 Rev. 1	2193 of 3674	6.4.6	6.4.6 The incoming external control supplies (AC & DC) shall be monitored continuously and alarm shall be given on failure. Vendor shall supply all necessary equipment and control for automatic change over from one source of control supply to the other in the event of failure of one source / contactor drop out.	Diode OR-ing based DC changeover scheme shall be considered for GIS LCC and 220 & 66kV Control/ Relay Panels only as per TS. For all other Panels/ Boards, 220V DC changeover shall be through contactor based scheme. Please confirm.	To be reviewed during detailed engineering. Bidder to follow tender.
207	Tender Doc Part-2 Engineering Design Basis (Electrical) B269-999-16-50-EDB-1001 Rev 0	1465 of 3674	5.4.3.3 27)	5.4.3.3 RELAY PROTECTION PHILOSOPHY 27) EHV switchboards shall be provided with low impedance type bus bar differential protection system with provision of manual bypass. Check zone relay (87CH) shall be provided as a separate relay.	For 220kV Busbar Protection, total two sets of busbar protection schemes shall be considered for the 220kV Indoor GIS system. Each set will consist of one central unit and one number peripheral unit for each bay, which will cater to all the four bus zones, viz. Main Bus-1 Section-1, Main Bus-1 Section-2, Main Bus-2 Section-1, Main Bus-2 Section-2. Please confirm.	To be reviewed during detailed engineering. Bidder to follow tender/ Technical Amendment-01
208	Tender Doc Part-3 SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR Doc No : 6-51-0066 Rev. 1	2188 of 3674	6.1.3	6.1.3 Pre-Insertion Resistor (applicable for 400 kV GIS) The circuit breakers for transmission line bay shall be provided with single step pre insertion closing resistors/ Controlled switching devices to limit the switching surges to a value of less than 2.3 p.u. The value of the pre-insertion resistor and the duration of pre-insertion time shall be as designed by vendor.	Any controlled switching device (CSD) not envisaged for the project, as it is not applicable for 220kV & below systems as per CEA guidelines. Please confirm.	Bidder to carry out transformer inrush current study & based on conclusion of the study, recommendation shall be furnished for CSD. In case of requirement meeting the acceptable voltage drop during transformer charging during worst operating condition & meeting HVPNL guidelines, CSD shall be provided at all 220kV outgoing breaker feeding to transformer (operating & spare). Bidder to refer Technical Amendment-01.
209	Tender Doc Part-3 SPECIFICATION FOR OUTDOOR SWITCHYARD Doc No : 6-51-0085 Rev. 4	2292 of 3674	5.10	5.10 Power Line Carrier Communication Equipment (PLCC)	Please confirm type of PLCC to be provided in subject project -- Analog PLCC or Digital PLCC ?	As per tender, type of PLCC shall be decided by bidder meeting HVPNL requirement.
210	Tender Doc Part-3 Overall Plot Plan Doc No. B269-999-17-44-00001 Rev-3	1630 of 3674	-	Sludge Pit	Please confirm whether Sludge Pit visible during site visit in P25 area near new 220/66kV P25 GIS (HV-100103 GIS/HV-100111 GIS) building area is located outside P25 GIS building Plot.	Graded land free from all encumbrances shall be provided to bidder.
211	TENDERDOCUMENT_PART-2 (scope of work)	778 of 3674	3.3.1	PLCC system with wave traps & 48V DC System for both sending & receiving end shall be procured as part of this tender and sending end equipments shall be free issued HVPNL end contractor. Make/model/design of same shall be as per HVPNL standard design philosophy.	We understand that the supply and erection of PLCC and Wave trap is in scope of bidder. 48v DCDB with battery & battery charger is in scope of bidder at IOCL end only and we have presume that for other end HVPNL shall be provide 48v DCDB feeder supply for PLCC. Kindly confirm.	Bidder understanding is not correct. Bidder to follow tender document.
212	PART - 2 OUTDOOR SWITCHYARD	795 of 3674	5.3.2	Total area available for installation of outdoor switchyard along with the substation cum control room is 95m x95m. Substation cum control room shall be located towards east side of this plot area however exact location shall be finalised during detailed engineering in consultation with owner.	As per site survey there is already under construction existing GIS Building (BHEL) and outdoor equipments foundations at the location of 95m X 95m. Swtchyard Area. kindly confirm remaining area which shall be available for construction of tender scope for 02 Nos. outdoor GIS Bay and control room building along with Transformers and other outdoor equipments. Kindly reconfirm the area and location.	As per tender, total area available for installation of outdoor switchyard along with the substation cum control room is 95m x95m.
213	TENDERDOCUMENT_PART-2 (scope of work)	778 of 3674	3.3.2	2 Numbers 220 kV, 2000 Amps, 50 kA (3 Sec), Gas Insulated Outdoor type Isolating breaker panel with Local Control Cubicle and Separate control and relay panel complete with numerical relay, metering and protection panel. Control and relay panel for GIS shall be simplex type. GIS shall be suitable for taking power from overhead ACSR conductor and outgoing shall be through cables.	We understand that the supply and erection of the bus bar protection for these bay are not required. kindly confirm. We have also presume the metering Panel is not in scope of bidder it shall be free issue from HVPNL kindly confirm.	For relay protection, refer hardware datasheet. For tariff metering, Bidder understanding is not correct. Bidder to refer cl.no. 3.3.1 of doc. No. SP-0020 attached with tender.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
214	TENDERDOCUMENT_PART-2 (scope of work)	779 of 3674	3.3.3	Extension by addition of 2 Number transformer feeder bays in existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear with Local Control Cubicle and Separate control and relay panel complete with numerical relay, metering, protection and synchronization panel. Other details shall be shared with successful bidder.	We understand that the supply and erection of the Busbar protection for 2 nos of GIS Transformer feeder bays with LCC & CRP (BHEL) in existing building is already considered in in existing Busbar (BHEL). Kindly confirm.	Bidder to follow the tender document along with hardware data sheet (-DS-0040) for hardware requirement.
215	TENDERDOCUMENT_PART-2 (scope of work)	779 of 3674	3.3.9	66kV, 1250A, 50kA (3 sec.), SF6 Gas Insulated, single phases busduct with all bends and flexibles comprising of the Gas monitoring devices, barriers, pressure switches, UHF PD sensors etc.	We understand that the supply and erection of 66kV bus duct to be considered for Transformer Bays only and all Feeders shall be connected through 66kV XLPE Cable supply & laying is not in bidder scope. Kindly confirm.	Bidder to follow tender document.
216	TENDERDOCUMENT_PART-2 (scope of work)	779 of 3674	3.3.9	2 Nos. 6.6 kV, 800 Amps, 40 kA (1 Sec), Isolating breaker panel with earthing truck, lifting truck (wherever applicable) complete with numerical relay, metering and protection as per enclosed specification and datasheet. Note that Internal Arc Classification (IAC) rating of switchboard shall be 40 kA for 0.2 sec.	Presume that the location of 6.6kv, VCB shall be in substation MRSS-100 in P25 area. Kindly confirm.	Bidder understanding is correct, location of 6.6kv, VCB shall be in substation MRSS-100.
217	TENDERDOCUMENT_PART-2 (scope of work)	779 of 3674	3.3.14	2 Numbers, 6.6/0.433 kV, 1250 KVA (minimum), Off Circuit tap changer, Dyn11, oil filled distribution transformer with Energy Efficiency Level 2 as per IS 1180 (Part-1) including amendments, for feeding substation loads.	Presume that the location of 2 Numbers, 6.6/0.433 kV, 1250 KVA Transformers shall be in substation MRSS-100 in P25 area Kindly confirm.	Bidder understanding is correct, location of 6.6kV/0.433kV transformer shall be in substation MRSS-100.
218	TENDERDOCUMENT_PART-2 (scope of work)	780 of 3674	3.3.28	MV Motors, as required. All MV motors shall be energy efficient IE3 type as per IS 12615.	Kindly confirm the qty of MV Motor and Location and purpose.	As per tender scope, quantity/location/purpose shall be decided by bidder.
219	TENDERDOCUMENT_PART-2 (scope of work)	780 of 3674	3.3.22	110V DC supply system comprising parallel redundant battery chargers, 2 x 50% Nickel Cadmium battery, DCDB, cell booster and online battery bank monitoring system, for switchgear protection & control including spare feeders and feeders for Owner's use as required.	kindly provide the nos of feeder required for Owner's use and its load, Battery Rating In Ah, Battery Charger and kindly confirm the location also.	Refer Technical Amendment-01 (Electrical)
220	TENDERDOCUMENT_PART-2 (scope of work)	780 of 3674	3.3.23	220V DC supply system comprising parallel redundant battery chargers, 2 x 50% Nickel Cadmium battery, DCDB, cell booster for critical lighting including spare feeders and feeders for Owner's use as required.	we have presume supply & erection of 220v DCDB and battery & battery charger only for MRSS-100 in P25 area Kindly confirm. We have consider Extension 220v DCDB panel and its supply near by other switchyard for new building 40m X30m equipments. Kindly confirm	Bidder understanding is not correct. Bidder to follow tender document.
221	TENDERDOCUMENT_PART-2 (scope of work)	780 of 3674	3.3.23	MRSS-100 in P25 1) 4 Number of 220/66 kV, 100/125 MVA 2) 2 Number of 220/66 kV, 40/50 MVA, Existing IOCL area New Building 1) 2 Number of 220/33 kV, 60/75 MVA	The 6 nos Transformers shown inside the Sub-Station MRSS 100 building size 120x56 m . Drawing No. 02406 & 02407 Revision -B & 2 nos transformer shown inside the Sub-Station (Switchyard) Building Size 40x30 m . Kindly confirm whether we can proposed all transformers outdoor side the buildings.	Bidder understanding is not correct. Bidder to follow tender document.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
222	TENDERDOCUMENT_PART-2 (scope of work)	780 of 3674	3.3.23	MRSS-100 in P25 1) 4 Number of 220/66 kV, 100/125 MVA 2) 2 Number of 220/66 kV, 40/50 MVA, Existing IOCL area New Building 1) 2 Number of 220/33 kV, 60/75 MVA	Please confirm if HVWS-based fire fighting system and NIFPS system both to be provided or only NIFPS system or only HVWS system with the 6 nos Transformers shown in Sub-Station 100 building size 120x56 m – Drawing No. 02406 & 02407 Revision –B – & 2 nos transformer shown in Sub-Station (Switchyard) Building Size 40x30 m –	As per tender, transformer having voltage ratio as 220/66kV & 220/33kV, both HVWS & NIFPS system has been envisaged. Bidder to follow tender document
223	Part - 3 (Specification for EHV Switchgear)	2185 of 3674	5.11	Painting, Protective Finish/Corrosion Protection of Surfaces	Painting, protective finish procedure will be as per CGPISL standard procedure.	Bidder to follow tender document.
224	Part - 3 (Specification for EHV Switchgear)	2193 of 3674	6.4.8	Local Alarm and Annunciation Overpressure for each gas compartment of the bay	Overpressure alam is not envisaged for GIS compartments. Kindly accept.	Bidder to follow tender document.
225	Part - 3 (Specification for EHV Switchgear)	2200 of 3674	6.14.4	Outdoor SF6-Air Bushings 6.14.4 All current carrying parts shall be of copper.	All current carrying parts (conductors) shall be of Aluminium Alloy. Kindly accept.	Bidder to follow tender document.
226	Part - 3 (220kV GIS Data sheet)	1646 of 3674	C.4	4. Rated peak withstand current - 135 kA	As per IEC, Rated peak withstand current is 125 kA. Kindly accept.	Bidder to follow tender document.
227	Part - 3 (66kV GIS Data sheet)	1651 of 3674	C.4	4. Rated peak withstand current - 108 kA	As per IEC, Rated peak withstand current is 100 kA. Kindly accept.	Bidder to follow tender document.
228	Part -3 (SLD)	1629 of 3674	SLD	Type of termination for the 220KV and 66KV GIS is not clear from SLD and specification.	From SLD, we understand that all 220KV GIS bays are with cable termination (Both Indoor and outdoor bays). Please confirm. .	As per tender, outdoor type 220kV GIS breaker panel in switchyard shall be suitable for taking power from overhead ACSR conductor and outgoing shall be through cables.
229	Part -3 (SLD)	1629 of 3674	SLD	Type of termination for the 220KV and 66KV GIS is not clear from SLD and specification.	Also From SLD , the terminations for 66KV GIS are not clear. Please confirm. for 66kV GIS if Transformer bays are terminated thru Bus duct, please clarify the type of termination bushing will be SF6 to Air or SF6 to Oil	Refer Technical Amendement-01
230	PART - 2 Scope of Supply & Work (Civil & UG, Structural, Arch.) Part A: Architectural	873 of 3674	1.1.1 a)	Substation - 220 KV GIS The building shall be RCC frame structure with brick masonry wall, RCC floors and RCC roof. The building shall comprise of Cable Cellar and Battery Room, Space for Transformers (on ground floor), Air – conditioned Switchgear Hall and Double height GIS Hall (air-conditioned) with Conference room, Office Rooms. The building shall have loading/unloading areas, Staircases, lifts, toilets etc., as per functional requirement. The building shall have Solar Panels installed on the roof of the building. Contractor shall design and construct the building conforming to all bid requirements and standard/ codal requirements as governing.	As per Sub-Station -MRSS 100 Main receiving Sub-Station Plan & Section Drawing No. 02406 & 02407 Revision -B conference room, office rooms, lift etc not mentioned. Kindly confirm the requirement whether bidder have to consider these room or not. If we have to consider these room kindly specify the floor at which we can considered.	Refer drawing provided in the bid document for room requirement..
231	PART - 2 Scope of Supply & Work (Civil & UG, Structural, Arch.) Part A: Architectural	873 of 3674	1.1.1 c)	Any other Building / Shed as required for functional operations	We understand that bidder scope is limited to Sub-Station MRSS 100 building size 120x56 m – Drawing No. 02406 & 02407 Revision –B – & Sub-Station (Switchyard) Building Size 40x30 m Drawing No. 02511 Revision -A for P25 project. Kindly specify the building/shed along with size if any required other than mentioned above.	Any other building/shed a required for the functional requirement of GIS package shall be detailed out during detail engineering by the contractor
232	PART - 2 Scope of Supply & Work (Civil & UG, Structural, Arch.) Part B: Structural	877 of 3674	1.0 g)	Piling is under Owner's scope of supply. Contractor shall prepare and submit pile layout drawing as per which piling shall be executed at site.	We understand that Piling is under Owner's scope but kindly clarify whether bidder have to consider pile foundation or open cast/ raft foundation for estimation at Tender stage because it will impact the project cost if open cast/raft foundation is recommended instead of pile foundation during execution. Kindly clarify quantity variation is payable or not.	Piling is under owner's scope

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
233	~~PART - 2~~ Scope of Supply & Work (Civil & UG, Structural, Arch.) Part B: Structural	878 of 3674	1.0 I)	Concrete block masonry with solid/hollow concrete blocks in substructure and superstructure for all depths and heights.	Kindly clarify the type of masonry whether it will be brick masonry of concrete block masonry.	Bidder to follow tender requirement
234	66 kV HV - HV-100111 GIS			Busbar Protection at 66kV GIS	Low Impedance Bus Bar protection is asked for 66 kV in specs. The number of bays in each section is very high. Centralized Low Impedance Bus Bar protection can be complex in this case as all CT wires will be connected to the Central Unit and this may result in maintenance issues. Distributed Low Impedance Bus bar protection is better solution from maintenance point of view. Please confirm if Distributed Load Impedance Bus Bar protection can be made applicable for all bidders.	Bidder to follow the tender document.
235	B269-999-80-43-SOW-0020 Rev 2	Scope of Work & Supply		Special tools and tackles	Kindly clarify the list of tools which to be considered.	Special tools & tackles as required, shall be supplied by bidder. Bidder to follow tender document.
236	B269-999-16-50-SP-0020 Rev C	Scope of Work & Job Specification (Electrical)	5.7.15.4	On Line Partial Discharge Monitoring system	a) 220kV GIS Bay extension B) Out Door 220kV Isolator Breaker Panel We understand that only sensors to be provided and that shall be integrated with existing PD Monitoring by existing supplier only. Please confirm.	Refer Technical amendment -01.
237	B269-999-16-50-SP-0020 Rev C	Scope of Work & Job Specification (Electrical)	5.7.15.5 & 5.7.15.2	SF6 topping system Gas filling and evacuating plant	We understand that SF6 Gas Topping system can be done through Gas Filling and evacuation plant only and there is no separate equipment is required against Gas Topping system. Kindly accept and confirm.	Bidder to follow the tender document.
238	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C & B269-999-16-50-DS-0035		66kV Trafo feeder connection	As per SLD & 66 kV GIS FEEDER DETAIL DATASHEET, we understand that the Transformer connection from GIS through GIBD only. However, in the same data sheet (SI.No. 18 & 19), Cable size details are mentioned. Please confirm the requirement of termination type(GIBD/Cable)	As per SLD & feeder detail data sheet (~DS-0035) attached with tender, GIBD has been envisaged at secondary side of 220/66kV transformer.
239	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C & B269-999-16-50-DS-0035		66kV Trafo feeder connection	Kindly confirm the battery limit of GIBD against spare Trafo feeders and also confirm the location of spare feeder in Layout.	Refer Technical amendment -01.
240	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C		Requirement of PT/VT	SLD does not show any VT. But in 66kV GIS Feeder data sheet(Refer Note 5 & 7), requirement of Line PT & Bus PT are given. Kindly clarify the feeder wise requirement of VT/PT	Key SLD is indicative only. Requirement of line PT & bus PT shall be considered as per feeder details data sheet & hardware data sheet attached with tender document.
241	B269-999-16-50-DS-0035	66 kV GIS FEEDER DETAIL DATASHEET	Notes-5 of DATA SHEET (Page2 of 2)	Gas Insulated surge arrestor shall be provided in incomers and all outgoing feeders. SLD does not show any S.A.	Please confirm the requirement of Surge Arrestor	Key SLD is indicative only. Bidder to refer feeder details data sheet & hardware data sheet attached with tender document.
242	6-51-0068 Rev. 0	Specification for EHV Power Transformers		Short circuit test report	We understand SCT Report to be provided of "similar" Transformer as per IS 2026 / IEC 60076.	Refer Technical amendment -01.
243	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C & B269-999-16-50-DS-0035		Wave Trap	We understand that wave Trap shall be Hanging Type. No separate foundations are required.	Vertical pedestal mounted wave trap is preferable. However, same shall be decided during detailed engineering based on footprint on (95x95) mtr. available area.
244	6-51-0068 Rev. 0	Specification for EHV Power Transformers		Short circuit test on cable box	We understand from TS that all 220 kV cable box will be oil filled cable box. Thereby SCT test to be conducted on only any one cable box Irrespective of MVA rating .	Bidder to follow tender document.
245	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C & B269-999-16-50-DS-0035		No of Bays	While going through the SLD and DATA SHEET- The Total No. of Breaker Bays are counted as 63. And Non-Breaker BM+BE Bays are 2. Kindly confirm the no of bays to be consider and accordingly control & Protection Panels.	Refer Technical amendment -01.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
246	BOQ_156474	SP-4	SP-4		Kindly clarify the feederwise/Boardwise requirement for the following: 1, Capacitive Voltage Detector, 2, LCC and ~~Separate CRP with Numerical Relays,~~ 3, ~~Bus Bar differential and Bus Bar Check Supervision protection.~~ 4, SF6 Gas Analyser, 5, Online Partial Discharge Monitoring System	Bidder to follow tender document.
247	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C		LT switch Boards	~~We understand that outgoing feeders shown for PMCC, LDB, DC system & UPS system are tentative only. Feeders will be considered as per requirement.~~ Kindly confirm.	~~Bidder's understanding is correct. Bidder to follow tender requirement.~~
248	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C		220kV GIS	As per the 220KV GIS SLD provided, LA / SA are not shown in any of the transformer feeders. Please clarify the requirement of LA / SA.	Surge arrestors shall be provided in all transformer feeders as per tender. Bidder to follow tender requirement.
249	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C		220kV GIS	We understand that we do not have to consider any length of 220KV GIB. Please clarify.	220KV connections shall be through cables and 220KV GIBD is not envisaged.
250	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C		220kV GIS	We understood from scope & SLD, 2nos. 220kV GIS bays need to extended at existing switchyard substation. Please confirm that sufficient space are there to cater the additional bays and Control Protection panel and for that no modification / extension works are involved in existing building.	From the substation equipment layout of 220kV GIS received from IOCL it is noticed that space is availbale for 1 no. additional bay on RHS however, on LHS it seems adequate space including statutory clearance is not available. IOCL to ensure & confirm that adequate space is made available by BHEL in ongoing 220kV GIS substation for locating 1 no.additional bay on either side. we will respond to bidder after getting confirmation from IOCL.
251	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C		33kV feeders	~~Cable and cable termination for 'Plant feeder to PNCP PPU-3' is not under present scope.~~ Please confirm.	~~Bidder's understanding is partly correct. Cable terminations including termination kits at 33kV GIS Isolation Panel is in scope of bidder.~~
252	~~KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)~~	~~DWG no.- 00200 Rev.C~~		66kV feeders	~~Cable and cable termination of Incoming and outgoing 66kV is not under present scope.~~ Please confirm.	~~For 66kV cable scope, refer Technical Amendment-1~~
253	~~KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)~~	~~DWG no.- 00200 Rev.C~~		66kV feeders	~~In 66kV GIS, CT will be considered at only one side of the breaker~~ Kindly confirm.	~~Query is not clear. Bidder's to follow tender document inclduing hardware data sheets.~~
254	~~KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)~~	~~DWG no.- 00200 Rev.C~~		6.6kV feeders	~~Cable and cable termination of incoming 6.6kV is not under present scope.~~ Please confirm.	~~For 6.6kV cable scope, bideer to refer Technical Amendment-1.~~
255	Drawing - Substation (Switchyard) Plan & Section	DWG no.- 02511 Rev.A		Existing Substation	This building is existing or under new scope. Kindly clarify. Please note, this building does not have any GIS room.	This is new building envisaged at (95x95) mtr. area. As per tender, same is kept in bidder's scope.
256	Drawing - Overall Plot Plan	DWG no.- 00001 Rev.3		Cable route	Control cable, LT power cable & 220kV EHV cable will follow same route as shown in overall plot plan.	Bidder's understanding is correct for cable routing between 220kV outdoor switchyard incoming gantry/ongoing 220kV GIS substation and MRSS-100.
257	Drawing - Overall Plot Plan	DWG no.- 00001 Rev.3		Cable route	Cable route sections are provided but which section is applicable for which portion of the cable route under present scope is not clear. Kindly clarify.	Supply, laying & termination of 220kV cable and associated cable trench is in scope of owner. Cable routing in overall plot plan has been shown for information purpose.
258	Drawing - Overall Plot Plan	DWG no.- 00001 Rev.3		Cable route	Kindly confirm that shown cable route is existing or need to be constructed.	Supply, laying & termination of 220kV cable and associated cable trench is in scope of owner. Cable routing in overall plot plan has been shown for information purpose.
259	Drawing - Overall Plot Plan	DWG no. - 00001 Rev.3		Substation Area	We understand that if 95x95 area is found not sufficient during detail engineering, addition land will be provided to us as per requirement. Kindly confirm.	As per tender scope, bidder to accommodate all facilities with in (95x95) mtr. only meeting tender and statutory requirements.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
260	Drawing - Overall Plot Plan			Earthing	Since for the 220KV new GIS, the space provided to bidder is 95X95Mtrs. The earthing design for this small area will be very difficult to achieve the step and touch voltage. Please confirm whether this earth grid will be allowed to be connected to the existing main earth mat. Please confirm.	Bidder to follow the tender & design earthing system accordingly. The same shall be reviewed during detail engineering considering soil resistivity and other design parameters.
261	Scope of Work & Job Specifications	B269-999-16-50-SP-0020 Rev C	Clause no. 3.2.8 & 3.3.12	Requirement of FOTE & PLCC	~~Kindly confirm the scope of FOTE or PLCC and associated power supply for 2 nos. 220kV Line bays.~~	~~As per tender scope, sending & receiving end equipment associated with PLCC along with power supplies has been considered in bidder's scope.~~ For FOTS, sending end equipments shall be by others as per tender documents.
262	Scope of Work & Job Specifications	B269-999-16-50-SP-0020 Rev C	Clause no. 3.3.53	Training	Training, inspection and testing (FAT & SAT) related no other cost like travelling, lodging, boarding for client & client representative are not to be considered. Please confirm	Charges for travel, boarding and lodging of Client representative for Training, Inspection and testing of works shall be not to Contractor's account.
263	Scope of Work & Job Specifications	B269-999-16-50-SP-0020 Rev C	Clause no. 3.4	Free Issue Equipment / item	We understand that the followings are not in present scope: a) 220kV, 66kV cable and Terminations (at both end) supply, laying & terminations. b) 33kV & 6.6kV cable and Terminations (at both end) supply, laying & terminations c) External Cable route from proposed AIS to MRSS-100 and others.	a. Bidder's understanding is correct. b. As per tender scope, termination of 33kV cable & 6.6kV cable along with termination kit for bidder's equipment is kept in bidder's scope. c. Query is not clear. For External cable trench, bidder may refer reply at sr. no. 11 above.
264	Feeder Details & Data sheet	B269-999-16-50-DS-0034 & 35		Number of cable run & size	We understand that cable size & run as mentioned in Data sheet only and accordingly GIS pnl end terminal housing to be considered. Please confirm.	Cable runs and cable sizes mentioned in feeder list are indicative and actual cable size shall be informed during review of documents post order without any time or cost implication to owner as metioned in tender.
265	Data sheet & Specification of Transformer	B269-999-16-50-DS-0306 & 6-51-0068 Rev. 0	Specification : 12.5 Data Sheet : Clause no. 46	Requirement of Special test like Short Circuit Test & Impulse Test	We understand that no repetition of Type Test & special tests are required and there is no time limit of Test report. Only Test Report / Certificate to be furnished for "similar" rating as per IS 2026 / IEC 60076. Please confirm	Bidder's understanding is partly correct. Bidder to follow tender document.
266	Data sheet of Transformer	B269-999-16-50-DS-0306	Data Sheet : Clause no. 41	Loss Capitalization	~~We understand that Loss capitalization is not applicable and only efficiency to be maintained as per note no. 2. Please confirm.~~	Bidder's understanding is correct.
267	Specification for grid connected Roof top Solar PV Power System	6-51-0022 Rev. 0	~~Clause no. 1~~	Solar Photovoltaic Panel installation	~~We understand that the Rooftop Solar Photovoltaic Installation would be a On-Grid type setup only, separate tariff metering is not applicable in this pkg. hence associated licenses and NOC from Statutory Authorities for the Solar Photovoltaic System is not envisaged in our scope. Please confirm~~	Bidder's understanding is correct. However, metering facility shall be considered as per tender scope.
268	Specification for grid connected Roof top Solar PV Power System	6-51-0022 Rev. 0	~~Clause no. 1~~	Solar Photovoltaic Panel installation	~~We understand that Solar Photovoltaic Panels would be installed on the roof area above the 220kV GIS Hall and Power Transformers only as per the layout provided in the tender document. Kindly confirm.~~	Solar system shall be installed at the vacant space available on the roof of MRSS-100 as well as new incoming gantry substation.
269	Mandatory Spare List	B269-999-16-50-SL-0020 Rev C	Sl no. 1	List of spares	Against sl no. 1 (1.1, 1.2 & 1.3) we understand that that only one (01) no. of each item to be considered. PI confirm.	1 no. of each item for each EHV GIS i.e. separate set for 220kV indoor GIS, 220kV outdoor GIS & 66kV indoor GIS switchboards.
270	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C		220kV GIS	Kindly provide the make, model and drg details of existing 220kV GIS on which 2 nos. bay extensions are there. We also understand that future bay extension provisions are there on existing 220kV GIS.	Details of existing 220kV GIS are awaited from IOCL.
271	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C		220kV GIS related SAS & Busbar protection	We understand that Busbar and SAS integration of existing s/s against additional 2 bays at existing substation are not in scope. If yes kindly provide the details and also confirm that provisions are there to cater the additional two bays.	Bidder to refer cl. No. 3.3.20 of doc (-SP-0020) in which same is kept in bidder's scope. Details of existing system are attached herewith.

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272	SLD for 220 kV GIS Package			Existing Switchyard Substation	In the 'Existing Switchyard Substation', 2 nos. 'Existing GIS bays' are shown and 2 nos. 'New Bay Addition' is shown. Please confirm - a. If CRP is existing for the 2 nos. 'Existing GIS bays'. b. If new CRP has to be provided for the 2 nos. 'New Bay Addition' c. Is there any requirement for integration of Bus Bar protection and SAS for the 'New Bay Addition' with the 'Existing GIS bays'. d. If Bus Bar integration is required, what is the make and model of bus bar protection relays in 'Existing GIS bays' and is there any provision in to add the two new bays. e. If SAS integration is required, what is the make of existing SAS and is there any provision in to add the two new bays	a. YES b. YES c. YES d. Refer attachment. e. Refer attachment.
273	SLD for 220 kV GIS Package			Outdoor Switchyard Control Room	Two numbers 33 kV IBP are shown in 'Outdoor Switchyard Control Room'. Please confirm - a. If CRP need to be provided for the 33 kV IBPs b. Will these CRP be integrated with any SAS	a. CRP shall be part of 33kV GIS. For details TA-01. b. YES.
274	SLD for 220 kV GIS Package			Outdoor Switchyard	Two numbers 220 kV GIS IBP are shown in 'Outdoor Switchyard'. Please confirm - a. if these CRP for 220 kV GIS IBP be placed in 'Outdoor Switchyard Control Room'. b. Please specify if the main protection relays for the overhead SEB lines are Distance relay or Line Differential relay. c. Are other end (SEB end) relays to be supplied as loose items d. If separate set of Line Differential protection is also to be provided for the line going to '220 kV HV-100103 GIS'	a. YES b. To be decided during detail engineering. c. YES, Refer cl. No. 5.7.6 of SOW doc. SP-0020. d. YES
275	SLD for 220 kV GIS Package			220 kV HV-100103 GIS	Two numbers 220 kV Incomers are coming from 220 kV 'Existing GIS' of 'Existing Switchyard Substation'. The Line Differential relays have to matched with that in 'Existing GIS'. Pl clarify - a) what is the make and model of the Line Differential relays at 'Existing GIS' b) whether Line Differential relays will be free-issued for '220 kV HV-100103 GIS'	a. Details shall be provided during detailed engineering stage. b. Recieveing end side relay shall be supplied by bidder (refer cl. No. 5.7.7 of SP-0020).
276	SLD for 220 kV GIS Package			66 kV HV - HV-100111 GIS	Two bays are shown in SLD for future use. Pl clarify if - a) CRP has to be provided for the bays for future use b) If yes, the should be for what type of feeder	a. YES b. Outgoing feeder shall be transformer feeder.
277	Relay & SAS System Architecture for 220kV GIS		Notes - 5	LAPTOP along with programming and application software shall be supplied as required with license.	Laptop will have software for relay programming. We understand that Laptop will NOT have software for HMI. Please confirm.	Bidder understanding is not in order. Bidder to follow tender document.
278	Mandatory Spares List - Electrical		Notes - 6	Relay Control Panel	Understand no relay is included in Mandatory spare. Pl confirm.	Bidder understanding is not in order. For mandatory spares, bidder to follow EDB cl. No. 6.1 & doc. No. SL-0020 attached tender.
279	5.0 DESIGN AND FABRICATION REQUIREMENTS	Technical specification for GIS	Clause no. 5.1.12	The ladders, walkways and platforms with handrail shall be provided wherever necessary for access to the equipment. A portable ladder with adjustable height shall also be supplied for access to the equipment during operation & maintenance.	Offered GIS is ergonomically designed such that accessing any equipment is very easy. Therefore we do not envisage the requirement of any walkways or handrails. However 1 no., portable ladder will be provided for each substation to enable ease of access.	Same shall be reviewed during detailed engineering stage meeting the tender specification. Bidder to follow tender document.
280	5.2 Accessibility & Maintenance	Technical specification for GIS	Clause no. 5.2.1	Checking and removal of components shall be possible without disturbing adjacent equipment.	The bay configuration is such that if a component is removed, gas pressure of the adjacent compartment is reduced. This is to safeguard the personnel working in the substation. Kindly accept.	Bidder to follow tender document.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
281	5.2 Accessibility & Maintenance	Technical specification for GIS	Clause no. 5.2.4	It shall be generally possible to remove a circuit element (breaker, disconnect switch etc.), without removing another element.	As GIS is a compact design where modules are catenated. Although the interrupter unit can be removed without disturbing other modules, removal of housings or other circuit elements will disturb the modules in the bay.	Bidder to follow tender document.
282	5.2 Accessibility & Maintenance	Technical specification for GIS	Clause no. 5.2.6	All special tools & tackles required for erection & maintenance of GIS & GIBD shall be provided by the vendor.	All the required tools & tackles will be brought to the site and taken back after the activities are over.	Tools and tackles required for operation and maintenacne shall be provided by bidder. Bidder to follow tender document.
283	5.7 220 kV & 66kV GAS INSULATED SWITCHGEAR	Scope of work and job specification	Clause no. 5.7.9.11	The GIS shall be designed, so as to take care of the Very Fast Transients (VFT) over voltages generated as a result of pre-strikes and re-strikes during isolator operation. Maximum VFT over voltages peak shall not be higher than rated lightning impulse withstand voltage of the equipment. Necessary measures shall be under taken by GIS manufacturer to restrict maximum VFT over voltages lower than the lightning impulse withstand voltage. Manufacturer shall submit the study report of VFTO generated for GIS installation.	The offered GIS has already been Type Tested for certain VFT values which are lower than LIWV. We understand that no additional VFT study needs to be performed for the system. We request you to kindly confirm the same.	Bidder to follow tender document.
284	5.7 220 kV & 66kV GAS INSULATED SWITCHGEAR	Scope of work and job specification	Clause no. 5.7.9.18	Contractor shall provide adequate number of UHF sensors in the offered GIS for detection of Partial discharge (of 5 pC and above) as per IEC 60270 through Partial Discharge (PD) monitoring system and the number and location of these sensors shall be subject to approval of Owner/ EIL. Further UHF sensors shall necessarily be provided in close proximity to VT compartments.	Number of UHF sensors & their location shall be as per manufacturers' recommendations. Please note that the locations of sensors shall be decided during detailed engineering itself to achieve the desired sensitivity & the same will be reflected on the drawings which will be submitted for approval. No change on the same recommended at the site. please accept.	The same shall be finalised during detailed engineering meeting requirement of tender documents withoput any time and cost implications to owner.
285	5.7 220 kV & 66kV GAS INSULATED SWITCHGEAR	Scope of work and job specification		The disconnectors and safety grounding switches shall have a mechanical and electrical inter-locks to prevent closing of the grounding switches when isolator switches are in the closed position and to prevent closing of the disconnectors when the grounding switch is in the closed position. Integrally mounted lock when provided shall be equipped with a unique key for such three phase group. Master key is not permitted.	The disconnectors and the safety grounding switches are separate modules in GIS design and shall have only electrical inter-locks between them. However the required padlocking facility shall be provided for the manual interlocking for additional protection.	Bidder to follow tender document.
286	5.7 220 kV & 66kV GAS INSULATED SWITCHGEAR	Scope of work and job specification		SF6 gas shall be tested for purity, dew point, air, hydrolysable fluorides and water contents as per IEC:376, 376A & 376B and test certificates shall be furnished to the owner indicating all test results as per IEC standards for each lot of SF6 gas. Further site tests for moisture, air content, flash point and dielectric strength to be done during commissioning of GIS. Gas bottles should be tested for leakage during receipt at site.	SF6 gas shall be tested for purity, dew point, air, hydrolysable fluorides and water contents as per IEC:376, 376A & 376B and test certificates shall be furnished to the owner indicating all test results as per IEC standards. Flash point and dielectric strength tests are not be possible at site due to practical restrictions and for all other tests, test reports shall be submitted. Please accept the same.	Bidder to follow tender document.

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287	B269-999-81-41-SOW-0020 Rev B	Pg. 4 of 16	Clause 1.1.4	Statutory Approvals	As per clause, The Contractor shall obtain all statutory approval from local authorities such as Municipal Corporation, Development Authorities, Inspector of Factories and any other concerned authorities required for their own working before starting the works at site. We request M/s IOCL to keep all statutory approvals in his scope. Please confirm.	Clause mentioned in the bid to be followed.
288	B269-999-81-41-SOW-0020 Rev-B	Pg. 3 of 16	Clause 1.1.1 (c)	Any other building	We understand that only main substation building and outdoor control room building at BHEL ss end as per given dimension shall be in present scope of bidder. Any other buildings/sheds are not in present scope of bidder. Please confirm.	Please refer scope of work document. Any other Building / Shed along with Substation and switchyard building as required for functional operations of GIS package is in the scope of contractor.
289	B269-999-81-41-SOW-0020 Rev-B	Pg. 3 of 16	Clause 1.1.1 (c)	Blast resistant building	We understand that main substation GIS building and outdoor control room building at BHEL ss end shall not be a blast resistant building. Please confirm.	Bidder to refer drawings/ documents (B269-000-81-41-02406/ 02407/ 02408/ 2511) attached in tender
290	B269-999-81-41-SOW-0020 Rev-B	Pg. 7 of 16	Clause 1.(e)	PCC	Request M/s IOCL to confirm grade of PCC for foundations, trenches, drains, roads etc.	Please refer Engineering Design Basis.
291	B269-999-81-41-SOW-0020 Rev-B	Pg. 7 of 16	Clause 1.(g)	Piling	As per clause Piling is under Owner's scope of supply. Contractor shall only prepare and submit pile layout drawing as per which piling shall be executed at site. Please confirm.	Bidder understanding is correct
292	B269-999-81-41-SOW-0020 Rev-B	Pg. 11 of 16	Clause 1.0(IV)	Roads and approaches	We understand that approach road from main plant road till substation premises shall be in scope of M/s IOCL. Please confirm.	Bidder to follow Clause no.9 of notes in Scope Drawing B269-999-81-41-14561 Rev.B in which it is stated that All Approach roads from main roads to battery limit shall be in Package contractor's scope.
293	B269-999-81-41-SOW-0020 Rev-B	Pg. 11 of 16	Clause 1.0(IV)	Roads and approaches	We understand that all internal roads within the battery limit shall be RCC Roads. Please confirm. Also provide detailed technical specifications for RCC Roads.	Bidder to follow bid documents
294	B269-999-16-50-SL-0020 Rev-C	Drawing no.- 02511	B269-000-81-41-025	Outdoor switchyard control room BHEL 220 kv ss side	We understand that plan and section provided in drawing no. 02511 shall be followed for outdoor switchyard control room shown in scope SLD drawing no. 00200 at BHEL 220 kv ss end. Please confirm.	Yes. However, please note that the size of building and rooms shown are the minimum and indicative. They shall be finalized and increased as per requirement during detailed engineering.
295	B269-999-81-41-SOW-0020 Rev-B	Pg. 14 of 16	Clause No. 1 (Xvi.e.)	Metal Spreading	We understand that No PCC is required below switchyard gravel spreading. Please confirm. Also provide the thickness of gravel spreading in proposed switchyard.	Refer Clause No. Clause No. 1 (Xvi.d) stated that Gravel filling around the transformers and within the switchyard area complete within battery limit as per OISD-173
296	B269-999-81-41-SOW-0020 Rev-B	Pg. 11 of 16	Clause No. 1(vi)	Storm water Drains	Request M/s IOCL to provide the detailed technical specifications and drawings for drains.	Refer Standard 7-65-272 attached with bid documents
297	B269-999-81-41-SOW-0020 Rev-B	Pg. 14 of 16	Clause No. 1 (Xvi.C.)	Switchyard Fencing	Request M/s IOCL to provide the detailed technical specifications and drawings for switchyard fencing.	Refer Specification 6-65-0013 and scope Drawing B269-999-81-41-14561 attached with bid documents
298	Site condition			Substation Drainage out fall point	Request M/s. IOCL to provide the distance for the drainage outfall point from the proposed SWYRD location.	Bidder to follow Scope Drawing B269-999-81-41-14561 Rev.B attached with tender documents
299	Site			Tree Cutting and debris cleaning	We assume that cutting of any dense bushes / trees and debris cleaning are not in bidder scope. Kindly confirm.	Refer Note No.7 of scope drawing B269-999-81-41-14561 attached with bid documents
300	Site			Testing laboratory	We request M/s. IOCL to provide us the details on the approved construction material testing laboratory.	Construction material testing laboratory shall be proposed by contractor and will be reviewed & approved during execution at site.
301	Site			Sand	Request M/s IOCL to permit use of Manufactured sand for all the civil works. Kindly confirm	Manufactured sand may also be used in line with Specification no. 6-68-0002
302	Site			Ready Mix Concrete	we request M/s IOCL to allow for site mix concrete for substation civil works. Please confirm.	Bidder to follow standard specification document no. 6-68-0004 attached with bid documents for civil & structural works – plain & reinforced cement concrete.
303	General			Contour Map	Please provide us the contour map and proposed finishing ground level (F.G.L.) w.r.t. existing ground level for IOCL Panipat GIS substation.	Refer Note No.7 of scope drawing B269-999-81-41-14561 attached with bid documents

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
304	General			Site Office/Labor colony/Store	Please confirm us that necessary land for site office/store/labor colony/batching plant will be provided to us near the area under present scope.	Tender conditions shall be followed by the bidder.
305	General			Water and Power	Please confirm us the distance of the location w.r.t. some reference point where point for water and power will be given to us.	Tender conditions shall be followed by the bidder.
306	General			Boundary wall	We understand that boundary wall for the proposed sub-station is not under present scope of bidder. Kindly confirm.	Refer scope drawing B269-999-81-41-14561 attached with bid documents
307	General			Land development	We understand that encumbrance free levelled land with level difference of max (+/-) 100 mm from FGL shall be provided to successful bidder and there will be no further cutting & fillings are required. Please confirm.	Refer Note No.7 of scope drawing B269-999-81-41-14561 attached with bid documents
308	Part-3	29	B269-999-16-50-00200	SLD	We presume that the number of Outgoing & Incoming feeders for 220kV & 66kV GIS shall be consider as per attached SLD. Please confirm whether Bidder's understanding is in order.	Number of Outgoing & Incoming feeders for 220kV & 66kV GIS shall be as per feeder details datasheet attached with tender. For revised feeder details, please refer TA-01.
309	Part-3	29	B269-999-16-50-00200	SLD	Please furnish the detailed Bay configuration for each type of 220kV & 66kV GIS Bays with appropriate legends.	Final bay configuration shall be decided post order during detail engineering which shall be proposed by bidder and reviewed / approved by Owner/EIL.
310	Price Schedule ,Form SP-4		1-A-1, Sl. No. a & b		In the line item description, it is mentioned that High speed earth switch is required for 220kV GIS & 66kV GIS. As a standard utility practice we request IOCL to accept High speed Earth switch only for Incoming line bays. For transformer bays the same is not required. Please confirm.	Bidder to follow tender documents
311	Part-2	29	B269-999-16-50-00200	Current Transformer	Number of CT Cores are not mentioned for 220kV GIS & 66kV GIS. Please furnish the following details in this regard: a) Number of cores b) CT ratio c) CT parameters such as accuracy class, VA burden, knee point voltage, magnetizing current etc.	Key SLD is indicative only. For details refer, Job specification, hardawre datasheet & other documents part of tender documents..
312	Part-3	29	B269-999-16-50-00200	Potential Transformer	Number of VT Cores are not mentioned for 220kV GIS & 66kV GIS. Please furnish the following details in this regard: a) Number of cores b) VT ratio c) VT parameters such as accuracy class & VA burden	Key SLD is indicative only. For details refer, Job specification, hardawre datasheet & other documents part of tender documents..
313	Part-2	43	3.4	Free issue items	Please specify the cable size for the following: a) 220kV Incoming cable feeders b) 220kV cable between existing 220kV GIS & 220/33kV transformer c) 66kV cable between 220/66kV transformers & 66kV GIS d) 66kV Cable for 66kV outgoing GIS feeders e) 33kV cable for 33kV IBP panel.	Refer revised SLD for indicative cable size attached with TA-01 (Electrical). However, Please note that Cable runs and cable sizes mentioned in feeder list & SLD are indicative and actual cable size shall be informed during review of documents post order without any time or cost implication to owner as metioned in tender.
314	Part-2	56	5.2.3	PLCC communication	Please specify the rating (inductance & current rating) of 220kV Wave trap.	The same shall be designed by bidder in consultation with HVPNL during detail engineering.
315	Part-2	46	4.2.10	Lighting system	As per clause the overall maintenance factor shall not be more than 0.63. However we presume that for outdoor switchyard & street lighting, the uniformity to be maintained shall not be less than 0.6. Please confirm.	Bidder to follow tender documents
316	Part-2			Control, relay and protection system	a) Please confirm whether Busbar protection is required for both 220kV & 66kV ? b) Please confirm the type of busbar protection scheme i.e. Centralized or decentralised?	a) Yes b) Refer TA-01.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
317	Part-3	29	B269-999-16-50-00200	GIS building	We presume that the 220kV & 66kV GIS halls shall be constructed only for the number of bays as indicated in the Section-Part-3 SLD. Please confirm.	Bidder understanding is not correct. Please refer cl. no. 4 (23) of doc. no. B269-999- 16-50-EDB-1001 attached with tender.
318	Part-2	47	4.45	ECS System	We understand that ECS System panels are not in scope of supply however space provision shall be provided in Switchgear Hall. Please confirm whether Bidder's understanding is in order & confirm the minimum dimension of the ECS panels.	Bidder understanding is in order. However, Size of ECS panels shall be as per the ECS interface input to be provided by the contractor during detailed engineering. Based on same space requirement, heat load and power requirement shall be provided during detailed engineering.
319	Part-2	38	3.3	Scope of work	As per the referred clause, "Equipment rating and specifications mentioned here are preliminary and approval has to be taken from HVPNL before finalizing the rating and placing order". In case of change in the equipment ratings, we presume the same shall be suitably compensated by IOCL. Please confirm whether Bidder's understanding is in order.	Bidder understanding is not correct. Bidder to follow tender documents.
320	Part-2	36	3.24	Solar PV	Please specify the Rating of Roof top solar system. We presume the application is for Indoor lighting only. Please confirm whether Bidder's understanding is in order.	Please note that solar system shall be installed at the vacant space available on the roof of MRSS-100 as well as new incoming gantry substation. Further for rating & details, refer cl. no. 5.26 of doc. no. B269-999-16-50-SP-0020 Rev.-C attached with tender.
321	Part-2	711	4.0, Specific design requirements, Sl. No.-18	OLTC & RTCC	As per referred clause of specific design requirements (Project Philosophy), OLTC with RTCC facility shall be provided for main power transformers (66/6.9kV) and (33/6.9kV) only however as per cl. 3.3.7, 3.3.6, 3.3.8 OLTC with RTCC shall be applicable for all transformer. Kindly Confirm the requirement.	OLTC shall be provided for all power transformer, not required for distribution transformer.
322	Part-2			Transformer	Please specify if any Ceiling limits are there for transformer losses. If so, please specify the Maximum losses allowable for each of the following transformer ratings: a) 220/33kV, 60/75MVA b) 220/66kV, 40/50MVA c) 220/66kV, 100/125MVA	Losses will be Annexure-A as per CEA specification dated April, 2021 (File No.CEA-PS-14-169/2/2019-PSETD Division).
323	Part-2	69	5.7.15.4	PD Monitoring System	We presume that one common online PD monitoring system shall be provided for the entire 220kV GIS & 66kV GIS. Please confirm.	Bidder understanding is not in order. Following online PD monitoring system shall be provided as per tender requirements: 1. One PD monitoring system at MRSS-100 2. One PD monitoring system at Outdoor Switchyard substation 3. Modification/Integration of existing PD monitoring system to include 2 nos. bay extension.
324	Part-2	69	Cl. 5.7.15.5	SF6 topping system	As per referred clause we understand that SF6 topping system for 220kV GIS to be supplied under the scope of this package. However SF6 topping system for 66kV GIS is not in scope of supply. Please confirm whether Bidder's understanding is in order.	Bidder understanding is not in order. Bidder to follow tender documents & provide SF6 topping system at MRSS-100 & new gantry substation.
325	Part-2	39	3.3.12	Telecommunication equipment	We understand that interfaces at remote end FOTE are to be provided in the scope of this package. Please provide the following details of HVPNL end FOTE: i) Make and Model number ii) Transmission capacity (STM-1/STM-4/STM-16)	As per tender documents, interface as required with HVPNL, regarding equipment, components, their rating, their specification and for establishing to & from voice and data communication with HVPNL shall also be in scope of CONTRACTOR. Details of existing system, wherever required, shall be obtained from HVPNL by BIDDER.
326	Part-2	40	3.3.19	SCADA System	Please furnish the following details w.r.t the HVPNL end SCADA system: a) Make & Model number b) Location of HVPNL SCADA	Refer reply at sr. no. 19 above.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
327	Part-2	40	3.3.19	DCS System	Please furnish the following details w.r.t the existing DCS system: a) Make & Model number b) Location of existing DCS & its distance from the MRSS-100 Substation Control building	a) Details of DCS system shall be intimated during detailed engg. b) DCS Rack room (SRR-104) shall be located at distance of 350m
328	Part-2	40	3.3.20	SAS & ECS	Please furnish the following details w.r.t SAS & ECS for existing 220KV GIS a) Make & Model number b) Location of existing SAS & ECS and their location	For details of existing system refer Annexure-A attached herewith. For any additional details, please contact OEM mentioned in the tender.
329	Part-2	40	3.3.20	SAS & ECS	Please furnish the following details w.r.t SAS & ECS at existing substation (SS-63) a) Make & Model number b) Location of existing SAS & ECS and their location	SS-63 is not applicable for this tender. Refer TA-01
330	Part-2	44	3.5.4	Switchboard	We understand from the Key SLD that the requirement as mentioned in this clause (i.e. extending 415V power supply from Owner's feeder to PMCC) is not relevant, as the PMCC incomer is directly supplied F41 from the 415V side of 6.6/0.433kV transformer. Please check & clarify. If the 415V supply need to be extended as mentioned in the referred clause, please specify the distance & location of the Owner's 415V Main DB.	Bidder understanding is in order. Bidder to follow tender documents.
331	Part-2	44	3.5	Interface with Owner's substation	Please furnish the transmission line distance between the existing HVPNL substation to proposed 220kV outdoor switchyard in P25 area.	These details shall be shared post order during detail engineering.
332	Part-2	42	3.349	Testing & Commissioning	We have our own testing & commissioning team with hands on experience in testing & commissioning of EHV substations up to 765kV. Hence, we request IOCL to accept testing & commissioning by EPC. However, the supervision shall be done by the respective OEMs. Please confirm.	Bidder to follow tender documents
333	Part-3	29	B269-999-16-50-00200	SLD	As per SLD 66kV GIS is splitted into 3nos. of Bus-sections by 2nos of Bus-coupler bays. We presume that Bidder need to provide only 2nos of Bus-coupler bays in line with this SLD. Please confirm.	Bus coupler bay and bus sectionaliser shall be provided as shown in SLD. For revised SLD, refer TA-01.
334	Part-3	29	B269-999-16-50-00200	SLD	We presume that only space provision need to be provided for the following GIS bays: a) 220kV GIS spare transformer feeder (2Nos.) b) 66kV GIS incomer bay (2Nos.) c) 66kV GIS spare transformer feeder (8Nos.) d) 66kV GIS Future Bus tie transformer feeder (4Nos.) Please confirm whether Bidder's understanding is in order.	Bidder understanding is not correct.
335	Part-3	29	B269-999-16-50-00200	SLD	Please furnish specification for 220kV, 33kV & 6.6kV Isolator Breaker panel (IBP).	Key SLD is indicative only. Bidder to refer tender documents.
336				General Input	Equipment details for each bay are not mentioned for 66kV GIS & 220kV GIS. Kindly furnish the details.	Key SLD is indicative only. Bidder to refer tender documents.
337	Part-2	48	4.5	Feeder detail	As per the referred clause, "It is the responsibility of the contractor to provide number of outgoing feeders in each switchboard as per actual loads, other electrical system requirements plus spare feeders in each switchboard in line with engineering design basis." We request IOCL to freeze the basic design & provide us the actual number of feeders to be considered at each voltage level (220kV, 66kV, 33kV & 6.6kV). Otherwise, Bidder shall quote as per the number of feeders as shown in the key SLD. Any increase in the number of feeders shall be suitably compensated by IOCL.	Bidder to refer feeder detail datasheet attached for each switchboard panels.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
338	Part-2	40	3.3.17	PMCC	As per clause PMCC shall have two incomer from transformer & one incomers from rooftop solar photovoltaic system. However as per SLD, only two incomers from transformer are shown. Kindly confirm the requirement of third incomer.	Key SLD is indicative only. Bidder to refer tender documents.
339	Part-2			General	We presume that Earthing, DSLP, Lighting, Cable trench & other associated works are required to be executed only for the present scope of works within the substation premises. Please confirm.	Bidder understanding is not correct. For scope related to existing 220kV substation and existing sytem. Bidder to refer tender documents.
340	Part-2	51	5.1.2.2	Type test	We understand repetition of type tests for transformer is required only for Heat run test. Hence we understand that repetition of any other type tests & special tests are not required. Please confirm.	Bidder understanding is not correct. Bidder to follow tender document regarding type test for transformers.
341	Part-3		12.5	Type & special tests	As the tests mentioned under this clause are type & special tests, we propose to repeat the tests (except Dynamic short circuit test) on only one unit of each type & rating. Please confirm acceptance.	Noted. Bidder to follow tender documents.
342	Part-3		12.5.2	Dynamic Short circuit withstand test	As Dynamic short circuit withstand test is a special test & it requires a long lead time, we request IOCL to accept either calculations (or) verification of design based on already short circuit tested similar transformer in line with similarity criteria as defined in IEC 60076-5. Please confirm.	Bidder to follow tender documents
343				Type test	We presume that there is no date validity requirement for type tests. Please confirm.	Bidder to follow tender documents
344	Part-2	45	3.5.15.7	Tariff meters	Tariff meters are excluded from the present scope of work. We presume these are free issue items from central / state transmission utilities. Mounting & wiring in respective panels alone are considered in scope of this package. Please confirm. If Tariff meters are to be considered in this package please confirm the following: a) Accuracy class of Tariff meters b) specification detailing the requirements such as ABT & TOD features c) Whether separate CT & PT cores are required? d) Bays for which Tariff metering is required in each voltage level	Bidder understanding is not correct. Bidder to follow tender document and provide tri-vector meter accordingly. Further, as per tender documents, interface as required with HVPNL, regarding equipment, components, their rating, their specification and for establishing to & from voice and data communication with HVPNL shall also be in scope of CONTRACTOR. Details of existing system, wherever required, shall be obtained from HVPNL by BIDDER.
345				Order of precedence	Incase of contradiction between various section, please confirm the order of precedence to be followed.	Bidder to refer tender documents.
346				Existing 220kV GIS	We request IOCL to furnish the following details for existing substation: a) Existing Single line diagram b) Existing Switchyard equipment layout (plan & section) c) Existing GIS building layout d) Existing Cable trench layout e) Existing Lighting protection (DSLP) layout f) Existing Control building layout g) Existing Earthmat Layout	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
347				Existing 220kV GIS	The following details are required w.r.t existing 220kV GIS: a) Whether Interface module/ extension module are available at existing GIS? b) We presume that the existing GIS building is having sufficient space for 220kV GIS extension. We do not envisage any modification or extension works in the GIS building. Please confirm.	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
348				Existing 220kV GIS	We understand that existing ACDB and DCDB (220V & 48V) are having sufficient spare feeders for 2# 220kV line bay to be extended under present scope of work. Please confirm.	Existing ACDB & DCDB system shall be extended to provide auxillary power supply to 2 nos. additional bays , LCC & CRP.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
349				Existing 220kV GIS	Please highlight the location of Existing 220kV GIS BHEL substation in Overall Plot Plan.	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
350	Part-3	685	4.3.1	O/H Line	Please furnish the Conductor type & size of O/H Transmission line coming from HVPNL end to 220kV Outdoor switchyard incomers.	Conductor type shall be HTLS -AAAC. The conductor size shall be finalised based 220kV trafo rating as mentioned in revised SLD attached with TA-01.
351	Part-2	35	2	ASB/LDB	As per referred clause ASB/LDB shall have two incomes, one from normal PCC and other from emergency PCC. However as per SLD incomer from emergency PCC is not shown. Kindly confirm the requirement.	Bidder understanding is partly correct. Bidder to refer revised SLD attached with TA-01.
352	Part-2	35	2	EPMC	As per referred clause a separate EPMC has been envisaged for feeding plant emergency loads. EPMC will be fed via 1 no. 6.6/0.433 kV distribution transformer and through DG to provide reliability in the system. However in the SLD EPMC is not shown. Kindly confirm the requirement.	Bidder to refer revised SLD attached with TA-01.
353	Part-2	73	5.9.14	Changeover scheme	We presume that changeover provision is not required for third incomer of PMCC through PV Solar system. Please confirm whether Bidder's understanding is in order.	Bidder to follow tender documents.
354	Part-2	54	5.2.9	Transformer	Please furnish the following Neutral CT details for all transformers: a) Number of cores b) CT ratio c) CT parameters such as accuracy class, VA burden, knee point voltage, magnetizing current etc.	Details shall be finalised by bidder during detail engineering as per tender requirements.
355	Part-2	55	5.3.2	Substation cum control room	a) Please furnish the dimension of Substation cum control room in the proposed outdoor switchyard area (95mx95m plot). b) Also please confirm whether the Metering room (3mx4m) shall be part of the above building or it shall be constructed as a separate building?	Substation cum control room shall be located towards east side of this plot area however exact location & dimension shall be finalised during detailed engineering in consultation with owner.
356	Part-3	772	6.18	DG Set Room	We presume that DG Set is not included the present scope of work as per pre bid meeting discussion. Hence we do not envisage any building for DG set under the present scope of works. Please confirm whether Bidder's understanding is in order.	Bidder understanding is in order.
357	Part-2	71	5.8.7	Surge arrester	As per referred clause Surge arrester shall be provided at both incoming & outgoing Isolating Breaker Panels (IBP). However the same is not indicated in SLD for 220kV & 33kV IBP. Kindly confirm the requirement. Also please confirm whether the surge arresters shall be AIS or GIS type?	Key SLD attached is indicative only. Bidder to follow tender documents.
358	Part-3	343	5.2	Surge arrester	Please furnish the Cantilever strength for outdoor AIS Surge arrester housing.	Bidder to follow tender documents and design the overall system accordingly.
359	Part-3	383	5	CT/VT/CVT	Please furnish the Cantilever strength for outdoor AIS CT/VT/CVT housing.	Bidder to follow tender documents and design the overall system accordingly.
360	Part-3	326	7.3	Isolator	As per referred clause minimum creepage distance shall be 25mm/kV. However as per data sheet minimum creepage distance shall be 31mm/kV. Please confirm the actual requirement.	Minimum creepage distance shall be 31mm/kV.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
361	Part-3	60	Note 7	220kV GIS feeder	As per referred clause Independent Bus PT panel shall be provided for all the four buses of the Double Bus GIS switchboard. We presume that panel in this context is nothing but the GIS modules for Bus PT. Please confirm.	Bidder undestaning is in order. Bidder to follow tender documents.
362	Part-3	60	20	220kV GIS feeder (Transformer Spare feeder)	As per referred clause, 3 Nos. of Transformer (Spare) are required. However per Key SLD 2 Nos. of Transformer (Spare) are indicated. Please confirm the requirement.	Bidder to refer feeder details datasheet & other documents attached with tender. For revised feeder details datasheet, refer TA-01.
363	Part-3	63	13-19	66kV GIS feeder (Transformer Spare feeder)	As per referred clause, the number of Transformer feeders are not matching w.r.t. to Key SLD following nos. of feeders are required. a) Transformer-1000A-35nos. b) Transformer(Spare)-1000A-8nos. c) Transformer (1250A)- 2nos. d) Transformer Bus Tie (Future)-1250A-4nos. Please confirm the actual requirement.	Bidder to refer feeder details datasheet attached with tender. Refer TA-01 for revised feeder list.
364	Part-2	39	3.3.12	SLDC	We do not envisage any integration works at SLDC SCADA. If the same need to be included under Bidder's scope, please furnish the following details: a) Location of SCADA b) Make & Model number of SLDC SCADA	As per tender documents, interface as required with HVPNL, regarding equipment, components, their rating, their specification and for establishing to & from voice and data communication with HVPNL shall also be in scope of CONTRACTOR. Details of existing system, wherever required, shall be obtained from HVPNL by BIDDER.
365	Part-3			Interface with Owner's substation	We understand that MV Cable & Cable termination from 6.6kV/415V transformer to 6.6kV IBP are not in scope of supply. Please confirm whether Bidder's understanding is in order.	Bidder understanding is not in order. Bidder to follow tender documents.
366	Part-3	413	5.3.21	UPS	We presume that the UPS supply is required for ECS panels & SAS HMI. In this regard we request IOCL to furnish the rating of UPS required for this package.	230V AC UPS shall be provided in the substation for feeding control supply for ECS Panels, LAN, HMIs, etc., in substation building as per tender documents. Sizing of UPS including owner's load is in bidder's scope as per tender document.
367	Part-2	84	5.12.26	Discharge duty	a) We understand that the loads mentioned in the table under clause 5.12.26 are the requirements of GIS Switchgear (220kV & 66kV) to be supplied under this package. If otherwise, please clarify what are these loads which are proposed to be supplied from the 110V DC system supplied under this package. b) As per the table, we understand that 110V DC system is required for both switchgear control & Critical lighting. However, as per Key SLD, 110V DC system is for Switchgear control & 220V DC system is for Critical lighting. Please check & issue suitable amendments in this regard.	a) Bidder understanding is not in order. These loads requirements mentioned in cl. no. 5.12.26 is owner's load requirement which shall be taken care by bidder while sizing and design of DC system for MRSS-100. b) Bidder to consider 110V DC system for Switchgear control & 220V DC system for Critical lighting.
368	Part-2	86	5.13.17	UPS ACDB	As per Key SLD, we presume that the UPS supply is 230V, 1-phase. As per referred clause, 10 feeders of 5kVA each is asked for Owner's ECS panels. In this regard, we request IOCL to revisit the rating. Also please confirm whether the UPS to be supplied is a 3-phase or 1-phase UPS.	Bidder to refer TA-01 for total load requirment for owner's use for sizing of UPS system supplied and design by bidder.
369					We understand that for free issue items such as FDA & PA system, the cabling scope under this package is limited within the substation boundary. Please confirm.	Bidder understanding is not correct. Bidder scope for FA system and PA system is limited to within package battery limit as defined in tender.
370					Please confirm whether room temperature can be taken as the minimum ambient for sizing the 220V, 110V, 48V & UPS Batteries.	Please note that Equipment design temperature is 45 DEG C & Minimum temperature for battery sizing is 5 DEG C.
371	Part-3	187	C.5	UPS	As per referred clause UPS Output voltage shall be 220V / 110V. Please confirm.	230V AC UPS shall be provided in the substation for feeding control supply for ECS Panels, LAN, HMIs, etc., in substation building as per tender documents.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
372	Part-2	36	3.1	Spares & Special Tools	Please furnish the following details: a) Commissioning Spares b) O&M Spares c) Special Tools & Tackles	Commissioning Spares, Special Tools & Tackles spares as required and Operation and Maintenance spares for the two years of normal operation for all equipment as recommended by the equipment manufacturer shall be provided by bidder.
373	B269-999-16-50-SP-0020 Rev.C	18 of 79	4.4.9	Rail cum road	As per referred clause its mentioned that "Rail track/ Channel shall be provided for the movement of the main transformers. Same shall be extended on the main approach road". We understand that rail cum road is required from transformer foundation upto road edge only. Please confirm.	Bidder to follow bid document
374	B269-999-16-50-SP-0020 Rev.C	18 of 79	4.4.10	Transformer shelter	As per referred clause its mentioned that "Transformer bays to be covered with concrete roof at double height.". We understand that the clear height of transformer room shall be two times the height of transformer equipment from FGL. Please confirm	Bidder to follow bid document
375	B269-999-16-50-SP-0020 Rev.C	18 of 79	4.4.12	Fire wall	As per referred clause its mentioned that "Fire wall between two adjacent transformers shall be extended at least 1 meter above the top most point of the Transformers." We understand that fire wall shall be extended upto concrete roof slab, and fire wall shall be on 3 sides of transformer since its adjacent to building. Please confirm.	Bid Specification/requirement shall be followed
376	B269-999-16-50-SP-0020 Rev.C	18 of 79	4.4.12	Fire wall	As per referred clause its mentioned that "Firewall thickness shall be minimum 355 mm in case of brick construction..". However as per provided Standard drawing in Tender document Part-3 (Drg. No: B269000814102511) the thickness of wall is mentioned as 345mm. Please confirm the thickness of brick wall to be followed.	Fire wall shall be 345mm thick with plaster additional.
377	B269-999-81-41-SOW-0020 Rev.B	3 of 16 7 of 16	PART-A-1.1.1 a PART-B-1.0, L	Masonry work in substation building	As per cl. 1.1.1 a, PART- A (ARCHITECTURAL) its mentioned that "The building shall be RCC frame structure with brick masonry wall". However in PART B (STRUCTURAL); Scope of supply, there is no requirement of brick masonry and instead Cl. 10. L mentions "Concrete block masonry with solid/hollow concrete blocks in substructure and superstructure for all depths and heights." Please confirm whether to use brick masonry or concrete block masonry in substation building.	Bidder to comply requirements as mentioned in EDB
378	B269-999-81-41-SOW-0020 Rev.B	9 of 16	PART-B-2.0, i	Galvanization thickness	As per referred clause its mentioned that "Structural steel shall be of grade E350-BR confirming to IS: 2062". We wish to propose galvaization thickness of 0.610kg/sq.m for all outdoor structural steel and 0.375kg/sq.m for bolts and nuts. Please confirm	Surface preparation, painting of primer and final coat shall be as per Job specification no. B269-000-02-42-PCS-0001.
379	B269-999-81-41-SOW-0020 Rev.B	10 of 16	PART-C-1.0, ii	FGL and pavemenet level	As per referred clause its mentioned that "Entire area within the scope limit area are already graded upto FGL 238.32m above MSL. Package contractor shall further raise the grading level to achieve level required for providing the pavement." Please clarify to us how much we need to raise the grading level for providing the pavement.	Refer Clause no. ii of PART C-1.0 in SOW B269-999-81-41-SOW-0020 Rev.B mentioned that HPP (Highest Pavement point) of the plant is 238.72 m above MSL.
380	B269-999-81-41-SOW-0020 Rev.B	11 of 16	PART-C-1.0, vi	STORM-WATER-DRAINAGE-SYSTEM	As per referred clause its mentioned that "Drainage work (network of RCC drains) shall also cover RCC paved area and plant facilities area and shall be connected to OSBL storm water drain." We trust that RCC drain within the battery limit area is only under package contractor's scope and OSBL will be readily available at substation boundry for connection. Please confirm.	Bidder to follow Scope Drawing B269-999-81-41-14561 Rev.B attached with tender documents

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
381	B269-999-81-41-SOW-0020-Rev-B	10 of 16	PART C -1.0, ii	FGL and pavemenet level	As per referred clause its mentioned that "Entire area within the scope limit area are already graded upto FGL 238.32m above MSL." We understand that the site will be already graded upto FGL 238.32m for GIS-MRSS-100 area, P25 area and Switchyard, Existing Panipat Refinery area. Please confirm.	Bidder's Understanding is correct
382	Part-2	196/860	3	General	Please provide the Make list details for HVAC equipment.	As per tender specefication, HVAC system shall be designed, engineered and supplied by one of the EIL approved vendor. Further details shall be discussed during detailed engineering stage after award of the job.
383	Part-2	204/860	3.1.13-C	Chemical Filtration	We presume that only Air conditioning rooms in Substations (SS-100 & Switchyard SS) needs to be maintained G1 environment (G1 environment not required inside cable cellar & Battery rooms).Please confirm.	Bidder understanding is correct.
384	Part-2	851/860	5.17.1	Cellar & Battery room ventilation	As per clause it has been mentioned to consider 15 ACH for ventilation system. Bidder understands that the same air changes is applicable for battery room & Cable cellar ventilation .Kindly confirm.	For ventilation of Battery room, bidder to refer Electrical specification. Exhaust fans shall be provided in the battery room & cable cellar for ventilation. No. of air changes shall be decided as per mechanical specification.
385	Part-2			General	No ventilation system is being considering for transformers.Please confir	No forced ventilation is envisaged for power and distribution transformer bays.
386	Part-2	189/860	2	Scope of supply	Selection of type of AC equipment for main receiving SS & Switch yard SS shall be followed as mentioned in table (Chiller for Main receiving SS & Water cooled PAC for Switchyard SS). Please confirm.	Bidder to follow tender.
387	Part-2	143/860	Xiii	Fire Protection System	As per the clause. Fixed water spray system to be considered. Please confirm the location to be protected	For Fire protection system refer doc no:B269-999-17-44-SOW-5000 Rev.B
388	Part-2	143/860	Xiii	Fire Protection System	As per the clause. Semi fixed foam system on hydrocarbon storage tanks to be considered.We presume the same is not in our scope as no such storage tanks are present in sub station premises.Please confirm.	Bidders understanding is correct and Refer doc no:B269-999-17-44-SOW-5000 Rev.B
389	Part-2	143/860	Xiii	Fire Protection System	As per the clause. water cum foam monitors to be considered. – Please confirm the location to be protected	For Fire protection system refer doc no:B269-999-17-44-SOW-5000 Rev.B
390	Part-2	143/860	Xiii	Fire Protection System	As per the clause. FIRE & Gas system to be considered.Please confirm the location to be protected	For Fire protection system refer doc no:B269-999-17-44-SOW-5000 Rev.B
391	Part-2	General	Xiii	Fire Protection System	Please confirm the scope of supply and installation of Portable Fire Extinguisher. If it in bidder scope. Please share the detailed specification.	The scope of supply and installation of portable fire extinguishers is bidder scope and specification available with tender.
392	BOQ		1-A-1) af)	Fire Protection System	Please confirm what are all the systems to be considered under this Serial no.	For Fire protection system refer doc no:B269-999-17-44-SOW-5000 Rev.B
MRSS-100						
393	General			DCS System	a) Make & Model number b) Location of existing DCS & its distance from the MRSS-100 Substation Control building	Interface with DCS system is not envisaged. For interface of F&G system refer Instrumentation part of tender document.
394	General			ECS	a) Make & Model number b) Location of existing SAS & ECS and their location	SAS system for MRSS-100 is new and is in bidder's scope. ECS system in MRSS-100 is also new but in Other's scope. For ECS interface in bidder's scope refer tender document. For details of ECS system for new gantry substation, bidder to refer tender/ Technical Amendment

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
Existing 220kV GIS (BHEL)						
395	General			General (Inputs for Terminal Bay extension work)	a) Existing Single line diagram b) Existing General Equipment arrangement layout (Plan &Section) c) Existing GIS building layout	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
396	General			General (Inputs for Terminal Bay extension work)	a) Existing cable trench layout b) Existing Lighting protection (DSL P) layout c) Existing control building layout d) Existing Earthing layout (If earth mat layout is not available, please request at least earth mat spacing.)	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender. Embedded earth mats in existing GIS substation flooring is taken care by others. Connectivity of 220kV GIS new extension bays and associated LCC & CRP with existing earthing system is included in bidder's scope.
397	General			Bus scheme & Rating	1) Continuous current rating of existing 220kV busbar 2) Short time current rating and duration for existing 200kV bay equipments	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
398	General			Bus bar extension	a) Whether space provision is available for bay extension in the existing Building? b) Please check whether space is available inside the relay room for locating 4Nos. additional CRP (800mmx800mm).	Adequate space is available for extension of 2 nos. 220kV GIS bays i.e. one bay each on either side as well as for locating corresponding LCCs and CRPs. Extension of GIS building is not required. For further details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
399	General			Existing busbar protection	a) Make b) Model number c) Centralized (or) Decentralized? d) Whether spare Bay units are available? e) Whether spare slots are available in the Main busbar protection central unit?	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
400	General			Existing GIS	a) Make & Model no of GIS b) GIS building layout c) Please check and confirm whether Interface module/ extension module are available at existing GIS d) What is the space available in the GIS building for installing GIS Modules of present scope?	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
401	General			Existing Automation system	What is the available system for control & automation at the existing station (SAS or RTU)? Please check & specify following: a) Make of SAS/RTU b) Model number of SAS/RTU c) Availability of spare ports	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
402	General			Communication protocol	Please confirm the communication protocol (IEC 61850 or IEC 60870-5-101 or IEC 60870-5-104) of existing relays with substation automation system/RTU	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender.
403	General			FOTE	Please confirm the following details with respect to FOTE: a) Make b) Model number c) Transmission capacity (STM-1/SM-4/STM-16) d) Number of spare teleprotection interface cards e) Number of spare data interface cards f) Number of speech interface cards	For details of existing system refer Annexure-A attached herewith. For any additional details , please contact OEM mentioned in the tender. FOTE is not applicable for 220kV outgoing bays being extended by the bidder.

SL. NO.	REFERENCE OF ENQUIRY DOCUMENT				BIDDER'S QUERY	EIL/IOCL REPLY
404	General			PLCC	Please confirm whether any existing PLCC system is available in the existing substation. If available, please share the make & model number of the same.	For details of existing system refer Annexure-A attached herewith. For any additional details, please contact OEM mentioned in the tender. PLCC is not applicable for 220kV outgoing bays being extended by the bidder.
405	General			Shut down sequence	Please confirm whether any specific shut down sequence to be followed.	These details shall be decided during detail engineering.
406	General			Control room building adequacy	Please confirm whether adequate space to accommodate augmentation of ACDB / DCDB/ battery & charger under present scope are already available? Or building need to be extended? (or) Control room building layout required	Existing AC and DC Aux. supply spare feeders shall be provided by Owner for use by package contractor for 2 nos. extension bays in existing substation.
407	General			Cable trench	a) Whether cable trench is available for the bays to be extended under present scope? Please share the cable trench layout drawing. Besides collecting drawing, please confirm the following aspects also; b) Whether existing cable trench has space to take cables of present scope? Or a new Trench needs to constructed? If new trench has to be constructed, what will be the length for which trench has to be constructed? c) Please check for a typical cable trench cross-section? d) Check for details such as Number of tiers & Width of trays	Adequate space is available for extension of 2 nos. 220kV GIS bays i.e. one bay each on either side as well as for locating corresponding LCCs and CRPs. Extension of GIS building is not required. For details of existing system refer Annexure-A attached herewith. For any additional details, please contact OEM mentioned in the tender.
408	General			Auxiliary system	a) Existing DC voltage level (220V or 110V)? b) Type of 220V or 110V charger- Float & Boost (or) Float-cum-boost (or) Float & Float-cum-boost c) Number & Rating of available spare feeders in existing ACDBs & DCDBs d) Bus bar rating of existing LT ACDB, DCDB & 48V DCDB	These details shall be provided post order during detail engineering. For any additional details, please contact OEM mentioned in the tender.
409	General			Space for extending AC & DC Distribution boards	If there are no spare feeders available, whether there is space for installing up new LT Swgr. verticals?	Existing AC & DC Aux. supply spare feeders shall be provided by Owner for use by package contractor for 2 nos. extension bays.
410	General			Switchyard illumination	Please confirm whether existing switchyard illumination covers the area proposed for new bays under this package.	No additional illumination required for 2 Nos. additional 220 kV GIS bays and associated LCCs & CRPs in existing GIS substation.
411	General			LV cables	Typical cable sizes for LV power & control cables which are generally adopted as per IOCL practice (or) Cable schedule of the existing substation can be ois required	These details shall be provided post order during detail engineering. For any additional details, please contact OEM mentioned in the tender.
HVPNL Substation (Remote end station)						
412	General			Transmission lines	Please Confirm line distance between the existing HVPNL substation to proposed 220kV outdoor switchyard in P25 area.	As per tender documents, interface as required with HVPNL, regarding equipment, components, their rating, their specification and for establishing to & from voice and data communication with HVPNL shall also be in scope of CONTRACTOR. Details of existing system, wherever required, shall be obtained from HVPNL by BIDDER.
413	General			FOTE	Please confirm the following details w.r.t. HVPNL end FOTE: i) Make and Model number ii) Transmission capacity (STM-1/STM-4/STM-16)	
414	General			SCADA System	Please Confirm the following details w.r.t. HVPNL end SCADA system: a) Make & Model number b) Location of HVPNL SCADA (Station name)	
415	General			Remote end Protection details	If the remote end bays are already constructed & in operation, the following details to be Confirmed: a) Type of Main protection (Differential or Distance) b) Make & Model number of the existing Main protection relay at HVNL end c) Make & Model number of the existing SAS/RTU at HVNL end	

	Description	UOM	QTY	Detailed Description of Scope
1.01	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - BUS BARS	LOT	1	This covers complete GIS System under this technical specification (TB-PBT-316-PN1) excluding the following BOQ line items.
1.02	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - TRANSFORMER GIS BAY MODULE (EXTN. TO EXISTING GIS)	SET	2	Extension by addition of transformer feeder bays in existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear (one set each on both side). Feeder details similar to Sr. nos. 1 / 2 (Incomer from PR 220kV GIS with Line PT) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module & Line PT Module which is covered in separate BOQ item)
1.03	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM -DOUBLE MAIN BUS SCHEME - GIS EXTENSION MODULE	SET	2	Bus extension module for interfacing of transformer feeder bays (of present scope) with existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear (one set equals complete extension module for one side of existing GIS). Bidder shall consider the modules including the bellows/ compensators like lateral mounting units, Axial compensators, Parallel compensators, tolerance compensators and vibration compensators etc as applicable. Please note, such extension shall be required on both side of GIS Bays.
1.04	SUPPLY- GIS : 220KV, 50KA FOR 3S, OUTDOOR GIS ISOLATING BREAKER BAY	SET	2	Please refer Sr. nos. 1 / 2 (220kV GIS Outdoor IBP with Line PT) of the document: 220 kV ICG FEEDER DETAIL DATASHEET (HV-100101/HV-100102), Nos: B269-999-16-50-DS-0033. (Excluding SF6 to air bushing, Surge Arrester Module, Line PT Module, Gas Insulated Bus Duct which are covered in separate BOQ items)
1.05	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A - SF6 TO AIR BUSHING	SET	6	Single phase 220kV , 2000A SF6 to Air Bushing for the air termination of the GIS shall be as per IEC. (a) Single phase, termination module for terminating GIS SF6 bus duct (b) Scope of supply shall be as per latest version of IEC . (c) Gas monitoring system, pressure relief device, busbar, insulator, expansion joint/ flexible connection etc. as required. (d) Barrier cones, mechanism box and other items as required. (e) Any other item required to complete the system in all respects but not limited to above.
1.06	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - LINE GIS BAY	SET	2	Incomer from Panipat Refinery 220kV GIS. Please refer Sr. nos. 1 / 2 (Incomer from PR 220kV GIS with Line PT) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module & Line PT Module which are covered in separate BOQ item)
1.07	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - LINE GIS BAY (TYPE 2)	SET	2	Incomer from Panipat Refinery Isolating Breaker Panel. Please refer Sr. nos. 3 / 4 (Incomer from PR IBP with Line PT) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module & Line PT Module which are covered in separate BOQ item)
1.08	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - BUS COUPLER GIS BAY	SET	2	Please refer Sr. nos. 7 / 8 (Bus Coupler 1A-2A & Bus Coupler 1B-2B) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D
1.09	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - BUS SECTIONALISER BAY MODULE	SET	2	Please refer Sr. nos. 5 / 6 (Bus Coupler 1A-1B & Bus Coupler 2A-2B) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D
1.10	SUPPLY- GIS : 220KV, 50KA FOR 3S, DOUBLE MAIN BUS SCHEME - BUS MEASUREMENT GIS BAY/ VOLTAGE TRANSFORMER BAY	SET	4	Please refer Sr. nos. 9 / 10 / 11 / 12 (Bus PT 1A, 1B, 2A & 2B) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D
1.11	SUPPLY- GIS : 220KV, 50KA FOR 3S, MAIN ITEM - DOUBLE MAIN BUS SCHEME - TRANSFORMER GIS BAY	SET	6	Please refer Sr. nos. 13 / 14 / 15 / 16 / 17 / 18 (Transformer Feeder) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module which is covered in separate BOQ item)

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SECTION 1:

SCOPE, PROJECT SPECIFIC TECHNICAL REQUIREMENTS & BILL OF QUANTITIES

1. Scope

This technical specification covers the requirements of (1.) design, type testing, engineering, fabrication, manufacturing, shop assembly, inspection and testing at manufacturer's works, proper packing, supply and delivery to project site, (2.) supervision of material reconciliation, installation / erection, (3.) execution of site testing & commissioning along with necessary kits, tools & equipment, putting GIS with LCC & its Accessories into successful operation complete with all materials, support structures, anchoring bolts, chemical anchor, accessories, commissioning spares & maintenance spares, special spanners, special tools & tackles, any specific required ancillary services, SF6 gas for first filling & spare etc. including design studies, training of BHEL / Customer personnel for offered GIS & its Accessories complete in all respects for efficient & trouble-free operation mentioned under this specification.

This section covers bidder's scope for GIS with LCC & its Accessories. The offered GIS with LCC & its Accessories shall comply with the Section-1, 2 & 3 of technical specification.

This section covers the specific technical requirements of 220kV GIS with LCC & its Accessories. This constitutes minimum technical parameters for the above item as specified by the BHEL/ Customer. The offered 220kV GIS with LCC & its Accessories shall also comply with the Section-3 (Project Details and General technical requirements for all equipment under the Project) of this specification.

The specification comprises of following sections:

Section-1	:	Scope, Project Specific Technical Requirements & Bill of Quantities
Section-2	:	Equipment Specification under scope of Supplies
Section-3	:	Project Details & General Technical Requirements (For All Equipment under the Project)
Section-4	:	Annexures
		Annexure A- Compliance Certificate
		Annexure B- Schedule of Technical Deviations
		Annexure C- Guaranteed Technical Particulars
		Annexure D- Technical Checklist

The following order of priority shall be followed. In case of conflict between requirements specified in various documents, the more stringent one shall be followed. BHEL/Customer concurrence shall, however, be obtained before taking a final decision in such matters.

1. Statutory Regulations

In particular, the latest version of the following statutory regulations, as applicable, shall be followed for system,

- o Indian Electricity Act
- o CEA regulations
- o The Factory Act

Bharat Heavy Electricals Limited

Project: Pre Bid Tie up for 220 kV GIS Package for Panipat Refinery Expansion Project (P25)

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- o The Petroleum Rules
 - o OISD standards
 - o Requirements of other statutory bodies as applicable, e.g. CEA, CCE, LPCB.
2. Section-1
 3. Section-2
 4. Section-3
 5. Codes & Standards

Bidder shall furnish list of conflicts/ ambiguities/ deviations, if any, along with their technical offer and also furnish the basis that is considered for submitting technical offer. BHEL will address the bidder's listed conflicts prior to award. In case of ambiguity, bidder shall inform BHEL of their interpretation. In case bidder fails to convey the same prior to award, BHEL decision on interpretation shall be considered final if need arises during the execution. No additional cost or extra time on account of conflicts/ ambiguities/ deviations shall be admissible.

In general, no deviation from the requirements specified in various clauses of this specification shall be allowed and hence, a certificate to this effect shall have to be furnished along with the offer (Annexure-A), however bidder shall furnish list of conflicts/ ambiguities/ deviations (Annexure-B), if any.

Please note, any deviation not specifically brought out in Annexure-B (Schedule of Technical Deviations) shall not be admissible for any time and commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer. Any conflicts/ ambiguities/ deviations mentioned elsewhere in technical offer shall not be reviewed.

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the notice inviting tender/ enquiry.

Any clarification(s) for 220kV GIS published by M/s IOCL with reference to Tender No. SG/B269-999-EB-T-0020/22, Pre Bid Tie up for 220 kV GIS Package for Panipat Refinery Expansion Project (P25) of M/s Indian Oil Corporation Limited (IOCL) will also valid for this specification.

The equipment is required for the following project:

Name of the Customer	:	Indian Oil Corporation Limited (IOCL)
Name of Consultant	:	Engineers India Limited
Name of Main Contractor	:	Bharat Heavy Electricals Limited
Name of the Project	:	LSTK job for ISBL work of 220KV Grid Power Import at IOCL, Panipat Refinery

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the notice inviting tender/ enquiry. In case of revision of document under technical specification, latest revision is to be followed.

2. Codes & Standards

The performance, testing and rating of the switchgear shall conform to the latest edition of the following IEC / IS publications,

IEC 60694	Common clauses for High Voltage Switchgear & Control Gear
IEC 62271-203	Gas Insulated metal-enclosed Switchgear for rated voltages above 52kV
IEC 62271-207	Seismic Qualification for Gas-insulated Switchgear Assemblies for rated voltages above 52kV
IEC 60376	New Sulphur Hexafluoride
IEC 62271-100	High Voltage Alternating Current Circuit Breakers
IEC 62271-1	Common Clauses for High Voltage Switchgear and Control-Gear Standards
IEC 62271-102	Alternating Current Disconnections (Isolators) and Earthing Switches
IEC 60044-1	Current Transformers
IEC 60044-2	Voltage Transformers
IEC 60137	Bushings for Alternating Voltages above 1000V
IEC 62271-209	Cable Connections for Gas-insulated Switchgear
IEC 60480	Guide to Checking of Sulphur Hexafluoride taken from Electrical Equipment
IEC 60099-1/4	Non-linear Resistor type Arresters for AC Systems
IEC 60439	Factory-built Assemblies of Low-voltage Switchgear and Control Gear.
IEEE 80 (2000)	IEEE Guide for Safety in AC Substation Grounding.
CIGRE-44	Earthing of GIS- An Application Guide. (Electra no. 151, Dec'93).
IEC 61639	Direct connection between Power Transformers and Gas-insulated metal-enclosed Switchgear for Rated Voltage 72.5kV and above

These are only indicative list and hence any other codes & standards, if applicable shall be complied by bidder.

3. Specific Technical Requirements

Specific technical requirements 220kV GIS with LCC & its Accessories shall be as follows,

220 kV Indoor Double Bus Gas Insulated Switchgear, 2000 A, 50 kA (3 Sec.), SF6 Breaker with 3 Position & 2 Position Disconnecter for Bus Side, 3 Position Disconnecter for Line Side, High Speed Make Proof Earthing Switch, Capacitive Voltage Detector, Gas Insulated Current Transformer, LCC and SF6 Gas Analyser, Online Partial Discharge Monitoring System, Online SF6 Gas filling system e.t.c. complete.

GIS Outdoor Type Isolating breaker panel 220 kV, 2000 Amps, 50 kA (3 Sec) with Local Control

Cubicle, - GIS shall be suitable for taking power from overhead ACSR conductor and outgoing shall be through cables. Terminal connector for SF6 to AIR bushing is not in bidder's scope of supply.

Extension of existing 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear with Local Control Cubicle - "Extension of transformer feeder bays in existing CG make 220 kV, 2000 Amps, 50 kA (3 Sec), Double Bus Gas Insulated Switchgear with Local Control Cubicle, other details shall be shared with successful bidder.

Although the indoor GIS system shall be installed in Air Conditioned GIS/ Switchgear hall, but same shall also be suitable for installation and satisfactory operation in a non-air conditioned, tropical, humid and corrosive environment.

Sl. No.	Technical Parameters	Unit	Particulars
	Type of GIS		Indoor & Outdoor Type, Double Bus type
	Installation		Indoor
	Meteorological data		
1.1	Maximum ambient temperature	°C	50
1.2	Minimum ambient temperature	°C	-5
1.3	Average ambient temperature	°C	35
1.4	Design ambient temperature	°C	45
2	Average no. of thunder storm days	Days	45
3.1	Maximum Relative humidity	%	95
3.2	Maximum Relative humidity	%	26
4	Average Annual Rain Fall	mm	900
5	Maximum Wind Pressure	Kg/ sqm	195
6	Maximum Altitude above Mean Sea Level	m	1000
7	Isoceraunic Level	Days/ Year	45
8	Seismic Level (Horizontal Acceleration)	Zone	4
9	Average no. of rainy day per Year	Days/ Year	120
	Switchgear Design Data		
10	Service Voltage	kV	220
11	Maximum Service Voltage	kVp	245
12	Rated Insulation Level		
	-at power frequency 1 min	kV	460
	-at lightning impulse (1.2/50 μs wave)	kV	1050
13	Frequency	Hz	50
14	Rated service current (minimum)		
	- Bus bar	A	2000
	- Input Feeder bay	A	2000
	- Transformer bay	A	1250
	- Bus coupling bay	A	2000

Bharat Heavy Electricals Limited

Project: Pre Bid Tie up for 220 kV GIS Package for Panipat Refinery Expansion Project (P25)

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15	Rated short time withstand current (Symmetrical)	kA	50
	- Duration	Seconds	3
16	Internal fault withstand time without burn Through	ms	As per IEC-62271-203
17	Temperature rise at rated service current (indicative)		
	- Conductor	°C	As per IEC-60694
	- Enclosure	°C	
18	Rated SF6 gauge pressure at 20°C		
	- Circuit breaker	bar rel.	As per standard
	- Switchgear	bar rel.	
19	Enclosure design pressure		
	- Circuit breaker	bar rel.	As per standard
	- Switchgear	bar rel.	
20	Leakage rate of SF6 per annum for the whole substation	%	< 0.5
21	Maximum partial discharge level	pC	≤ 5
22	Factory Dielectric routine test 50Hz	kV	460
23	Site dielectric test	kV	380
24	Painting of switchgear		
	- Coating design and execution	RAL	As per detailed Specification/ Standard.
	- Top coat colour	RAL	
25	Surface protection of steel frames		Hot-dip Galvanizing with Zinc with 610gm/ square meter
26	Degree of Protection	IP	42
27	Disconnecter class		M2
28	Rated line charging interrupting current of breaker		As per IEC on light loaded line and 4 km of cable

Insulation co-ordination studies for the 220 kV GIS substation package to finalize location and quantity of surge arrestors required in addition to those shown in SLD. Insulation co-ordination studies for the 220 kV GIS substation package to finalize location and quantity of surge arrestors required in addition to those shown in SLD, cost of the same shall be inclusive in the bidder's scope.

All current carrying components of the equipment specified shall be capable of continuous operation at the specified rated current without exceeding the maximum temperature rise specified in the relevant IEC standards. Thermal calculations shall be based on the climatic conditions mentioned elsewhere in specification.

4. Bill of Quantities

1. SF6 gas for initial installation of complete GIS System, including wastage during installation, testing and successful commissioning shall be deemed included in the bidder's scope.
2. The offered GIS with LCC & its Accessories shall be complete in all respect in compliance to technical specification and relevant IS / IEC / IEEE standards as applicable. Any other equipment/material required to complete the specified GIS scope of work are inclusive of bidder's scope of supply & services.
3. All essential and desirable accessories are deemed inclusive of offer i.e. and not limited to Gas Monitoring Devices, Pressure Switches, PD sensors, Pressure relief device, insulator, expansion joint/ flexible, bellows/ compensators like lateral mounting units, Axial compensators, Parallel compensators, tolerance compensators and vibration compensators etc. complete in all respect.
4. Total contract value may vary up to $\pm 30\%$ at contract stage.
5. Any Item not quoted mentioned "Not Applicable" in bid price schedule and found applicable as per technical specification and system requirement shall be supplied free of cost by bidder without any time / cost implication to BHEL / Customer.
6. Length & route of GIB is purely indicative and same shall be finalized during detailed engineering stage.
7. BHEL reserve rights to amend Bay sequence during contract stage, no separate claim shall be admissible in this regards.
8. Supply scope of Testing & Maintenance Equipment – Scope of supply of following Equipments shall be applicable only if covered in BOQ / BPS.
9. SF6 Gas leakage detector
10. Gas filling and evacuating plant: (Gas Processing unit)
11. SF6 gas analyser
12. Portable Partial Discharge(PD) monitoring system
13. Online Partial Discharge Monitoring System
14. Main Bus 1 / 2 / Transfer Bus etc. (as applicable) Gas Insulated Bus Bars running across the length of the switchgear to interconnect each of the bay modules (as per layout) and necessary interfaces (as applicable under the technical requirement) is deemed inclusive in the scope. The same may or may not be indicated with break-up in BOQ / BPS. (BPS means Bid Price Schedule)
15. GIS shall be Double Bus configuration complete with local Control Cubical (LCC). Typical Bay includes Busbar, Circuit Breaker, Disconnecter & Maintenance Grounding Switch, Fast Acting Make Proof Grounding Switches, Voltage Transformer, Current Transformer, Surge Arrestor, SF6 to Air Bushings/ Cable Connection Module, GIS bus duct, Gas Monitoring Devices, Online PD Monitoring System, Pressure Switches, PD sensors, Pressure relief device, insulator, expansion joint/ flexible, compensator, online SF6 Gas filling system etc complete in all respect. (Refer attached Single Line Diagram & Feeder Datasheets). GIS shall be complete in all respect such as and not limited to all necessary terminal boxes, inspection windows, SF6 gas filling, interconnecting cabling & wirings, grounding connections, gas monitoring systems and

- piping, trays, support structures, wall / floor Inserts, **Foundation Bolts, Anchor Bolts**. Hence, the scope shall include supply erection / mounting of hardware.
16. Power, control & instrumentation cables for Cabling (1.) within GIS, (2.) GIS to LCC, (3.) LCC to LCC shall be deemed inclusive in bidder's scope of supply.
 17. Scope includes for completeness for GIS system with LCC & its Accessories
 18. Cabling between LCC to LCC shall be applicable if required in bidder's design philosophy.
 19. Cables required for bidder supplied GIS sub-system i.e. condition monitoring system (Gas monitoring system, PD monitoring system etc) are to be supplied by bidder as complete system.
 20. Necessary Cable Lug, Glands & shroud etc. required for installation of bidder's supplied cable are deemed inclusive in bidder's scope.
 21. Bidder to provide detailed "Bill of Quantity" during detailed engineering stage. Cabling & termination schedule for the same shall be provided by successful bidder along with AS BUILT drawing during contract stage.
 22. Power Cable TB's (for both AC & DC incoming feeder cables) shall be suitable for termination of requisite cable.
 23. Please refer 220kV Feeder Detail Datasheet (B269-999-16-50-DS-0034 & B269-999-16-50-DS-0033), Single Line Diagram and other sections of technical specification.
 24. Quantities for supply and services for 220kV GIS with LCC & its Accessories shall be as per Annexure_BOQ. Mandatory spares for applicable items shall be as per BOQ attached with the tender document.
 25. **GIS Services:** Site service activities shall be carried out at in stages as per requirement or front availability at site, and hence multiple visits for completion of work are envisaged. Site visit for supervision of unloading & verification of materials for proper storage and up-keeping at site includes following activities but not limited to, (a) Supervision of safe unloading of GIS & its accessories at site. (b) Reconciliation, storage & up keeping of materials, with due instructions/ training to site persons for long storage.
 26. Supervision of complete GIS System (as per scope of supply) along with all bay Equipments, indoor & outdoor (excluding Bus duct and SF6 to air bushing covered separate BOQ line item) such as and not limited to GIS extension module, GIS bus extension module, surge arrester, voltage transformer, LCC including structure, cabling, earthing & other associated activities shall be included in the scope.
 27. **Training of IOCL's personnel, performance guarantee test run for 72 hours of 220 KV GIS** is in the scope of bidder, cost of the same is deemed inclusive.
 28. During tender stage No of bays of 220KV GIS may vary. Number bays of 220KV GIS shall be finalized after receipt of Notification of award (NOA) from IOCL.
 29. Bidder to submit price break-up of spares as per Annexure_Sapres (**B269-999-16-50-SL-0020**) FOR GIS during tender stage. It shall not be binding on the BHEL to procure all of these mandatory spares.
 30. Length of GIB is purely indicative and same shall be finalized during detailed engineering stage in line with final approval of drawings from IOCL.
 31. Prices for all applicable accessories of GIS shall be included in the equipment prices. All items required for completeness of bay/ module such as SF6 gas, sensors, structure, earthing etc. shall be the part of respective bay/ module price. However, in the case of award of contract, Bidder will submit the price break-up for those items.

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32. Any other equipment/material required to complete the specified GIS scope of work are inclusive of bidder's scope of supply.
 33. **Gas Insulated Bus Duct:** GIB length of 1-phase busduct outside the GIS BAY MODULE shall be considered for mode of measurement. Bus duct lengths shall be taken from the end of bay equipment (VT, LA etc.) to end equipment (SF6 to air bushing, SF6 to oil bushing/ connection etc.). This including SF6 Gas, structure, Earthing, foundation bolt, PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, compensator, insulators etc. Complete in all respect.
 34. Connection between GIS to cable connection module is deemed inclusive in the scope of respective GIS Bay cost of the same shall not be paid separately.
 35. Any change in bay pitch (distance between bays): In a case where shifting of GIS bays shall be called by BHEL (during contract stage) due to layout requirement / cost optimization / revision / change in civil architectural requirement (Refer drawing B26900081410240B, SUBSTATION-100 (MAIN RECEIVING SUBSTATION) or due to expansion joint requirement in the GIS building, Bidder to incorporate the same with full compliance of technical requirement. Payment equivalent of BPS / BOQ item under head "Gas Insulated Bus Duct" shall be operated for additional length of Main Bus, subject to such shifting is not attributed to bidder.
 36. **Total GIS System has three different installation locations in Panipat Refinery Expansion Project (P25)**
 - a. **Substation – 100 MRSS (MAIN RECEIVING SUBSTATION)**
 - b. **Extension to Existing GIS near Switchyard (2 Bays)**
 - c. **Outdoor Switchyard (2 Bays)**

5. Other General Requirements

Other general requirements 220kV GIS with LCC & its Accessories shall be as follows,

1. Power, Control & Instrumentation / Special cable: All cables within GIS, GIS to LCC, between LCC to LCC shall be in bidder's scope of supply. Bidder to provide detailed "Bill of Quantity" during detailed engineering stage. Cabling & termination schedule for the same shall be provided by successful bidder along with AS BUILT drawing during contract stage. Power Cable TB's (for both AC & DC incomer cables) shall be suitable for termination of two wire of 16 Sqmm Aluminum (for each phase / polarity). The cables between LCC to CRP/ Bus Bar Panel shall be supplied and laid by BHEL under the supervision and input of the bidder.
2. Storage shall be provided by BHEL/ its contractor. However, bidder shall provide their tentative space requirement for covered and/ or open store area during tender stage only. In addition to this, bidder shall submit their standard storage instruction manual specifically specifying the item detailed with details of type of storage.
3. Bidder shall submit list of consumables with shelf life of less than six months and same shall be dispatched just before the erection and only after specific clearance from BHEL/ Customer.
4. Project Site is located in petrochemical/ process industry, which is highly corrosive & abundance of hydrocarbon area. Hence, GIS should be compatible with above

requirements during design, material selection and construction of GIS & its accessories and all equipment, accessories and wiring shall have tropical protection, involving special treatment of metal and insulation against fungus, insects and corrosion.

5. Packing of GIS & its accessories shall be suitable for long term storage without any deterioration in quality and performance (minimum 1 years, if required).
6. Bidder shall offer their latest type tested compact model to accommodate the specified & allocated space as per attached layout drawing of GIS. Bidder to note that if bidder fails to meet above requirement, its technical offer is liable for non-evaluation.
7. Bidder shall conduct insulation co-ordination studies in line with IEC:60071 for establishing surge arrester rating, quantity and any other requirement for successful operation of GIS.
8. Bidder shall check and ensure adequacy of system protection for successful operation of GIS. After checking of system by bidder, GIS shall be installed and if any failure, malfunction of any part occurs after/ during commissioning, same shall be replaced immediately without any extra cost.
9. The 220kV GIS building shall comprise an EOT (Electric overhead travel) crane. EOT crane for GIS is not envisaged in bidder's scope but bidder shall provide all the calculations basis for sizing of EOT crane during tender stage only.
10. CT/VT parameters mentioned in CT VT parameter document is indicative only. Bidder has to ensure correctness of CT/VT sizing for GIS during contact stage / detailed Engineering stage.
11. Any change in bay pitch (distance between bays) as per civil requirement for during detailed engineering stage shall be incorporated by the bidder without any cost and delivery implication to BHEL.
12. Bidder shall include painting and marking of all buses, individual incomers, all outgoing feeders etc. with details such as tag no., feeder rating, sending end source reference etc. for all switchboards.
13. The GIS shall be designed in such a way that suitable walkways are provided all around the switchgears so that the operators will be able to have free access to all the operating mechanism.
14. The GIS Equipment shall be complete with all necessary supports, ladders, galleries, staircases, catwalks, movable platforms or walkways (for accessing the equipment above two meters for maintenance and operation), mechanism cabinets, internal cable raceways etc for each bay and it shall be of modular construction and extendable design. All structures, galleries, staircases and walkways shall conform to the relevant Occupational Safety and Health Administration (OSHA).
15. Special tools & tackles for installation and testing kits for testing & commissioning including gas handling plant required for successful installation of GIS shall be in bidder's scope, however, it shall be brought at site on returnable basis only.
16. The general Tools and Tackles shall be provided by BHEL, list of the requirement i.e. general tools-tackle, spanners, gauges, slings and other lifting devices, crane, welding machines, drills, general instruments and appliances necessary for the installation of GIS is to be submit by bidder along the technical bid.
17. Bidder to furnish detailed BOQ for non-returnable special Tools and Tackles, if applicable along with unit prices to be handed over to ultimate customer. The prices for

the same shall be considered during evaluation.

18. All the testing kits including HV Test Kit required for successful testing / commissioning of offered GIS are to be arranged by bidder on returnable basis. Cost of the same shall be deemed inclusive in the offer.
19. SF6 Gas handling equipment required during erection, testing & commissioning in bidder' It is the responsibility of the contractor to supply all necessary commissioning spares as required unless/ until the equipment/ systems are handed over to the Purchaser (IOCL). scope.
20. Start-up & Commissioning spares are included in bidder's scope of supply and shall be included in the base price. Adequate stock of start-up & commissioning spares shall be made available at the site such that the start-up and commissioning of the equipment /systems, performance testing and handing over the equipment/ systems to the Purchaser can be carried out without any hindrance or delays.
21. ETC work schedule for all the GIS may vary according to readiness of site. Respective dates for the commencement of erection, testing and commissioning activities of GIS shall be communicated to manufacturers from time to time as per the readiness of site.
22. **Final documentation** shall be submitted in hard copy (Seven prints) and soft (Three CDs/DVDs)
23. For all control cables minimum 1 Pair shall be provided as spare.
24. Bidder to submit following **drawings/ documents at tender stage**:
 - Preliminary GAS SLD for the GIS.
 - Preliminary Layout/ section for the GIS.
 - Tentative building size including Colum placement and GIB exit requirement.
 - EOT Crane Details/ sizing.
 - Heat Load calculation for all the three GIS (Indoor part) for AHU load calculation.
 - AC-DC Load cycle, Continuous and Momentary load.

6. Earthing of GIS

1. Bidder to submit detailed calculations and layout drawings for earthing system during detailed engineering stage based on technical specification, bidder's design philosophy, IS/IEC/IEEE requirement as applicable. Bidder to provide the bill of quantity of entire GIS system with LCC & its Accessories
2. Supply of 40 mm MS ROD, 75X12 mm GI Flat, 50X06 mm GI Flat is not in bidder's scope of supply.
3. All other earthing materials including complete Hardwares, nut, bolts washers, lug etc. required, as per earthing design shall be in bidder's scope of supply.
4. Installation / Erection of earthing will be done by BHEL team under the supervision of bidder/manufacturer, as per manufacturer's design.

7. Modular Design & Future extensions

5. The GIS switch gear shall be of modular design offering high degree of flexibility. Each module shall be complete with SF6 gas circuit breaker, disconnectors, Maintenance Grounding

switches, fast Earthing switches, voltage transformers, Current transformers, bus & elbow sections, Gas Insulated Bus-duct, local control cubicle and all necessary components required for safe & reliable operation and maintenance.

6. The GIS shall be of either single-phase enclosure type or three-phase enclosure type for voltage levels of 220kV.
7. In those design where bus bar is continuous, provision is to be made available for isolation of individual bay without disturbing adjacent bay.
8. The switchgear shall be of the freestanding, self-supporting dead-front design, with all high-voltage equipment installed inside gas-insulated, metallic grounded enclosures, and suitably sub-divided into individual arc and gas proof compartments, preferably for:
 - (1) Bus bars
 - (2) Intermediate compartment
 - (3) Circuit breakers
 - (4) Line dis-connectors
 - (5) Voltage transformers
 - (6) Gas Insulated bus duct section between GIS and,
 - (7) Gas insulated bus section between GIS and oil filled transformer.
 - (8) Current Transformers.
9. The bus enclosure shall be sectionalized in a manner that maintenance work on any bus disconnector (when bus and bus disconnector are enclosed in a single enclosure) can be carried out by isolating and evacuating the small effected section and not the entire bus.
10. Arc faults caused by external reasons shall be positively confined to the originating compartment and shall not spread to other parts of the switchgear. In case of any internal arc fault in a busbar, busbar disconnector or circuit breaker, of double bus system, repair works must be possible without shutting down complete substation and at least one busbar and the undisturbed bays must remain in operation.
11. The busbar system shall be sectionalized for each bay and contained in individual SF6 gas tight bus compartments to prevent contamination of the gas of the whole bus bar due to fault in one bay zone and refill lesser quantity of SF6 gas.
12. Where bus Coupler is specified and in case of any internal arc fault in a busbar, busbar disconnector or sectionaliser, repair work must be possible without shutting down the complete substation and at least one half of the substation must remain in operation.
13. Documents indicating sequence of repair work steps and description of necessary restrictions during work shall be submitted with the technical manual during as built drawing submission.
14. Each bay module should be equipped with suitable arrangement for easy dismantling and refitting during maintenance without disturbing other units.
15. Material clearance certificate shall be issued after demonstration of the functionality of maintenance equipment.
16. Structural Steel, Support Structure & Hardwares (required for installation of complete GIS system with LCC & its Accessories etc.) are deemed inclusive of bidder's scope of supply. The same may or may not be indicated with break-up in BOQ / BPS.
17. All steel structure members shall be hot-dip galvanized after fabrication (excluding floor embedded items for which standard practice is to be followed). All field assembly joints shall be bolted. Field welding shall generally not be acceptable. Noncorrosive metal or plated steel shall be used for bolts and nuts throughout the work.

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18. Unless otherwise specified, minimum mass of zinc coating for Galvanizing shall be 610 gm/square meter.
 19. Lattice / Pipe structure Materials for support of GIS, Bus Ducts, SF6 to oil bushing/ SF6 to cable connection and SF6 to air bushing/ connection including Anchor Fastener Bolts, Foundation Bolts, Base Plate / Channel / Metallic / Structural Member for seating of GIS system, all floor and wall Embedded Items, wall crossing arrangements, Rails and/ or other items structural items as required. Manufacturer shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts, Anchor Fasteners, foundation bolts, nuts and washers, equipment fixing hardware shall be provided to fasten the switchgear base frames to the foundation channels as applicable
 20. The GIS Equipment shall be complete with all necessary supports, ladders, galleries, staircases, catwalks, movable platforms or walkways (for accessing the equipment above two meters for maintenance and operation), mechanism cabinets, internal cable raceways etc. for each bay and it shall be of modular construction and extendable design.
 21. Structural steel for complete GIS system with LCC & its Accessories is deemed inclusive in bidder's scope of supply.

8. Maintenance and Repair of Circuit Breaker

1. The positioning of the circuit breaker in the GIS shall be such that it shall be possible to access the circuit breaker of any feeder from the front side for routine inspection, maintenance and repair without interfering with the operation of the adjacent feeders.
2. The GIS shall be so designed that any component of the GIS can be removed easily. With minimum flexibility in the layout arrangement it shall be possible to remove the circuit breaker with both busbars remaining in service and it shall be possible to remove the disconnectors of the busbars, with one bus bar remaining in service. For achieving this requirement, adequate number of intermediate compartments, if required, shall be provided to ensure equipment & operating personnel's safety.
3. The bidder shall be required to demonstrate clearly in his submitted documents the suitability of the switchgear design in this respect. The arrangement shall be such that expansion of the original installation can be accomplished with minimum GIS down time.
4. In case of extension, the interface shall incorporate facilities for installation and testing of extension to limit the part of the existing GIS to be re-tested and to allow for connection to the existing GIS without further dielectric testing.
5. All the elements shall be accessible without removing support structures for routine inspections and possible repairs.

9. Interchangeability & Future Extension

1. As much as possible, all the parts shall be of standard manufacturer with similar parts and assemblies being interchangeable.
2. The GIS system shall be suitable for future extension on either end by the addition of extra feeders, bus couplers, bus-bars, circuit breakers, dis-connectors, and other switch gear

components. The arrangement of gas sections or compartments shall be such as to facilitate future extension without any drilling, cutting or welding on the existing equipment. To add equipment, it shall not be necessary to move or dislocate the existing switchgear bays

3. The layout shall ensure that GIS bus link section is provided for future extension of the GIS buses to avoid de-gassing and modification of the existing bus.
4. The physical layout shall ensure free movement of the SF6 Gas Cart and easy access to all components of the GIS for maintenance purposes.

10. Drawings / Documents for Manufacturing Clearance

The drawings/ documents, as follows shall be used for providing technical clearance for manufacturing of GIS and furthermore, it shall be used for delay analysis, if any, from bidder. The first drawing submission will be counted from the date of submitting reasonably correct drawings.

Sl. No.	Overall Drawings approval required in Cat I /Cat II
1	220KV GIS- Gas Schematics with Single Line Diagram (Including CT VT Parameters)
2	220KV GIS- Guaranteed Technical Particulars (Including all GIS equipment
3	220KV GIS- Layout Plan & Section
4	220KV GIS- Interfacing Drawings for Cable Connection Module, SF6 to Air Bushing, SF6 to Oil Module with Guaranteed Technical Particulars
5	220KV GIS- Equipment Layout with Earthing philosophy
6	220KV GIS- Type Test Reports (Including all GIS equipment)
7	220KV GIS- Secondary Engineering Base Design
8	220KV GIS- Control Schematics for GIS and Local Control Cabinet
9	220KV GIS- Maintenance Equipment Catalogue with Guaranteed Technical Particulars
10	220KV GIS- Quality Assurance Plan & Inspection Test Schedule
11	220KV GIS- Civil Design Specification with Foundation Loading Diagram (Including interfacing details)
12	220KV GIS- Quantification for main Items, Spares, Consumables
13	220KV GIS- 3D OGA Drawing (3D-Model with complete editable data base) compatible with Autocad & Primtech for complete GIS & its accessories.
14	Other documents as per Technical Specification / BOQ shall be finalized during detailed engineering stage.

The Manufacturing clearance shall be provided Lot wise, however lot item can be clubbed together subject to approval of drawing/ documents. MFC date will be counted from the date of approval of drawings in Cat I/ cat II , for each lot. **Break-up for lot items shall be done during detailed engineering stage, on receipt of firm order by customer.**

11. Type Testing

The offered 220kV GIS equipment and components shall conform to the type tests as per IEC

62271-203. bidder to ensure at the time of order placement that copies of valid type test certificates for tests conducted on identical design of offered equipment is available. In case of non-availability of type test certificates, same shall be conducted without any cost and time implication to Owner/ EIL

Please refer document 6-81-1066 Rev. 0, Inspection and Test Plan for EHV GIS Switchboard for details of type test requirement.

In case any of Type tests have not been conducted on the offered design or there has been a change in the design after the type tests. The requisite tests shall be conducted by bidder on the offered design without any extra cost and delivery impact to BHEL/ Customer.

12. Quality Plan

The successful bidder shall submit Quality Assurance Plan for major components such as breakers, disconnecting switches, lightning arrestors, earth switches, etc. with in-process inspection methods, tests, records, etc. for BHEL/ Customer approval. Customer hold points will also be included in the plan, which shall be mutually agreed by the BHEL/ Customer and Bidder and approved. In case bidder has reference Quality Assurance Plan agreed with BHEL/Customer, same shall be submitted for specific project to BHEL/ Customer approval. There shall be no commercial implication to BHEL/ Customer on account of Quality Plan approval.

Superior quality control system shall be adopted to assure high product quality. Raw materials of the best commercial grade quality and high reliability shall be used in the manufacture of GIS. High reliability of materials shall be ensured so as to keep maintenance work to a minimum. All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan. The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification. Charges for all these tests for all the equipment & components shall be deemed to be included in bidder's scope.

13. Inspection & Testing

1. GIS and its associated materials shall be subject to inspection by BHEL/ Customer or authorized representative at bidder/manufacturers' works. Hence, Bidder shall furnish all necessary information concerning the supply to BHEL/ Customer.
2. During fabrication, the equipment shall be subject to inspection by BHEL/ Customer or by an agency authorized by BHEL/ Customer to assess the progress of work as well as to ascertain that only quality raw material is used.
3. Bidder shall ensure that the hazardous area equipment provided shall have the necessary test certificates and valid CCOE approval certificates.
4. Bidder shall also furnish factory acceptance test (FAT) from manufacturers for BHEL/ customer approval in line with technical specifications.

14. Field Testing & Commissioning

1. Bidder shall carry out the supervision of installation, field testing and commissioning of 220kV GIS with LCC & its Accessories. Further appropriate test and commissioning reports and as-built documentation as necessary be submitted.
2. Field testing and commissioning of 220kV GIS with LCC & its Accessories shall be done by Bidder/OEM only.
3. Bidder shall also submit site acceptance testing (SAT) procedures and get them approved from BHEL/ Customer before carrying out the site testing at site.
4. All switchboard protection shall be subject to primary injection test before commissioning.
5. Bidder/ OEM shall coordinate with manufacturers of other equipment wherever required and shall freely and readily supply all technical information for this purpose as and when called for.
6. All electrical equipment shall be said to be installed and mechanically complete after circuit testing, primary and secondary injection testing and loop simulation is complete. Due care and consideration shall be given to the installation of 220kV GIS with LCC & its Accessories.

15. Makes of Equipment/ Components

Bidder/ vendor while ordering shall ensure the availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply. Bidder/ OEM shall give a notice of at least one year to the BHEL/ Customer before phasing out the products/spares to enable the owner for placement of order for spares and services.

16. Packing and Dispatch

1. The equipment shall be carefully packed for transport by sea, rail and road in such a manner that it is protected against the climatic conditions and for any damage during transportation, transit and storage. Packing of the equipment shall be suitable for long storage (minimum 1 year).
2. The SF6 equipment shall be shipped in the largest factory assembled units within transport and loading limitations and considering handling facilities on site to reduce the erection and installation work on site to a minimum. Where possible all items of equipment or factory assembled units shall be boxed in substantial crates or containers to facilitate handling in a safe and secure manner.
3. Each individual piece to be shipped, whether crate, container or large unit, shall be marked special notations such as 'Fragile', 'This side up', 'Centre of gravity', 'Weight', 'Owner's particulars', 'PO no.' etc., and other details as per purchase order.
4. 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.
5. Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. This applies particularly to the equipment of which each gas section shall be sealed and pressurized prior to shipping. Either dry nitrogen/air or dry SF6 gas shall be used and the pressure shall be such as to ensure that, allowing for reasonable leakage, it will always be greater than the atmospheric pressure for all variations in ambient temperature and the atmospheric pressure encountered during shipment to site and calculating the pressure to

which the sections shall be filled to ensure positive pressure at all times during shipment.

6. All blanking plates, caps, seals, etc., necessary for sealing the gas sections during shipment to site shall be provided. Any seals, gaskets, 'O' rings, etc. that will be used as part of the arrangement for sealing off gas sections for shipment of site, shall not be used in the final installation of the equipment at site. Vendor to provide quantity of components accordingly considering permanent installation and commissioning.

17. Abbreviations Used

The following terminology/ acronym hereunder and elsewhere in the technical specification used and their grammatical variations shall unless repugnant to the subject or context thereof, have the following full form hereunder respectively assigned to them, namely,

GIS:	Gas Insulated Switchgear
LCC:	Local Control Centre
IBP:	Isolating breaker panel
CT:	Current Transformer
DC:	Direct Current
HV:	High Voltage
EHV:	Extra High Voltage
kV:	Kilovolt
Hz:	Hertz
IP:	Ingress Protection
SAT:	Site Acceptance Testing
CCOE:	Chief Controller of Explosives
OEM:	Original Equipment Manufacturer
kV:	Kilovolt
Hz:	Hertz
IP:	Ingress Protection
PE:	Poly Ethylene
ANSI:	American National Standards Institute
ASTM:	American Society for Testing and Materials
BIS:	Bureau of Indian Standards
BS:	British Standard
IEC:	International Electro Technical Commission
IEEE:	Institute of Electrical & Electronics Engineers
IS:	Indian Standards
NEMA:	National Electrical Manufactures Association
CEA:	Central Electricity Authority
DIN:	Deutsches Institiut fur Normung
CCE:	Continuous and Comprehensive Evaluation
LPCB:	Loss Prevention Certification Board
CCOE:	Chief Controller of Explosives
OEM:	Original Equipment Manufacturer
BHEL:	Bharat Heavy Electricals Limited
OISD:	Oil Industry Safety Directorate

IOCL:	Indian Oil Corporation Limited
HVPNL:	Haryana Vidyut Prasaran Nigam Limited
ISBL:	Inside Battery Limit
OSBL:	Outside Battery Limit
LSTK:	Lump sum Turnkey
PRPC:	Petroleum Refining and Petrochemical
PNC:	Panipat Naphtha Cracker Complex
PR:	Panipat Refinery Complex
GIS:	Gas Insulated Sub-station
URT:	Unit Ratio Transformer
QAP:	Quality Assurance Plan
BOQ:	Bill of Quantities
PR:	Panipat Refinery

18. Definitions Used

The following expressions hereunder and elsewhere in the technical specification used and their grammatical variations shall unless repugnant to the subject or context thereof, have the following meanings hereunder respectively assigned to them, namely:

1. Battery Limit: The demarcated area within which the Unit is to be located.
2. Bid/Bidding Documents: The totality of the documents comprising the Bidding Document for the notice inviting tender.
3. Contract: The totality of agreement between Customer/ Purchaser/ Owner/IOCL and the Contractor/ LSTK Contractor/ BHEL as derived from the contract documents.
4. Contractor/ LSTK contractor: The bidder selected by the Customer/ Purchaser/ Owner/IOCL for the performance of the work and supply of materials. In this case, it is BHEL.
5. Customer/ Purchaser/ Owner: Indian Oil Corporation Limited.
6. Consultant: Any person(s)/ Firm nominated/ assigned by the Contractor/ LSTK Contractor/ BHEL for providing the engineering consultant services.
7. Bidder/ vendor: The bidder selected for this intended work shall be known as vendor.

19. List of Documents/ Drawings

Following drawing/ documents are attached for information purpose,

1. NTS B269999165000200C, KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)

In the following documents, bidder to please read as follows

1. EIL / Owner – Please read as BHEL/EIL /IOCL
2. Owner – Please read as BHEL/IOCL
3. Subcontractor – Please read as Bidder
4. Scope of supply & Services mentioned in Section -1 & BOQ shall super shed remaining section of technical specification
5. Please read documents w.r.t. the scope mentioned specifically for GIS, GIS accessories &

Other items mentioned in Technical Specifications.

20. Exclusions from Bidder's scope (NOT in bidder's scope)

The following items are specifically excluded from the bidder's scope of supply & services, irrespective of the same if covered under any section of technical specification other than Section-1 (PART-B). If specific requirement mentioned in the Section-1(PART-B) of technical specification shall overrule this specific exclusion.

1. Any scope of supply / services mentioned in Section-2 or Section-3 of technical specification but not having any relationship with GIS, LCC & its Accessories and not covered in Section-1 or BPS / BOQ shall be deemed excluded from bidder's scope. In case of ambiguity bidder to submit the same with technical bid / schedule of technical deviations.
2. 66 kV (& below) GIS system is not in bidder's scope, irrespective of the specification for the same may appear in technical specification.
3. Outdoor AIS Equipments
4. 220 kV Cables shall be supplied and laid by others.
5. 220 kV Cable termination kits for GIS shall be supplied by others. Termination of 220 kV Cables at 220 kV GIS end shall be done by others, necessary interfacing supply services are in bidder's scope.
6. Installation / Erection of GIS with LCC & its Accessories except supervision work.
7. Cable laying & terminations, however supervision work & termination of special cables shall be in bidder's scope.
8. Open & Closed stores at site. (Bidder to provide space requirement in tech bid)
9. Local transportation/ conveyance for bidder's engineers shall be arranged by BHEL between local stay and site.
10. Office assistance shall be provided BHEL including sitting facility etc.
11. Receipt & unloading of material at site except supervision work
12. Terminal connector for SF6 to Air Bushing to conductor or any other interfacing equipment.
13. Watch & Ward of GIS material at BHEL Store
14. Civil Works i.e. GIS Hall, civil works requirement for GIS System. (Please refer clause "Structure-Steel" for bidder's scope of supply)
15. EOT crane, Air Conditioning & Ventilation System, Illumination System & Fire detection & alarm system, however complete input shall be provided for EOT and other system
16. Control Relay & Protection Panels, Numerical Relays, Bus Bar Protection Panel, SAS & ECS system, ACDB, DCDB, Battery & Charger
17. Earthing material i.e. 40 mm MS Rod, 50X6 GI Flat, 75X12 GI Flat, 100X12 GI Flat for earthing
18. Power & Control cable beyond LCC
19. BHEL / Customer / BHEL appointed 3rd party inspector travel, lodging & boarding charges during testing / inspection.

	Description	UOM	QTY	Detailed Description of Scope
1.12	SUPPLY- GIS : 220KV, 50KA FOR 3S, GIS DOUBLE MAIN BUS SCHEME - SPARE TRANSFORMER GIS BAY MODULE	SET	2	Please refer Sr. nos. 19 / 20 (Transformer Feeder Spare) of the document: 220 kV GIS FEEDER DETAIL DATASHEET (HV-100103), Nos: B269-999-16-50-DS-0034, Rev.D . (Excluding Surge Arrester Module which is covered in separate BOQ item)
1.13	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - SF6 TO EHV CABLE GIS CONNECTION MODULE	SET	12	SF6 to EHV cable GIS connection module suitable upto 1600 Sqmm (above 630 Sqmm) and as per technical requirement mentioned in specification, 1 phase Cable, shall be as follows, but not limited to, (a) It shall be of the plug-in type with dry-type or fluid-filled terminations. The interfaces conform to IEC standards. A removable link, which disconnects and isolates the GIS from the cable during high-voltage test for convenience and ease of operations shall also be provided. (b) Termination kit for fixing of cable shall also be provided in line with IEC62271-209. (c) PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, insulators etc. as required. (d) Any other item required to complete the system in all respects but not limited to above. (e) 1 Set equals to supplies required for one Phase
1.14	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, GIS DOUBLE MAIN BUS SCHEME - SF6 TO EHV CABLE GIS CONNECTION MODULE (TYPE 2)	SET	36	SF6 to EHV cable GIS connection module suitable upto 630 Sqmm and as per technical requirement mentioned in specification, 1 phase Cable, shall be as follows, but not limited to, (a) It shall be of the plug-in type with dry-type or fluid-filled terminations. The interfaces conform to IEC standards. A removable link, which disconnects and isolates the GIS from the cable during high-voltage test for convenience and ease of operations shall also be provided. (b) Termination kit for fixing of cable shall also be provided in line with IEC62271-209. (c) PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, insulators etc. as required. (d) Any other item required to complete the system in all respects but not limited to above. (e) (e) 1 Set equals to supplies required for one Phase
1.15	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - GAS INSULATED BUS DUCT	MTR	30	GIB length of 1-phase busduct outside the GIS BAY MODULE shall be considered for mode of measurement. This including SF6 Gas, structure, Earthing, foundation bolt, PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, compensator, insulators etc. Complete in all respect.
1.16	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM - DOUBLE MAIN BUS SCHEME - BUS EARTH SWITCH GIS BAY	SET	2	220kV, 50kA for 3 second, 2000A GIS double main bus scheme bus earth switch bay GIS bay, each set comprising of following but not limited to, (a) 2 set- 1x3 phase high speed make proof grounding switch, complete with operating mechanism. (b) PD sensors, gas monitoring device, pressure relief device, busbar, insulator, expansion joint/ flexible, insulators etc. as required. (c) Any other item required to complete the system in all respects but not limited to above.
1.17	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, MAIN ITEM-DOUBLE MAIN BUS SCHEME - GIS SURGE ARRESTER MODULE WITH SURGE COUNTER	SET	48	1 Set equals 1 Phase surge arrestor. Necessary surge counter for every 3 numbers of surge arrestor is inclusive in the scope.
1.18	SUPPLY- GIS : 220KV, LOCAL CONTROL CUBICLE	SET	20	Bidder shall meet the requirement of LCC for the complete GIS System, mode of measurement shall be nos. of Bays with Circuit Breaker. LCC requirements other than Circuit Breaker Bays i.e. Bus PT, Bus earthswitch etc shall be deemed inclusive of bidders scope of supply with respective main item.
1.19	SUPPLY- GIS : 220KV, 50KA FOR 3S, 2000A, DOUBLE MAIN BUS SCHEME - SF6 GAS REQUIRED FOR PLACING GIS INTO SUCCESSFUL OPERATION	LOT	1	(1.) First filling of SF6 gas for the equipment supplied plus (2.) an additional quantity sufficient for conducting all the tests on equipment at site before placing it into successful operation plus (3.) 10% extra quantity of first filling as Quality of spare gas.

	Description	UOM	QTY	Detailed Description of Scope
1.20	SUPPLY- GIS : STRUCTURE MATERIALS FOR SUPPORT OF GIS, BUS DUCTS, SF6 TO OIL BUSHING/ CONNECTION AND SF6 TO AIR BUSHING/ CONNECTION INCLUDING FOUNDATION BOLTS, EMBEDDED ITEMS, RAILS AND/ OR OTHER ITEMS STRUCTURAL ITEMS REQUIRED	LOT	1	Structure Materials for support of GIS, SF6 to oil bushing/ connection and SF6 to air bushing/ connection including Foundation Bolts, Embedded Items, Rails and/ or other items structural items required. All steel structure members shall be hot-dip galvanized after fabrication. Unless otherwise specified, minimum mass of zinc coating for Galvanizing shall be 610 gm/square meter. All field assembly joints shall be bolted. Field welding shall not be acceptable. Noncorrosive metal or plated steel shall be used for bolts and nuts throughout the work. Manufacturer shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts, nuts and washers shall be provided to fasten the switchgear base frames to the foundation channels. In addition to above, supports, platforms, foundation bolts, embedded parts in floors etc., are also included in the scope as per the specification, but not limited to the following, (a) Base Plate, Channel, Metallic / Structural Member for seating of GIS system (b) Lattice / Pipe structure required for GIS bay, GIB,SF6 to oil bushing/ connection and SF6 to air bushing/ connection. (c) Foundation bolt / Anchor Fastening bolts for GIS system, if required. (d) Equipment fixing hardware. (e) Cable tray arrangement (mounted on structures of) GIS bay, GIB,SF6 to oil bushing/ connection and SF6 to air bushing/ connection. (f) Any other structural item required to complete the system in all respects but not limited to above. (Excluding structure for GIB which covered with main GIB item itself)
1.21	SUPPLY- GIS : EARTHING MATERIALS INCLUDING HIGH FREQUENCY EARTHING, IF APPLICABLE	LOT	1	Earthing Materials, except 40mm MS rod,75x12mm / 50x6 / 100X12 GI Flat, which shall be provided by BHEL as free issue item (FIM), however, exact requirement shall be intimated by bidder based on the earthing philosophy approved, and Supervision of erection of all earthing connection for GIS to Earth Mesh on Floor shall be scope including any special requirements including high frequency earthing. In case, high frequency earthing is not required, necessary design and calculations shall be submitted by bidder.
1.22	SUPPLY- GIS : 220KV, CONSUMABLES FOR GIS	LOT	1	All consumables including grouting material and chemicals for the chemical anchors bolts etc., if applicable for GIS system shall be provided by bidder, however, in case of consumables with shelf life less than six months shall be supplied with special permission and intimation from BHEL.
1.23	SUPPLY- GIS : 220KV, MAIN ITEM - LINE PT MODULE	SET	24	1 Set equals 1 Phase of line PT module complete in all respect. Please note, this shall be part of main bay & separate BOQ item is created for billing break-up purpose.
2.01	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - ONLINE PARTIAL DISCHARGE (PD) MONITORING SYSTEM FOR BOTH INDOOR & OUTDOOR GIS	LOT	1	5.7.15.4 Online Partial Discharge(PD) monitoring system for (a) 220kV indoor GIS, (b) 220kV outdoor GIS & (c) 220kV GIS extension. Please refer clause: 5.7.15.4 Online Partial Discharge(PD) monitoring system for both indoor & outdoor GIS of document: B269-999-16-50-SP-0020. Following online PD monitoring system shall be provided: (1.) One PD monitoring system at MRSS-1002. (2.) One PD monitoring system at Outdoor Switchyard substation (3.) Modification/Integration of existing PD monitoring system to include 2 nos. GIS bay extension.
2.02	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - ONLINE SF6 GAS FILLING / TOPPING-UP SYSTEM	SET	2	Please refer clause:5.7.15.5 SF6 topping system of document: B269-999-16-50-SP-0020. SF6 topping system shall be provided for 220 kV GIS for filling / topping up SF6 gas to panel under energized condition manually. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).
2.03	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - PORTABLE PD ANALYZER/ MEASUREMENT KIT SUITABLE FOR GIS ALONG WITH REQUIRED ACCESSORIES	SET	2	(Remark: 1 Set of each item for each location i.e. separate set for MRSS-100 (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).).

	Description	UOM	QTY	Detailed Description of Scope
2.04	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS LEAKAGE DETECTOR	SET	2	Please refer clause: 5.7.15.1 SF6 Gas leakage detector of document: B269-999-16-50-SP-0020. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).
2.05	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS FILLING, EVACUATING, FILTERING, DRYING, PUMPING & STORAGE PLANT	SET	2	Please refer clause: 5.7.15.2 Gas filling and evacuating plant of document: B269-999-16-50-SP-0020. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).
2.06	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 GAS ANALYZER	SET	2	Please refer clause: 5.7.15.3 SF6 gas analyser of document: B269-999-16-50-SP-0020. (Remark: 1 Set for each location i.e. separate set for MRSS-100 (i.e. common set for 220kV existing & 66kV Indoor future GIS) & New gantry substation (i.e. common set for 220kV Outdoor existing GIS and 33kV indoor future GIS).
2.07	SUPPLY- GIS MANDATORY MAINTENANCE EQUIPMENT - SF6 Gas Handling Unit / Service Cart	SET	1	Please refer clause: 6.11 of document: 6-51-0066, Document title: SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR
2.08	SPARES- GIS : 220KV, MANDATORY SPARES AS PER TECHNICAL SPECIFICATION	LOT	1	Price Break-up are to be submitted with technical bid
2.09	SUPPLY- GIS : RECOMMENDED OPERATION AND MAINTENANCE SPARES	LOT	1	Price Break-up are to be submitted with technical bid
3.01	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GIS BAYS INCLUDING LCC	LOT	1	Site service activities shall be carried out at in stages as per requirement or front availability at site, and hence multiple visits for completion of work are envisaged. Site visit for supervision of unloading & verification of materials for proper storage and up-keeping at site includes following activities but not limited to, (a) Supervision of safe unloading of GIS & its accessories at site. (b) Reconciliation, storage & up keeping of materials, with due instructions/ training to site persons for long storage. Supervision of complete GIS System (as per scope of supply) along with all bay Equipments, indoor & outdoor (excluding Bus duct and SF6 to air bushing covered separate BOQ line item) such as and not limited to GIS extension module, GIS bus extension module, surge arrester, voltage transformer, LCC including structure, cabling, earthing & other associated activities shall be included in the scope. (Excluding the Services item covered in separate BOQ items)
3.02	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GAS INSULATED BUS DUCT	MTR	30	GIB length of 1-phase busduct outside the <u>GIS BAY MODULE</u> shall be considered for mode of measurement.
3.03	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF SF6 TO AIR BUSHING	SET	6	Complete in all respect
3.04	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GIS	LOT	1	Complete in all respect (excluding Bus duct and SF6 to air bushing covered separate BOQ line item)
3.05	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GAS INSULATED BUS DUCT	MTR	30	Complete in all respect
3.06	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF SF6 TO AIR BUSHING	SET	6	Complete in all respect
3.07	SERVICES- GIS : 220KV, FINAL SUCCESSFUL HV/ POWER FREQUENCY TESTING OF GIS INCLUDING ARRANGING OF HV TEST KIT ALONG WITH OPERATOR	LOT	1	Complete in all respect
3.08	SERVICES- GIS : INSULATION CO-ORDINATION STUDIES FOR GIS SYSTEM	LOT	1	Complete in all respect

	Description	UOM	QTY	Detailed Description of Scope
	SPARES- GIS : REFERENCE UNIT PRICE FOR ADDITION / DELETION OF SUPPLY ITEMS (Unit Prices of Individual Equipment included here or in mandatory spares are required for any Addition/Deletion of Equipment and replacement of damaged items. Vendor to ensure that the unit prices have a logical relationship with prices of assemblies in main items. Quoting for unit prices is mandatory and shall be considered for evaluation)			
4.01	SPARES- GIS : SINGLE PHASE BUS BAR	MTR	1	Complete in all respect.
4.02	SPARES- GIS : GIS METALLIC ENCLOSURE	KG	50	
4.03	SPARES- GIS : EXPANSION BELLOWS/ JOINTS	Set	1	For Single Phase of any type and any rating.
4.04	SPARES- GIS : TEE BEND	Set	1	For Single Phase of any type and any rating.
4.05	SPARES- GIS : ANGLE BEND (135°)	Set	1	For Single Phase of any type and any rating.
4.06	SPARES- GIS : L-BEND	Set	1	For Single Phase of any type and any rating.
4.07	220KV GIS- SINGLE PHASE OF CURRENT TRANSFORMER EXCLUDING ASSOCIATED ENCLOSURE AND PRIMARY CONDUCTOR	SET	1	For Single Phase of any type and any rating.
	SERVICES- GIS : REFERENCE UNIT PRICE FOR ADDITION / DELETION OF SERVICES (Unit Prices of Individual services included here are required for any Addition/Deletion of Equipment and replacement of damaged items. Vendor to ensure that the unit prices have a logical relationship with prices of assemblies in main items. Quoting for unit prices is mandatory and shall be considered for evaluation)			
5.01	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR SUPERVISION OF ERECTION OF GIS	MANDAY	10	Charges for repetition of services - (if required due to reasons not attributed to the contractor) This item will be executed only if repetition of services is required by BHEL.
5.02	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR TESTING & COMMISSIONING OF GIS	MANDAY	10	Charges for repetition of services - (if required due to reasons not attributed to the contractor) This item will be executed only if repetition of services is required by BHEL.
5.03	SERVICES- GIS : REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - HIRING CHARGES OF HV TEST KIT WITH OPERATOR	LOT	1	Additional HV test kit charges including charges of operator, HV test kit, accessories & tools required for completion of HV test (Dielectric Test after installation of GIS). This item is executed only if repetition/ additional HV Test is required by BHEL i.e. post successful commissioning of GIS. (if required due to reasons not attributed to the contractor)
5.04	SERVICES- GIS : TRAINING FOR GIS AT SITE	DAY	1	
5.05	SERVICES- GIS : TRAINING FOR GIS AT MANUFACTURER WORKS	DAY	1	