Integration of new GIS system with existing ECS facility at both PR and PNCP -

1- Introduction – Presently Emerson make ECS system is used in Panipat refinery and ABB make ECS system is used at PNCP end for electrical system monitoring and Load shedding requirement. With the addition of grid facility, new GIS system components needs to be integrated with ECS system .

2- The ECS integration concept in ISBL scope of work is limited to providing all required IO for existing ECS system up-to intermediate marshalling box (MB) system . The major Scope of work under this head is limited to

a- Provision of all required IO signals at GIS, LIB , UPS, Charger, LT distribution system for hook up with existing ECS system. All critical signals shall be redundant as listed in IO list in Table-1 and 2 of this chapter.

b- Design, fabrication, supply & installation of Suitable sized MB at both PR and PNCP. Location of MB in PR will be in GIS substation building and location of MB for PNCP will be in existing SS-9 building. The MB specific requirement is listed in part-3 of this document.

c- Design, engineering, supply , laying , termination of all control and signal cables as per standard design requirement shall be in the scope of ~~EPC~~ contractor between source of signal to MB panel. Any cabling from MB to existing ECS system will be in IOCL scope.

d- Development of complete cable schedule and interconnection charts for IO signals from source to MB. Such documents shall be provided to IOCL for there use as required and instructed by EIC.

e- No other hardware of existing ECS system is in ~~EPC~~ contractor scope.

f- Scope of work is detailed below in two parts for modifications in existing ECS system for load shedding requirement –

Part 1- (work at PR- SS-28 end)-

a- The listed IO of new Grid system (for all 11 bays) and associated system needs to be provided for ECS hook up. The IO list for ECS hook up at PR end is given in table-A

b- One Marshalling box shall be provided in GIS substation for developing required connectivity with existing ECS system of PR .

Table-A

Sr no	Signal description	Source	Redundancy
1	220 KV all bays breaker ON status	~~220 KV GIS swgr~~ CRP	Yes (every signal shall be double). Only contacts/ Latche based contacts sha be provided
2	220 KV all bays breaker OFF status	~~220 KV GIS swgr~~ CRP	Yes (every sig be double) C contacts/ based co ay all

			be provided
3	220 KV all bays all isolator ON status	~~220 KV GIS swgr~~ CRP	Yes (every signal shall be double) Only hard contacts/ Latched relay based contacts shall be provided
4	220 KV all bays all isolator Off status	~~220 KV GIS swgr~~ CRP	Yes (every signal shall be double) Only hard contacts/ Latched relay based contacts shall be provided
5	220 KV all bays breaker ON command	MB to GIS	No
6	220 KV all bays breaker Off command	MB to GIS	No
7	220 KV all bays all isolator ON command	MB to GIS	No
8	220 KV all bays all isolator Off command	MB to GIS	No
7	Running MW in 4-20 ma mode from transducer for all 11 bays of GIS system	~~220 KV GIS swgr~~ CRP	Yes. Every MW signal shall be double .
8	Running MVAR in 4-20 ma mode from transducer for all 11 bays of GIS system	~~220 KV GIS swgr~~ CRP	No
9	MWH /MVArH of all 11 bays of 220KV	~~220 KV GIS swgr~~ CRP	No
10	System frequency (both line and both bus)	~~220 KV GIS swgr~~ CRP	yes
11	System Voltage (both line and both bus)	~~220 KV GIS swgr~~ CRP	Yes
12	Trip status of all 220 kv breakers	~~220 KV GIS swgr/~~ CRP	No
13	Trip circuit supervision of both trip circuit for all	~~220 KV GIS swgr~~ CRP	No

	breakers of 220KV GIS		
14	DC & AC supply supervision of both section	~~220 KV GIS swgr~~ CRP	No
15	Alarms of GIS monitoring system- -All compartment gas pressure -Humidity & density monitoring alarm -Bus differential supervision	~~220 KV GIS swgr/~~ CRP	No
16	Power factor of both grid incomers in 4-20 mA mode.	~~220 KV GIS swgr.~~ CRP	No
17	Monitoring of all relays healthiness (watchdog concept	~~220 KV CRP~~ CRP	No
18	Monitoring of DC control supply of CRP	~~220KV CRP~~ 220kV CRP	No
19	Common alarms of incipient fault (WTI/OTI/PRV/Buccohlz/MOG) of all grid transformers	220 KV CRP	No
20	Monitoring of relay healthiness (watchdog) of all LIB breakers.	LIB at Ss-63	No
21	Monitoring of healthiness of cable differential relay of both LIB	LIB at Ss-63	No
22	Monitoring of Trip circuit supervision of both LIB	LIB at Ss-63	No
23	Monitoring of DC & AC control supply of both LIB	LIB at Ss-63	No
24	Both LIB ON status	LIB at Ss-63	No
25	Both LIB OFF status	LIB at Ss-63	No

26	Both LIB ON command	LIB at Ss-63	No
27	Both LIB OFF command	LIB at Ss-63	No
28	Running MW in 4-20 ma mode from transducer for both LIB	LIB at Ss-63	No
30	Running MVAr in 4-20 ma mode from transducer for both LIB	LIB at Ss-63	No
31	Trip status of both LIB	LIB at Ss-63	No
32	Common alarm monitoring of all UPS/Chargers	220 KV GIS SS	No
33	Monitoring of Output voltage of all UPS in 4-20 mA concept	220 KV GIS SS	No
34	220KV Swg PMCC all breaker ON status	220 KV GIS SS	No
35	220KV Swg PMCC all breaker oFF status	220 KV GIS SS	No
36	220KV Swg PMCC all breaker ON command	220 KV GIS SS	No
37	220KV Swg PMCC all breaker OFF command	220 KV GIS SS	No
38	Monitoring of Trip circuit supervision of 220KV swg PMCC all breakers	220 KV GIS SS	No
39	Monitoring of DC & AC control supply of 220KV swg PMCC all PMCC breakers	220 KV GIS SS	No
40	Monitoring of DC & AC control supply of 220KV swg PMCC all breakers	220 KV GIS SS	No
41	Monitoring auto circuit supervision of 220Kv swg PMCC	220 KV GIS SS	No
42	Monitoring of temperature & humidity of 220 KV GIS	220 KV GIS SS	No

	substation room		
43	Monitoring of healthiness & alarms of NIFP & HVWS system of all four grid transformers	220 KV GIS SS	No
44	Monitoring of status & alarms of fault limiting devices	SS-63	No

c- All kind of hardware required in new 220 KV GIS system like contact multiplier, transducers shall be in the ~~ESTK~~ contractor scope including its supply, installation and commissioning.

Part 2- (work at PNCP SS-9 end)

a- The listed IO of new Grid GIS incomers & 2 nos LIB panels and associated system needs to be provided for ECS hook up. The IO list for ECS hook up at PNCP end is given in table-B

Table- B

1	33 KV both breaker ON status	SS-9 GIS generation bus	Yes (every signal shall be double). Only hard contacts/ Latched relay based contacts shall be provided
2	33KV both breaker OFF status	SS-9 GIS generation bus	Yes (every signal shall be double) Only hard contacts/ Latched relay based contacts shall be provided
3	33KV both incomer ON status	SS-9 GIS generation bus	Yes (every signal shall be double) Only hard contacts/ Latched relay based contacts shall be provided
4	33KV both incomer isolators Off status	SS-9 GIS generation bus	Yes (every signal shall be double) Only hard contacts/ Latched relay based contacts shall be provided
5	33KV both breaker ON	MB to SS-9 GIS	No

0 057

	command	generation bus	
6	33KV both breaker Off command	MB to SS-9 GIS generation bus	No
7	33KV both breaker isolators ON command	MB to SS-9 GIS generation bus	No
8	33KV both breaker isolators Off command	MB to SS-9 GIS generation bus	No
9	Running MW in 4-20 ma mode from transducer for both 33KV grid incomer	SS-9 GIS generation bus	Yes. Every MW signal shall be double .
10	Running MVAR in 4-20 ma mode from transducer for both 33KV grid incomer	SS-9 GIS generation bus	No
11	MWH /MVArH of both 33KV grid incomer	SS-9 GIS generation bus	No
12	System frequency (both line)	SS-9 GIS generation bus	yes
13	System Voltage (both line)	SS-9 GIS generation bus	Yes
15	Trip status of both 33KV grid incomer	SS-9 GIS generation bus	NO
16	Trip circuit supervision of both trip circuit for both 33KV grid incomer	SS-9 GIS generation bus	NO
19	DC & AC supply supervision of both 33KV grid incomer	SS-9 GIS generation bus	NO
20	Power factor of both 33KV grid incomer in 4-20 mA mode.	SS-9 GIS generation bus	NO
21	Monitoring of all relays of both 33KV grid incomer & LIBs (watchdog concept)	SS-9 GIS generation bus & LIB at SS-9	NO
22	Monitoring of relay healthiness (watchdog) of all	LIB at SS-9	NO

	LIB breakers.		
23	Monitoring of healthiness of cable differential relay of both LIB	LIB at SS-9	NO
24	Monitoring of Trip circuit supervision of both LIB	LIB at SS-9	NO
25	Monitoring of DC & AC control supply of both LIB	LIB at SS-9	NO
26	Both LIB ON status	LIB at SS-9	NO
27	Both LIB OFF status	LIB at SS-9	NO
28	Both LIB ON command	LIB at SS-9	NO
29	Both LIB OFF command	LIB at SS-9	NO
30	Running MW in 4-20 ma mode from transducer for both LIB	LIB at SS-9	NO
31	Running MVAr in 4-20 ma mode from transducer for both LIB	LIB at SS-9	NO
32	Trip status of both LIB	LIB at SS-9	NO

All kind of hardware required in new LIB and existing SS-9 GIS system like contact multiplier, transducers shall be in the ~~BSEK~~ contractor scope including its supply, installation and commissioning

Part-3 – MB Box & control cabling -

a- The marshalling box shall be of minimum IP-42 or better category with suitable Control TB mounting arrangement.

b- Digital and analogue output TB shall be separate and shall be clearly identified.

c- Cable entry in Marshalling box shall only be bottom entry . The minimum sheet thickness for non load bearing member shall be 1.6 mm while for load bearing members shall be 2.5 mm

d- All Digital signal shall be through 1.1 Kv LV control cable of minimum size of 1.5 sqmm, multistrand type

e- All signal cables shall be signal screened cable of size 2.5 sqmm

f- The MB and gland plate shall be big enough to accommodate total cables of control and signal nature. For sizing purpose the number of outgoing cables to be considered same as incoming cables

g- All the TB blocks shall be properly tagged with clear identification and shall macth with MB drawings.

h- MB box shall be floor mounted . All ~~structural work for MB installation , its earthing~~ , illumination and space heater shall be in the scope of ~~GETK~~ contractor including supply of material.

i- The MB can be with both side installation arrangement with provision of proper hinged type door system.

j- Minimum 20% spare TB of both Digital and analogue type signals (of total signals) shall be provided as spare

k- Insulating Separator plate or dual side insulated TB shall be used for all applications.

- **Minimum Indicative IO list of LMS system**

Annexure S-3/C-9/4

Sr no	Signal description	Source	Redundancy
1	220 KV all bays breaker ON status	~~220 KV GIS swgr~~ CRP	Yes (every signal shall be double). Only hard contacts/ Latched relay based contacts shall be provided
2	220 KV all bays breaker OFF status	~~220 KV GIS swgr~~ CRP	Yes (every signal shall be double) Only hard contacts/ Latched relay based contacts shall be provided
3	220 KV all bays all isolator ON status	~~220 KV GIS swgr~~ CRP	Yes (every signal shall be double) Only hard contacts/ Latched relay based contacts shall be provided
4	220 KV all bays all isolator Off status	~~220 KV GIS swgr~~ CRP	Yes (every signal shall be double) Only hard contacts/ Latched relay based contacts shall be provided
7	Running MW in 4-20 ma mode from transducer for all 11 bays of GIS system	~~220 KV GIS swgr~~ CRP	Yes. Every MW signal shall be double .
8	Running MVAR in 4-20 ma mode from transducer for all 11 bays of GIS system	~~220 KV GIS swgr~~ CRP	Yes. Every MVAR signal shall be double
10	Grid frequency (both line and both bus) from transducer	~~220 KV GIS swgr~~ CRP	Yes. Every Frequency signal shall be double
11	Grid Voltage (both line and both bus) from transducers	~~220 KV GIS swgr~~ CRP	Yes. Every voltag signal shall be do
12	Trip status of all 220 kv GIS breakers	~~220 KV GIS swgr/~~ CRP	No

13	Tap position feedback of all 4 grid transformer	Grid transformer	yes
14	Tap changing circuit healthy of all 4 grid transformer	Grid transformer	No
15	Tap changer raise command for all four grid transformer	Grid transformer	No
16	Tap changer lower command for all four grid transformer	Grid transformer	No
17	Generator breaker ON status of all PR and PNCP generators in hardwired mode . For PNCP signal OFC based IO transfer scheme may be used	PR Ss-28 , PR STG switchgear room and PNCP SS-9	Yes
18	Generator breaker OFF status of all PR and PNCP generators in hardwired mode . For PNCP signal OFC based IO transfer scheme may be used	PR Ss-28 , PR STG switchgear room and PNCP SS-9	Yes
19	Running MW in 4-20 ma mode from transducer for all 16 generators	PR Ss-28 , PR STG switchgear room and PNCP SS-9	Yes. Every MW signal shall be double .
15	Running MVAR in 4-20 ma mode from transducer for all 16 generators	PR Ss-28 , PR STG switchgear room and PNCP SS-9	Yes. Every MVAR signal shall be double .
16	System Frequency of PR generation system from transducer (tapped from 2 different generation bus)	PR SS-28	Yes. Total 4 Frequency input
17	System Frequency of PNCP generation system from transducer (tapped from 2 different generation bus)	PNCP SS-09	Yes. Total 4 Frequency input
18	PR generation bus voltage from transducer (tapped from 2 different generation bus)	PR SS-28	Yes. Total 4 voltage input
19	PNCP generation bus voltage from transducer (tapped from	PNCP SS-09	Yes. Total 4 voltage input

	2 different generation bus)		
20	All 16 generators active load raise command	PR SS-28/ PR STG control room & PNCP SS-09	No
21	All 16 generators active load Lower command	PR SS-28/ PR STG control room & PNCP SS-09	No
22	All 16 generators reactive load raise command	PR SS-28/ PR STG control room & PNCP SS-09	No
23	All 16 generators reactive load Lower command	PR SS-28/ PR STG control room & PNCP SS-09	No
24	All 4 URT tap changer Raise command	PR SS-28/ SS-63	No
25	All 4 URT tap changer status	PR SS-28 / SS-63	No
26	All 4 URT tap changer lower command	PR SS-28/ SS-63	NO
27	LMS system Auto. Manual selection	PR CPP control room / PNCP CPP control rrom	Yes

Note : Above IO list for reference purpose. Detail engineering and IO finalization shall be done as per project requirement and in line with tender documents.

Contents

SECTION 3
PROJECT DETAILS & GENERAL TECHNICAL REQUIREMENTS

1. General

1. This section stipulates the general technical requirements under the contract and will form integral part of the technical specification.
2. The provisions under this specification are intended to supplement requirement for the materials, equipment and services covered under this specification and is not exclusive. However, in case of conflict between requirements specified in this section and requirements specified in other sections the requirements specified under respective sections shall hold good.

2. Project Details

Panipat Refinery is a PSU Refinery and is having capacity of 15 MMTPA, catering the customers of northern India and is strategically important as per national interest. The refinery is located at Panipat, Haryana and was commissioned in the year 1998.

Presently 132KV supply to Panipat Refinery is provided from 2 sections of grid (one from PTPS and one from Munak) and point of supply is at Panipat Refinery 132KV switchyard Panipat Refinery complex is consisting of Refinery (will be marked as PR here onwards) and Naphtha cracker complex (will be marked as PNCP here onwards). As a strategic initiative, Panipat Refinery is planning for Bulk power import from HVPNL (Haryana Vidyut Prasaran Nigam Limited) at 220 KV level of 70 MW.

In view of this, Indian Oil Corporation Ltd. (IOCL) - Panipat Refinery is in the process of developing infrastructure to import 70 MW power from grid at 220 KV. Infrastructure development for grid power import at 220KV jobs consists of Inside Battery Limit (ISBL) jobs, Outside Battery Limit (OSBL) jobs.

Sl. No.	Description	Particulars
1	Customer	Indian Oil Corporation Ltd.
2	Consultant	TATA Consulting Engineers Ltd.
3	Project	LSTK job for ISBL work of 220KV Grid Power Import at IOCL, Panipat Refinery
4	Project location	Panipat (City): 16 Km (approx.) Chandigarh Highway: 11 Km (approx.) Noida (Advant)/ Delhi: 150 Km/ 80 Km (approx.)
5	Transport facilities	Well connected by road, rail & air with other parts of the country.

3. Meteorological Data

Equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions,

Sl. No.	Technical Parameters	Unit	Particulars
1	Location	Panipat, Haryana, India	
1.1	Maximum ambient temperature	^{0}C	50
1.2	Minimum ambient temperature	^{0}C	-5
1.3	Average ambient temperature	^{0}C	35
1.4	Design ambient temperature	^{0}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

NOTE: Moderately hot and humid tropical climate conductive to rust and fungus growth. The climate conditions are also prone to wide variations in ambient condition. Smoke is also present in the atmosphere. Heavy lightening also occurs during June to October. Switchyard is inside the refinery premise which is also prone to other corrosive gases like sulphur, H2S, Chlorine etc.

4. Instruction to Bidders

1. The bidders shall submit the technical requirements, data and information as per the technical specifications provided in the bid documents.
2. The bidders shall furnish catalogues, engineering data, technical information, design document, drawings etc fully in conformity with the technical specification.
3. It is recognised that the Manufacturer may have standardised on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the owner. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously; All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the schedule, will not be considered as valid deviation.

4. Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the technical specifications unless include in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard shall be deemed to be included in the scope of the specification. All similar standard components/parts of similar standard equipment provided, shall be inter changeable with one another.
5. Unless brought out clearly in the respective schedule of deviations, it will be considered that, the bid proposal scrupulously confirms compliance to the specification. The bidder must bring out all the deviations in the bid proposal.
6. In case there is a discrepancy between the data offered equipment and catalogue furnished, and unless the deviations are brought out clearly in the Technical Deviation Schedule, the equipment will be deemed to conform compliance to the specification scrupulously.

5. Standards

1. The works covered by the specification shall be designed, engineered, manufactured, built tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.
2. The equipment to be furnished under this specification shall conform to latest issue with all amendments of standard specified of this section as well as under respective Sections/Chapters of the specification.
3. In addition to meeting the specific requirement called for in the respective sections of the Technical Specification, the equipment shall also conform to the general requirement of the relevant standards and shall form an internal part of the specification.
4. The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intend to complement each other.
5. The Manufacturer shall also note that list of standards presented in this specification is not complete. Wherever necessary the list of standards shall of the specification shall take precedence.
6. When the specific requirements stipulated in the specification exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.
7. Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards referred shall also be accepted.
8. In case governing standards for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in deviation sheets along with English language version of standard or relevant shall be subject to Owner's approval.
9. Indicative List of Standards and Specifications General Standards Indian Electricity Rules

shall be as per Annexure- A.

6. Services to be performed by the Equipment being furnished

1. The 220/33 kV system is being designed to limit the switching surge over voltage and the power frequency over voltage within limits of IEC. The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, re-strike etc. under such over voltage conditions and in system where line lengths would extend up to 200 km.
2. All equipment shall also perform satisfactorily under various Electro-mechanical and meteorological conditions of the site of installation.
3. All the Equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, short circuit etc. for the equipment.
4. The bidder shall design the various forces for terminal connectors of the equipment are required to withstand.
5. The equipment shall also comply to the following:
   - All outdoor EHV equipment shall be suitable for hot line washing.
   - To facilitate erection of equipment, all items to be assembled as site shall be "match marked". All piping, if any between equipment control cabinet operating mechanism to marshalling box of the equipment shall bear proper identification to facilitate the connection at site.

7. Engineering Data

1. The furnishing of engineering data by the Manufacturer shall be in accordance with the schedule for each set of equipment as specified in the technical specifications.
2. The review of these data by the owner will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. This review by the owner may not indicate a thorough review of all dimensions, quantities and accuracy of the information submitted. This review and/or approval by the owner shall not be considered by the Manufacturer, as limiting any of his responsibilities and liabilities for mistakes and deviation from the requirements, specified under these specifications and documents.
3. All engineering data submitted by the Manufacturer after final process including review and approval by the owner shall from part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the owner in Writing.
4. LIST OF DOCUMENTS
   4.1 The bidder must furnish a detailed list of drawings/documents along with the bid proposal which he intends to submit to the owner after awarded of the contract.
   4.2 The supplier shall necessarily submit all the drawings/ documents unless anything is

waived. The supplier shall submit required sets of drawings/design documents/test reports as may be required for the approval of the owner.

4.3 All engineering data submitted by the Manufacturer after final process including review and approval by the Owner shall from part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the owner in Writing.

5. DRAWINGS

5.1 All drawing submitted by the Manufacturer including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnection between various portions of equipment and any other information specifically requested in the specifications.

5.2 Each drawing submitted by the Manufacturer shall be clearly marked with the name of the Owner, the unit designation, the specifications title, the specification number and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

5.3 Further work by the Manufacturer shall be in strict accordance with these drawing and no deviation shall be permitted without the written approval of the Owner if so required.

5.4 All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Manufacturer's risk. The Manufacturer may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Owner. Approval of Manufacturer's drawing or work by the Owner shall not relieve the Manufacturer of any of his responsibilities and liabilities under the Contract.

5.5 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Owner would be discussed and finalised at the time of award. The supplier shall also submit six (6) copies of all drawings/design documents/test report for approval of the Owner. The following tentative schedule shall be followed in general for approval. However final schedule shall be prepared with approval of Engineer in-charge post award of approval.

1	Submission, comments, by resubmission and approval recommended agency	Within 4 weeks of receipt
2	Approval/ comments/ by Owner	Within 4 weeks of receipt.

	on initial submission	
3	Resubmission	Within 3 (three) weeks (whenever from date of comments required) including both ways postal time.
4	Approval or comments	Within 3 weeks of receipt of commented drawing/ documents.
5	Furnishing of distribution copies	1 weeks from the date of last approval.

NOTE: The Manufacturer may please note that all resubmission must incorporate all comments given in the submission by the Owner failing which the submission of documents is likely to be returned.

5.6 The drawing which are required to be referred frequently during execution should be submitted on cloth lined paper.

5.7 OTHER REQUIREMENTS OF DOCUMENTATION

5.7.1 One set of soft copy of all drawings, manual, catalogues to be submitted along with 6 sets of hardcopies during submission of as built documents.

5.7.2 6 copies of instruction/operation manuals for complete project shall also be furnished. The instruction Manuals shall contain full details of drawing of all equipment being supplied under this contract, their exploded diagrams with complete instruction for storage, handing, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.

5.7.3 If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/additions/changes, the same shall be incorporated and the updated final instruction manual in the form of one (1) reproducible original and twelve (12) copies shall be submitted by the Manufacturer to the Owner.

The Manufacturer shall furnish to the Owners, twelve (12) sets of spare part catalogue.

5.8 TITLE BLOCK

Title block for project shall be as follows,

Customer:	Indian Oil Corporation Ltd.
Consultant:	TATA Consulting Engineers Ltd.
LSTK Manufacturer:	Bharat Heavy Electricals Ltd.
Project:	LSTK job for ISBL work of 220KV Grid Power Import at IOCL, Panipat Refinery

8. Colour Scheme and Codes

1. The Manufacturer shall propose parts a colour scheme for those equipment/ Items for which the colour scheme has not been specified in the specification, for the approval of Owner. The decision of Owner shall be final. The scheme shall include,
   - Finishing colour of Indoor equipment.
   - Finishing colour of Outdoor equipment.

- Finishing colour of all cubicles.
- Finishing colour of various auxiliary system equipment including piping.
- Finishing colour of various building items.

2. All steel structures, plates etc. shall be hot dip galvanised or painted with noncorrosive paint on a suitable primer as per the provisions of the respective Section. It may be noted that normally all Owner's electrical equipment in Owner's switchyard are painted with shade 631 of IS-5 and Owner will prefer to follow the same for this project also. All the indoor cubicles shall be of same colour scheme and for other miscellaneous items colour scheme will be approved by the Owner.

9. Material/ Workmanship

1. GENERAL REQUIREMENTS

1.1 Where the specification does not contain characteristics with reference to workmanship, equipment, materials and component of the covered Equipment, it is understood that the same must be new, of highest, grade of the best quality of their kind, conforming to the best engineering practice and suitable for the purpose for which they are intended.

1.2 The equipment must be new, of highest grade, the best quality of their kind, to best engineering practice and latest state of ardent in accordance with purpose for which they are intended and to ensure satisfactory performance throughout the service life.

1.3 In case where the equipment, material or components are indicated in the specification as "similar" to any special standard, the Owner shall decide upon the question of similarly. When required by the specification or required by the Owner the supplier shall submit, for approval, all the information concerning the material or components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Supplier.

1.4 The design of the work shall be such that installation, future expansions, replacement and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised; constructed and documented so that the component part shall be accurately positioned and retained to fulfil their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Owner.

1.5 Whenever possible, all similar part of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same material and workmanship as the corresponding parts of the equipment supplied under specification. Where feasible, common

component units shall be Employed in different pieces of the equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

1.6 All material and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). The erection procedure must be approved by the OEM and erection completion shall be certified by OEM for satisfactory completion. The commissioning of all major equipment as recommended by Engineer in-charge.

1.7 Only first-class work in accordance with the best modern practice will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouping, levelling, aligning, coupling of or bolting down to previously installed equipment bases/ foundation, performing the alignment check and final adjusting prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instruction and the specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits suitable guards shall be provided for the protection of personnel on all exposed rotating and/or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated location and tested for healthiness.

1.8 The Supplier shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purpose shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Supplier shall apply all operational lubricants to the equipment installed by him.

1.9 All oil, grease and other consumable used in the Works/Equipment shall be purchased in India unless the Supplier has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help Owner in establishing equivalent India make and Indian supplier. The same shall be applicable to other consumable too.

1.10 A cast iron or welded steel base plate shall be provided for all rotating equipment which are to be installed on a concrete base unless otherwise agreed to by the Owner. Each base plate shall support the units and its drive assembly, shall be of design with pads for anchoring the units and shall have a raised up all around and shall have threaded in air connections, if so required.

2. PROVISION FOR EXPOSURE TO HOT HUMID CLIMATE

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipment located in non- air conditioned areas shall also be same type.

2.1 SPACE HEATERS

2.1.1 The heater shall be suitable for continuous operation at 240 V as supply voltage. On-off switch and fuse shall be provided.

2.1.2 One or more adequately rated permanently or thermostatically connected heater shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the lower portion of the compartment and electrical connection shall be made from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation. This shall be demonstrated by tests.

2.1.3 The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centred in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conducting and electrical insulation properties, or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternately, they shall consist of a resistance wire mounted into a tubular ceramic body and embedded in vitreous gale. The surface temperature of the heater shall be restricted wire is wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

2.2 FUNGISTATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied to parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

2.3 VENTILATION OPENING

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass or galvanized steel to prevent the entry if insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

2.4 DEGREE OF PROTECTION

The enclosures of the control cabinets, junction boxes and marshalling boxes to be installed shall provide degree of protection as detailed here under:

a) Installed outdoor: IP 55

b) Installed indoor in air conditioned area: IP31

c) Installed in covered area: IP 52

d) Installed indoor in non-air-conditioned area where possibility of entry of water is limited: IP 41

The degree of protection shall be in accordance with IS: 13947(Part-I) or IEC-947 (Part-I). Type test report for degree of protection test, on each type of the box shall be submitted for approval.

The above requirement is indicative only. Requirements as provided in respective technical specification shall prevail.

10. Rating Plates, Name Plates and Labels

1. Each main and auxiliary item of substation is to be permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading condition under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Owner. The rating plates of each equipment shall be according to IEC requirement.
2. All such nameplates instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternatively, two separate plates one with Hindi and the other English Instruction may be provided.

11. First Fill of Consumable, Oil and Lubricant

All the first fill consumable such as SF6, AC refrigerant, oil, lubricant, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into successful operation, shall be supplied by the Manufacturer unless specification excluded under the exclusions in these specifications and documents.

12. Design Improvements

1. The bidder may note that the equipment offered by him in the bid only shall be acceptable, however, the Purchaser or the Supplier may propose changes in the specification of the equipment or quality thereof and if the parties agreed upon any such changes, the specification shall be modified accordingly.
2. If any such agreed upon change is such that if affects the price. and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of the completion before the Manufacturer proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

13. Quality Assurance Programme

1. To ensure that the equipment and services under the scope of this contract whether manufactured or performed within the Manufacturer's Work or at his SubManufacturer's premises or at the Owner's site or at any other place of work are in accordance with the

specification, the Manufacturer shall adopt suitable quality assurance programme to control such activities at all points necessary.

Such programme shall be outlined by the Manufacturer and shall be finally accepted by the Owner after discussions before award of contract. A quality assurance programme of the Manufacturer shall be generally covered the following,

a) His Organization structure for the management and implementation of the proposed quality assurance programme.
b) Qualification data for bidder's key personnel.
c) Documentation control System.
d) The procedure for purchases of material, parts components and selection of subManufacturer's services including vendor analysis, source, inspection, incoming raw material inspection, verification of material purchases etc.
e) System for shop manufacturing and, site erection control including process controls and fabrication and assembly control.
f) Control and non-conforming items and system for corrective actions.
g) Inspection and test procedure both for manufacture and field activities.
h) Control of calibration and testing of measuring instruments and field activities.
i) System for indication and appraisal of inspection status.
j) System for quality audits.
k) System for authorising release of manufactured product to the Purchaser.
l) System for maintenance of records.
m) System for handling storage and delivery. and
n) A quality plan detailing out the specific quality control measures and procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services ordered.

The Owner or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Manufacturer/his vendor's quality management and control activities.

2. QUALITY ASSURANCE DOCUMENTS

The Manufacturer shall be required to submit the following quality Assurance Documents within three weeks after despatch of the equipment.

All Non-destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication and report including radiography interpretation reports.

Welder identification list, listing welder's and welding operator qualification procedure and welding identification symbols.

Welder and Welding operator qualification certificate.

Raw material test reports on components as specified by the specification and for agreed to in the quality plan.

Stress relief time temperature chart/oil impregnation tile temperature chart.

Factory test results for testing required as per applicable codes/ mutually agreed quality plan/standards referred in the technical specification.

The quality plan with verification of various customer inspection points(CAP) as mutually agreed and methods used to verify the inspection and testing points in the quality plan were performed satisfactory.

14. Inspection, Testing and Inspection Certificate

1. The Owner/ his duly authorised representative and/or outside inspection agency acting on behalf of the Owner shall have at all reasonable times free access to the Manufacturer's premises or Works and shall have the power at all reasonable times to inspect and examine the material and the Workmanship of the Works during its manufacture or erection and if part of the works during its manufacturing or erection and if the part of works being manufactured or assembled at other premises or works, the Manufacturer shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the work were manufactured or assembled on the Manufacturer own premises or works, Inspection may be made at any stage of manufacture, despatch or at site at the option of the Owner and equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.
2. All equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with relevant standards.
3. The Manufacturer shall give the Owner/Inspector thirty (30) days written notice of any material being ready for testing along with work test certificate. Such tests shall be to the Manufacturer's account. The Owner unless witnessing of the tests is virtually waived, will attend such tests with thirty (30) days of the date of which the equipment is notified as being ready for tests/inspection, the Manufacturer must ensure TPI for all inspections in line with tender documents.
4. The Owner or Inspector shall, within fifteen (15) days from the date of inspection as defined here in give notice in writing to the Manufacturer, of any objection to any drawings and all any equipment and workmanship which in his opinion is not in accordance with the contract. The Manufacturer shall give due consideration to such objections and shall either made the modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the Contract.
5. When the, factory tests have been completed at the Manufacturer's or Sub-Manufacturer's Works the Owner/Inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests. The completion of these tests or the issue of

the certificate shall not bind the Owner to accept the equipment should, it, on further tests after erection be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of dispatch clearances in approved by the Owner.

6. In all cases where the Manufacturer provides for tests whether at the premises or at the works of the Manufacturer or of any Sub-Manufacturer. The Manufacturer except where otherwise specified shall provide free of charge such items as labour, material electrically, field water, stores, apparatus and instruments as may be reasonably demanded by the Owner/Inspector or his authorized representative to carry out effectively such tests of the equipment in accordance with the Manufacturer and shall give facilities to the Owner/ inspector or to his authorised representative to accomplish testing.
7. The inspection by Owner and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Manufacturer in respect of the agreed quality assurance programme forming a part of the Manufacturers.
8. The Owner will have the right of having at his own expenses any other test(s) of Reasonable nature carried out at Manufacturer premises or at site of in any other place in addition of aforesaid type and routine tests, to satisfy that the materials comply with the specification.
9. The Owner reserves the right for getting any field tests conducted on the completely assembled equipment at site.

15. Tests

1. CHARGING

   On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Owner and the Manufacturer for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at site. The list of pre-commissioning tests to be performed are given in section-7 and shall be included in the Manufacturer's quality assurance programme.

2. COMMISSIONING TESTS

   2.1 The available instrumentation and control equipment will be used during such tests shall calibrated. However un-measurable parameters shall be taken into account in a reasonable manner by the Owner for the requirement of these tests. The tests will be conducted at the specified load points and as near the specified cycle condition as practicable. The Owner will apply proper corrections in calculation, to take into account conditions which do not correspond to the specified condition.

   2.2 Any special equipment, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Manufacturer, free of cost.

   2.3 The specified tests to be conducted on equipment have been brought out in the respective chapters of the technical specification.

   2.4 The Manufacturer shall be responsible for obtaining statutory clearances from the

concerned authorities for commissioning the equipment and the switchyard. However, necessary fee shall be paid by Owner.

16. Packing and Shipping

All the equipment shall be suitably protected, coated, covered or boxes and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken account. The Manufacturer shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Owner takes no responsibility of the wagons.

17. Protection

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and pilings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

18. Painting and Finishing of Metal Surfaces

1. GENERAL

All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use shall be hot-dip galvanized after fabrication. High tensile steel nuts and bolts and spring washers shall be electro-galvanized to service condition. All steel conductors including those used for earthing/grounding (above ground level) shall also be galvanized according to IS: 2629.

2. HOT DIP GALVANIZING

2.1 The minimum weight of the zinc coating shall be 610g/sq.m and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM.

2.2 The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel; The finished surfaces shall be clean and smooth and shall be free from defects liked is colour patches, are spots, unevenness of coating, plate which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects notices on visual or microscopic inspection shall render the material liable to rejection.

2.3 After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

2.4 The galvanized steel shall be subjected to six one minute dips in copper sulphate solution as per IS-2633.

2.5 Sharp edges with radii less than 2.5mm shall be able to withstand four immersions of the standard price test. All other coating shall withstand six immersions. The following galvanizing tests should essentially be performed as per relevant Indian Standards.

- Coating
- Uniformity of zinc
- Adhesion test
- Mass of Zinc

2.6 Galvanized material must be transported properly to ensure that galvanized surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

3. PAINTING

3.1 All sheet steel work shall be digressed, pickled, phosphated in accordance with the IS-6005 "code of practice for phosphating iron and sheet". All surfaces which will not be easily accessible after shop assembly shall beforehand to be treated and protected for the life of the equipment. The surface which are to be finished painted after installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swart shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

3.2 After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and over drying. The phosphate coating shall be sealed with application of two coats may be "flash dried" while the second coat shall be stoved.

3.3 After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.

3.4 The exterior colour of the paint shall be as per shade No.:631 of IS-5 and inside shall be glossy white. Each coat of primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipment.

3.5 In case the bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures, like electrostatic painting etc. the procedure shall be submitted along with the bids for Owner's review & approval.

19. Handling, Storing and Installation

1. In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Owner or his representative, the Manufacturer shall unload, store, erect, install, wire test and place into commercial use all the electrical equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energization at rated voltage.
2. Manufacturer may engage manufacturer's engineer to supervise the unloading, transportation to site, storing and erection. The Manufacturer shall engage the manufacturer's Engineer's for testing and commissioning of the various equipment being procured by them separately. Manufacturer shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s)/ as per Manufacturer's approved process and shall extend full cooperation to them.
3. In case of any doubt or misunderstanding as to the correct interpretation of manufacture's drawing or instruction, necessary clarifications shall be obtained from the Owner/ Manufacturer. Manufacturer shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawing/instructions correctly.
4. Where assemblies are supplied in more than one section, Manufacturer shall make all necessary mechanical and electrical connections between section including the connection between buses. Manufacturer shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected during testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Manufacturer at his own expense.
5. Supplier shall be responsible for examining all the shipment and notify the Owner immediately of any damage, shortage, discrepancy etc. for the purpose of Owner's information only. The supplier shall submit to the Owner every week a report detailing all the receipts for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the Supplier.
6. The Manufacturer shall be fully responsible for the equipment material unit the same is handed over to the Owner in an operating condition after commissioning. Manufacturer shall be responsible for the maintenance of the equipment material while in storage as well as after erection unit taken over by Owner, as well as protection of the same against theft, element of nature, corrosion, damages etc.
7. Where material/equipment is unloaded by Owner before the Manufacturer arrives at site or even when he is at site. Owner by right can hand over the same to Manufacturer and there upon it will be the responsibility of Manufacturer to store the material in an orderly

and proper manner.

8. The Supplier shall be responsible for making suitable indoor storage facilities, to store all equipment which require indoor storage.
9. The words 'erection' and 'installation' used in the specification are synonymous.
10. Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.
11. The minimum phase to earth, phase to phase and section clearance for the various 132 kV, 66 kV and 33 kV sections of the switchyard are given below,

Voltage Grade	220kV	132kV	33kV
Phase to earth (mm)	2100	1300	320
Phase to Phase (mm)	2100	1600	350
Section clearance (mm)	5000	4000	2800

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life.

20. Protective Guard

Suitable guards shall be provided for protection of personnel on all exposed rotating and/ or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy installation and removal for maintenance purpose.

21. Design Co-ordination

1. The Manufacturer shall be responsible for the selection and design of appropriate equipment to provide the best co-ordinate performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done so that it facilitates easy field assembly and maintenance.
2. The Manufacturer has to coordinate designs and termination with the agencies (If any) who are LSTK vendors/ Manufacturer for the Owner if applicable. The names of agencies shall be intimated to the successful bidders.

22. Design Co-Ordination Meeting

The Manufacturer will be called upon to attend design co-ordination meeting with the Engineer, other Manufacturer's and the LSTK vendors of Owner (If any) during the period of Contract. The Manufacturer shall attend such meeting at his own cost as and when required and fully cooperate with such person and agencies involved during those discussions.

23. Tools and Tackles

The Manufacturer shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately, packed and brought on to Site.

24. Equipment Bases

A cast iron or welded steel base plate shall be provided for all rotating equipment which is

to be installed on a concrete base unless otherwise agreed to by the Owner. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.

25. Control Cabinets, Junction Boxes, Terminal Boxes & Marshalling Boxes for Outdoor Equipment

1. All type of boxes, cabinets etc. shall generally conform to & be tested in accordance with IS5039/IS-8623, IEC-439, as applicable, and the clauses given below.
2. Control cabinet, junction boxes, marshalling boxes & terminal boxes shall be made of sheet steel or aluminium and shall be dust, water and vermin proof. Sheet used shall be least 2.0 mm cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminium enclosed box the thickness of aluminium shall be such that it provides adequate rigidity and long life as comparable with sheet of specified thickness.
3. The enclosures of the control cabinets, junction boxes, terminal boxes &marshalling boxes shall provide a degree of protection of not less than IP 55 as per IS: 2147. The bidder shall offer type tested (IP:55) Marshalling kiosk and type test report for degree of protection test each type of box shall be furnished for arrival. After protection degree test of marshalling kiosk, 2.0 kVrms for 1 (one) minute, insulation resistance and functional test should have been conducted. In case these tests have not been carried out during IP55 test, then the Manufacturer shall carry out the IP-55 test along with these tests, at his cost.
4. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.
5. All door, removable covers and plates shall be gasketed all around with suitably profiled EPDM gaskets. The gasket shall be tested in the presence of Owners representative. The quality of gasket shall be such that it does not get damaged/ cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth straight and reinforced of necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass or GI wires.
6. All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connection. Boxes and cabinet shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the base of the marshalling kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland plate. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required. The Nickel

plated glands shall be dust proof, screw on & double compression type and made of brass. The gland shall have provision for securing armour of the cable separately and shall be provided with earthing tag. The glands shall conform to BS:6121.

7. A 240V, single phase, 50Hz, 15amp AC plug and socket shall be provided the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.
8. For illumination of control cabinet, a 7 Watt LED shall be provided.
9. All control switches shall be of rotary switch type and Toggle/piano switches shall not be provided.
10. EARTHING
    Positive earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire shall be terminated on to the earthing pad and secured by the use of star of self-etching washer. Earthing of hinged door shall be done by using a separate earth wire.
11. TESTS
    The marshalling kiosks shall be subject to routine tests as per 18:5039. The following routine tests shall also be conducted:
    - Check for wiring
    - Visual and dimension check

    Marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/ferruling by pasting the same on the inside of the door.

26. Auxiliary Switches

The auxiliary switch shall confirm to the following type tests:

a) Electrical endurance test -A minimum of 2000 operation for 2A DC with a time constant examination of mV drop/visual defects/temperature rise test.
b) Mechanical endurance test. A minimum of operations as specified in the relevant IS with a subsequent checking of contact pressure test visual examination. Heat run test on contacts.

27. Terminal Blocks and Wiring

1. Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.
2. Terminal blocks shall be 1100 v grade and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be non-disconnecting stud type equivalent to Elmex type CATM4, Phoenix cage clamp type of Wedge or equivalent. The insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

3. Terminal block for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.
4. The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally.
5. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable.
6. The terminal blocks shall be of extensible design.
7. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.
8. The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.
9. Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

a)	All circuits except CT circuits	Minimum of 2.5 sq.mm copper flexible
b)	All CT circuits copper flexible.	Minimum of 4 sq.mm.

10. The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live.
11. At least 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.
12. There shall be a minimum clearance of 250 mm between the First bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm.
    The Supplier shall furnish all wire, conduits and terminals for the necessary interphase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets. The wiring required in these items shall be run in metallic ducts or shielded cables in order to avoid surge overvoltage either transferred though the equipment or due to transients induced from the EHV circuits.
13. All input and output terminals of each control cubicle shall be tested for surge withstand capability and transverse modes. The supplier shall also provide all necessary to achieve an impulse withstand level at the cable interfaces of equipment.

28. Lamps and Sockets

1. LAMPS
   All indication lamps shall also be LED based. Socket base shall be as per IS-1258, except in the case of signal lamps.
2. SOCKETS
   All sockets (convenience outlets) shall be suitable to accept both 5 A &15 A pin round

Standard Indian plugs. They shall be switched sockets with shutters.

3. HAND LAMP
   A 240 Volts, single phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.
4. INTERIOR LIGHTING
   Each panel shall be provided with a LED lighting fixture of Standard Indian type rates for 240 Volts, single phase, 50 Hz supply for the interior illumination of the panel during maintenance. The Fitting shall be controlled by the respective panel door switch.
5. SWITCHES AND FUSES
   5.1 Each control panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with switch fuse units. Selection of the main and Sub-circuit fuse rating shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by fuses.

   5.2 All fuses be of HRC cartridge type conforming to IS:9228 mounted on plug-in type fuse bases.

   5.3 Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. AII accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuses carrier base shall have imprints of the fuse rating and voltage.

29. Rating Plates, Name Plates and Labels

Each main and auxiliary item of equipment is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment, type or serial number together with details of loading conditions under which the item of equipment in question has been designed to operate and such diagram plates as may be required by the Owner. The rating plate shall conform to lEC requirement.

All such name plates, instruction plates rating plates etc. shall be in bilingual with Hindi inscription first followed by English. Alternatively, two separate plates one with Hindi & the other with English inscription may be provided.

Annexure-A:

List of Standards and Specifications/ General Standards/ Indian Electricity Rules

IS-5: Colours for Ready Mixed Paints and Enamels IS-335 Insulating Oil for Transformers and switchgear
IS-375: Marketing and Arrangement for Bus-bars, Main Connection & Auxiliary Winding
IS-617: Aluminium and Aluminium alloy & Ingots and Castings for General Engineering Purposes
IS-1448: Methods of Test for Petroleum and its Products.
IS-2071: Measuring Devices
IS-2147: Degree of Protection Provided by Enclosures of for Low voltage switch gear and control Gear
IS-2165: Phase-to-Phase Insulation Co-ordination, Principles and Rules
IS-2362: Determination of Water by the Karl fisher Method
IS-3043: Codes of practice for earning
IS-3202: Code of Practice for climate proofing of electrical equipment
IS-3637: Gas Operated Relays
IS-6103: Methods of Test for specific resistance (Resistivity) of Electrical Insulating Liquids
IS-6104: Method of Test for Interfacial Tension of Oil against Water by the Ring Method.
IS-6262: Method for Determination of Electric strength of insulating liquids.
IS-6792: Method for Radio Interference Tests on High Voltage Insulators
IEC-214: On-Load Tap-Changers
IEC-289: Reactors
IEC-354: Loading Guide for Oil Immersed power transformers.
IEC-551: Determination of Transformer and reactor Sound levels
ANSI-C57, 12, 80: General requirements for Distribution, Power and Regulating Transformers.
ANSI-C57, 12, 90: Test Code for Distribution, Power and Regulation Transformers.
ANSI-C57, 16: Terminology & Test Code for current limiting Reactors.
ANSI-C57, 21: Requirements Terminology and Test Code for Shunt Reactors Rates over 500 KVA.
ANSI-C57, 92: Guide for loading Oil-Immersed Power Transformer up to and including 100 MVA with 55oC or 65oC Winding Rise
ANSI-CG, IEEE-4: Standard Techniques for high Voltage Testing
NEMA-TR-1: Transformers, Regulators and Reactors
IS-4379: Identification of the Contents of Industrial Gas Cylinders

1. Cubicles and Panels & Other related Equipment

IS:722: AC Electricity Meters (P1 to P9)
IS 1248 Direct acting indicating analogue electrical measuring instruments their accessories.
IS722, IS-1248: (PO-3) Electrical relays for power system protection.
IS-3231, 3231, IEC-68.2.2: Basic environmental testing procedures Part 2: Test B: Dry heat
IEC-529: Degree of Protection provided by enclosures

IEC-158: Low Voltage control gear, Manufacturers
IEC-439: Low voltage switchgear and control gear assemblies
ANSI-C37.20: Switchgear assemblies, including metal enclosed bus.
ANSI-C37.50: Test Procedures for low voltage alternating current power circuit breakers
ANSI-C39: Electric Measuring instrument.
ANSI-C83: Components for electric equipment
IS:8623: Specification for sugar NEMA-AB-Moulded Case circuit and systems

2. Lt Switchgear

IS:8623: Specification for factory built assemblies of Switchgear & Control gear for voltages upto and including 1000 V AC/ 1200V DC
IS:4237: General requirements for switchgear and control gear for voltage not exceeding 1000 V.
IS2147: Degree of protection provided by enclosures for low voltage switchgear and control gear.
IS:3202: Code of practice for climate proofing of electrical equipment.
IS:3072: Code of practice for installation and maintenance of switchgear
IS:8544: AC motor starters of voltage not exceeding 1000 Volts
IS:4064: Air-break switches, air break dis-connectors air break dis-connectors and fuse combination unit for voltages not exceeding 1000V AC or 1200V DC.
IS:3231: Electrical relays for power system protection.
IS:1248: Electricity indicating instruments
IS:722: AC Electricity meters.
IS:375: Marking and arrangements of bus bars.
IS:9224: HRC Cartridge fuses (Part II)
IS:6875: Switches and push-buttons
IS:6005: Code of practice of phosphating iron and steel
IS:5082: Wrought Aluminium and Aluminium alloys for electrical purposes.

3. Protection and Control Equipment

IEC-51: Recommendations for Direct acting indicating analogue electrical measuring instruments and their accessories.
IEC-255: Electrical relays
IEC-297: Dimensions of mechanical structures of the 482.6mm (19 inches) series.
IEC-359: Expression of the performance of electrical & electronic measuring equipment. IEC-387 Symbols for Alternating-Current Electricity meters
IEC-447: Man machine interface/ MM-Alternating principles
IEC-521: Class 0.5, 1 and 2 alternating current wall hour meters
IEC-547: Modular plug-in unit and standard 19-inch rack mounting unit based on NIM standard (for electronic nuclear instruments)
ANSI-81: Screw threads.
ANSI-B18: Bolts and Nuts
ANSI-C37.1: Relays, Station controls etc.

ANSI-C37.2: Manual and automatic station control, supervisory and associated telemetering equipment.
ANSI-C37.2: Relays and relay system associated with electric power apparatus.
ANSI-C39.1: Requirements for electrical analogue indicating instruments.

4. Material and Workmanship Standards

IS-1363: Hexagon head bolts, screws and nuts of product grade C.
IS-1364: Hexagon head bolts, screws and nuts of products grades A and B
IS-3138: Hexagonal Bolts and nuts (M42 to M150)
IS-898: Fasteners: Bolts, screws and studs

5. Battery Chargers

IS:3895: Mono-Crystalline Semiconductor Rectifier Cells and stacks
IS:4540: Mono-crystalline semiconductor rectifier assemblies and equipment
IS:6619: Safety code for semiconductor rectifier equipment.
IS:2026: Power Transformer
IS:2959: AC Manufacturers for voltage not exceeding 1000 Volts
IS:1248: Indicating Instruments
IS:2208: HRC Fuses
IS:4064: Air break switches, air break Disconnector & fuse combination units for voltage not exceeding 1000V Ac or 1200V DC.
IS:2147: Degree of protection provided by enclosures for low voltage switchgear and control gear.
IS: 600:5: Code of practice for phosphating of Iron and steel.
IS:3231: Electrical relays for power system protection
IS:3842: Electrical relay for AC systems.
IS:5: Colours for ready mix paints.

6. Battery

IS:1651: Stationary Cells and Batteries, Lead-Acid Type (with Tubular Positive Plates).
IS:1652: Stationary Cells and Batteries, Lead-Acid Type (with Plant Positive Plates).
IS:1146: Rubber and plastic containers for Lead-Acid Batteries
IS:6071: Synthetic separators for Lead-Acid batteries.
IS:266: Specification for Sulphuric Acid.
IS:1069: Specification of water for storage batteries
IS:3116: Specification for sealing compound for lead-acid batteries
IS:1248: Indicating Instruments

7. Wire and Cables

IS-694: PVC insulated cables for working voltages upto and including 1100Volts.
IS-1255: Code of practice for installation and maintenance of power cables upto and including 33 kV rating.
IS-1554: PVC insulated (heavy duty) electric cables (part 1) for working voltage upto and including 1100 V Part (2) for working voltage from 3.3 upto including 11 kV.

IS-1753:	Aluminium conductors for insulated cables
IS-2982:	Copper conductors in insulated cables and cords.
IS-3961:	Recommended current rating for cables.
IS-3975:	Mild steel wires, formed wires and tapes for armouring of cables
IS-5831:	PVC insulated and sheath of electric cables
IS-6380:	Elastomeric insulating and sheath of electric cables.
IS-7098:	Cross linked polyethylene insulated PVC sheathed cables for working voltage up to and including 1100 volts. Part (2) Cross-linked polyethylene insulated PVC sheathed cables for working voltage from 3.3 kV up to and including 33 kV.
IS-8130:	Conductors for insulated electrical cables and flexible cords.
IS-10418:	Specification for drums for electrical cables. IEC-96 Radio Frequency cables
IEC-183:	Guide to the selection of High Voltage Cables.
IEC-189:	Low frequency cables and wires with PVC insulation and PVC Sheath
IEC-227:	Polyvinyl Chloride insulated cables of rated voltages up to and including 450/750 V.
IEC228L	Conductors of insulated cables.
IEC-230:	Impulse tests on cables and their accessories.
IEC-287:	Calculation of the continuous current rating of cables (100% load factor).
IEC-304:	Standard colours for insulation for low frequency cables and wires.
IEC-331:	Fire resisting characteristics of Electric cables.
IEC-332:	Tests on electric cables under fire conditions
IEC-502:	Extruded solid dielectric insulated power cable for rates voltages from 1 kV up to 30 kV.
IEC-754:	Tests on gases evolved during combustion of electric cables.
NEMA-WC1:	Asbestos and asbestos-varnished cloth and asbestos thermoplastic insulated wire and cable
NEMA-WC2:	Steel armour and associated covering for impregnated paper insulated cables
NEMA-WC3:	Rubber insulated wire and cable for transmission and distribution of electrical energy.
NEMA-WC5:	Thermoplastic insulated wire and cable for the transmission and distribution of electric energy.
NEMA-WC7:	Cross linked thermo setting polyethylene insulated wire and cable for the transmission and distribution of electrical energy.
NEMA-WC8:	Ethylene-propylene-rubber insulated wire and cable for the transmission and distribution of electrical energy.
NEMA-W67:	Cross linked thermo setting polyethylene
IS-659:	Safety code for air conditioning
IS-1391:	Room air conditioners.
IS-6272:	Industrial cooling fans.

8. Galvanizing

IS-209:	Zinc Ingot.
IS-2629:	Recommended practice for Hot-Dip galvanizing on iron and steel.
IS-2629:	Methods for testing uniformity of coating of zinc coating articles.
ASTM-a-123:	Specification for zinc (Hot galvanizing) coatings on products fabricated from rolled, pressed and forged steel shapes, plates, bars and strips.

ASTM-A-153: Specification for Zinc coating (Hot Dip) on iron and steel hardware
ASTM-A-239: Test method for locating the thinnest. Spot in a Zinc (galvanised) coating on iron and steel articles by the preece test (Copper sulfated dip).

9. Fire Protection

IS-554: Dimensions for pipe threads where pressure tight joints are required on the threads.
IS638: Sheet rubber jointing and rubber insertion jointing.
IS-778: Copper alloy gate, globe and check values for water works purposes.
IS-780: Sluice valves for water-works purposes (50 to 300 mm size)
IS-1536: Centrifugally cast (spun) iron pressure pipes for water gas and sewage.
IS-1538(1993): Cast iron fitting for pressure pipes for water gas and sewage.
IS-1703(1989): Copper aloy bar values (horizontal plunger type) for water supply fittings.
IS2379(1990): Colour code for identification of pipe lines.
IS-2643 (P1 to P3: 1990): Dimensions for pipe threads for fastening purposes.
IS-2685(1992): Code of practice for selection, installation and maintenance of sluice valves.
IS-2906(1990): Specification for sluice valves for water works purposes (350 to 1200 mm size)
IS-3589(1991): Seamers or eclectically welded steel pipes for water, gas and sewage (168.3 to 2032 mm outside diameter).
IS-4038(1990): Foot valves for water works purposes
IS-4927(1991): Unlined flax canvas hose for firefighting.
IS-5321-(P1 and P2 1991): Swing check type reflux (non-return) valves
IS-13095 (1991): Butterfly valves for general purposes

10. Steel Structures

IS-228: Method of chemical analysis of pig iron, cast iron and plain carbon and low alloy steels.
IS-802: Code of practice for use of structural steel in overhead transmission line towers.
IS-806: Code of practice for use of steel tubes in general building construction.
IS-808: Dimensions for hot rolled steel beam column channel and angle sections.
IS-814: Covered electrodes for manual arc welding of carbon manganese steel
IS-816: Code of practice for use of metal arc welding for general construction in mild steel.
IS817: Code of practice for training and testing of metal arc welders. Part 1: Manual metal arc welding
IS-875: Code of practice for design loads (other than earthquake) for buildings and structures.
IS-1161: Steel tube for structural purposes.
IS-1182: Recommended practice for radiographic examination of fusion welded but joints in steel plates.
IS-1363: Hexagonal head bolts, screws and nuts of products grade C.
IS-1364: Hexagon head bolts, screw & nuts of products grade A and B.
IS-1367: Technical supply condition for threaded steel fasteners
IS-1599: Method for bend test.
IS-1608: Method for tensile testing of steel products.
IS-1893: Criteria for earthquake resistant design of structures
IS-1978: Line pipe

IS-2062: Steel for general structural purposes
IS-2595: Code of practice for Radiographic testing
IS-3063: Single built rectangular section spring washers for bolts, nuts and screws.
IS-3664: Code of practice for ultra-sonic pulse echo testing by contact and immersion methods.
IS-7205: Safety code for erection of structural steel work.
IS-9595: Recommendations for metal arc welding of iron and carbon manganese steels.
ANSIB18.2.1: Inch series square and Hexagonal bolts and screws.
ANSI-B18.2.2: Square and hexagonal nuts
ANSI-G8.14: Round head bolts

SECTION 4

List of Enclosures with Technical Specification:

1. Following Single Line Diagram:

   a) 220/33 kV GIS Substation at IOCL Panipat - Dwg. No. TB-411-510-001, Rev. No. 05 (2 SHEETS)

2. Following Trench Layout Plan:

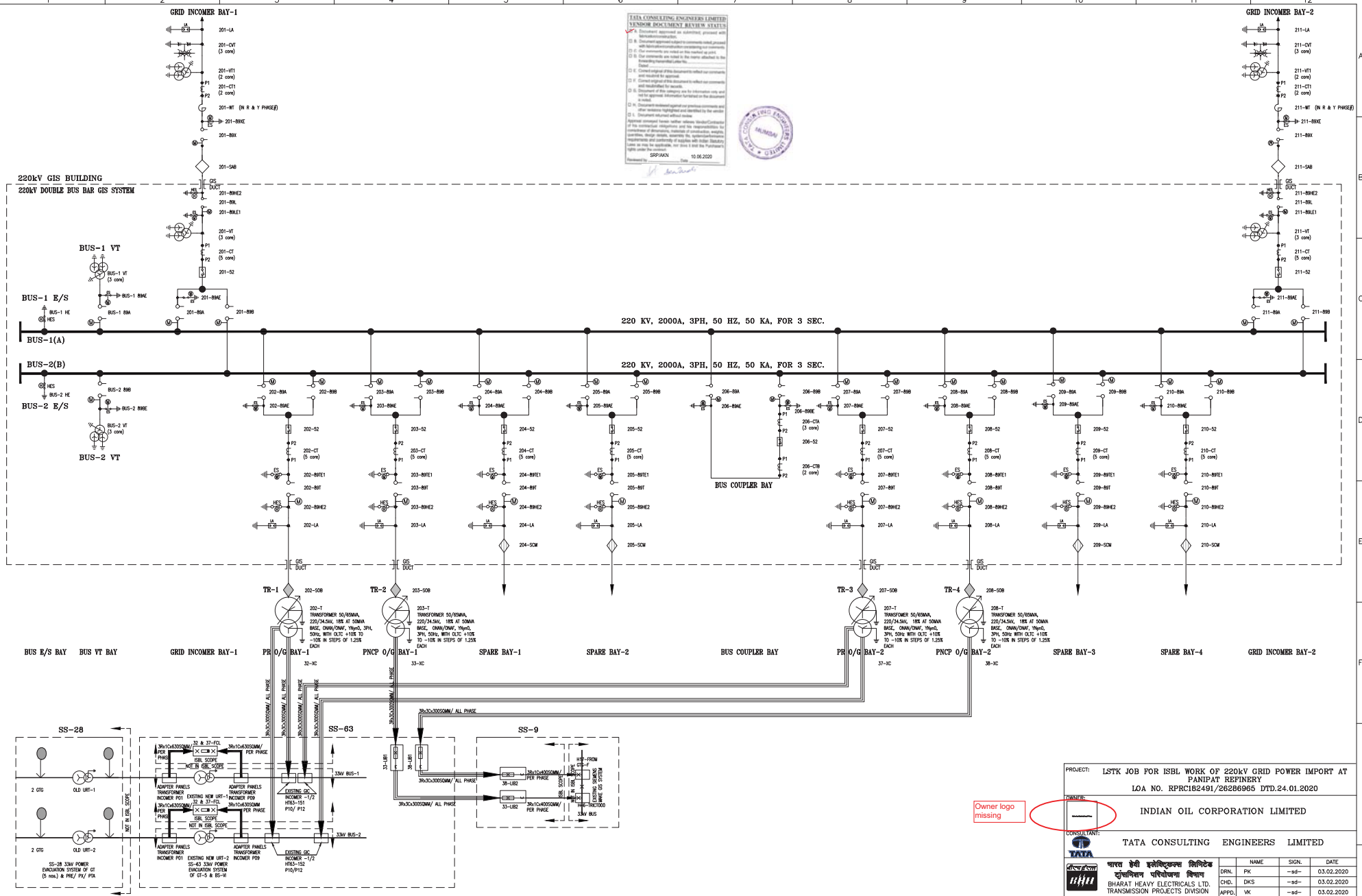
   b) 220/33 kV GIS Substation at IOCL Panipat - Dwg. No. TB-411-316-018, Rev. No. 02 (1 SHEET)

3. Following Key Metering and Protection Single Line Diagrams (For tender purpose only):

   c) 220/33 kV GIS Substation at IOCL Panipat - Dwg. No. TB-3-411-510-002, Rev. No. 04 (8 SHEETS)

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

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



Owner logo missing

REV.	DATE	ALTERED	CHECKED	APPROVED	ZONE
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04	07.05.20		CHECKED	APPROVED	AS PER TCE/IOCL COMMENTS DTD.30.04.2020 & 06.05.2020.
03	27.04.20		CHEDCKED	APPROVED	AS PER TCE/IOCL COMMENTS DTD.23.04.2020 & 22.04.2020.
02	22.04.20	PK	CHEDCKED DKS	APPROVED VK	AS PER TCE/IOCL COMMENTS DTD. 30.03.2020 & 22.04.2020
01	14.02.20	PK	CHECKED DKS	APPROVED VK	AS PER HVPNL/IOCL COMMENTS ON DTD. 13.02.2020 IN HVPNL OFFICE.

PROJECT: LSTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY
LOA NO. RPRC182491/26286965 DTD.24.01.2020

OWNER: INDIAN OIL CORPORATION LIMITED

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
पारेषण परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	NAME	SIGN.	DATE
DRN.	PK	–sd–	03.02.2020
CHD.	DKS	–sd–	03.02.2020
APPD.	VK	–sd–	03.02.2020

DEPT.	UNTOL. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
TBEM CODE: 411	GR. ~~C/M/F~~	–N.A.–	–N.A.–	–N.A.–	–N.A.–	–N.A.–

TITLE: 220/33KV SWITCHYARD–SINGLE LINE DIAGRAM

DRAWING/ DOCUMENT NO.: TB–411–510–001 REV. 05

SHT. No 01 NO. OF SHT. 03

SIZE–A1

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

A. 220kV OUTDOOR EQUIPMENT

SL.NO.	DESCRIPTION	SYMBOL	LEGEND	BAY NO/LOCATION	UNIT	QTY
1.	198kV, 10kA, CLASS-III, 1 PHASE SURGE ARRESTER (SA)/ LIGHTNING ARRESTER (LA)		LA	201, 211.	NO	06
2.	220kV, 8800pF, 1 PHASE CAPACITOR VOLTAGE TRANSFORMER (CVT), (220/ √3kV)/(110/ √3V)/(110/ √3V)/(110/ √3V)		CVT	201, 211.	NO	06
3.	220kV, 1250A, 1mH, 31.5kA/1s, 1 PHASE WAVE TRAP		WT	201, 211.	NO	04
4.	220kV, 1 PHASE TARIFF METERING PT		PT1	201, 211.	NO	06
5.	220kV, 1 PHASE TARIFF METERING CT		CT1	201, 211.	NO	06
6.	220kV, 2000A, 1X3 PHASE, HCB ISOLATOR (ELECTRICALLY OPERATED MECHANICALLY GANGED) WITH ONE EARTH SWITCH (ELECTRICALLY OPERATED MECHANICALLY GANGED)		89X	201, 211.	SET	02

B. 220kV INDOOR GIS

SL.NO.	DESCRIPTION	SYMBOL	LEGEND	BAY NO/LOCATION	UNIT	QTY
1.	220kV, 2000A, 1X3 PHASE CIRCUIT BREAKER		52	201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211.	SET	11
2.	220kV, 2000A, 1X3 PHASE DISCONNECTING SWITCH WITHOUT EARTH SWITCH		89B	201, 202, 203, 204, 205, 207, 208, 209, 210, 211.	SET	10
3.	220kV, 2000A, 1X3 PHASE DISCONNECTING SWITCH WITH SINGLE EARTH SWITCH		89A, 89AE 89B, 89BE 89L, 89LE1 89T, 89TE1	BUS-1, BUS-2 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211.	SET	24
4.	220kV, 2000A, 1X3 PHASE HIGH SPEED/ FAST EARTHING SWITCH		89HE2	BUS-1, BUS-2 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211.	SET	12
5.	198kV, 10kA, CLASS-III, 1 PHASE SURGE ARRESTER		LA	202, 203, 204, 205, 207, 208, 209, 210.	NO	24
6.	220kV, 1 PHASE CURRENT TRANSFORMER		CT	201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211.	NO	33
7.	220kV, 1 PHASE VOLTAGE TRANSFORMER		VT	BUS-1, BUS-2, 201, 211	NO	12
8.	220kV, 1 PHASE SF6 TO AIR BUSHING		SAB	201, 211.	NO	06
9.	220kV, 1 PHASE SF6 TO OIL BUSHING		SOB	202, 203, 207, 208.	NO	12
10.	220kV, 1 PHASE SF6 TO CABLE MODULE		SCM	204, 205, 209, 210.	NO	12
11.	220kV, 1 PHASE GIS BUS DUCT		--	201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211.	LOT	01

C. 33kV OUTDOOR EQUIPMENT INCLUDING 220/33KV POWER TRANSFORMER

SL.NO.	DESCRIPTION	SYMBOL	LEGEND	BAY NO/LOCATION	UNIT	QTY
1.	TRANSFORMER 50/65MVA, 220/34.5KV, 18% AT 50MVA BASE, ONAN/ONAF, YNYN0, 3PH, 50HZ, WITH OLTC +10% TO -10% IN STEPS OF 1.25% EACH		TR	202/32, 203/33, 207/37, 208/38.	NO	04
2.	33KV AIS LIB PANEL		LIB1, LIB2	33, 38.	SET	04
3.	33KV FAULT CURRENT LIMITER PANEL		FCL	33KV BUS-1, 33KV BUS-2	SET	02
4.	33kV(E), 3CX300SQMM, CU, XLPE, ARMORED CABLE INCLUDING END TERMINATION AND STRAIGHT THROUGH JOINTS		--	32, 33, 37, 38.	LOT	01
5.	33kV(E), 1CX400SQMM, CU, XLPE, ARMORED CABLE INCLUDING END TERMINATION AND STRAIGHT THROUGH JOINTS		--	33, 38.	LOT	01
6.	33kV(E), 1CX630SQMM, CU, XLPE, ARMORED CABLE INCLUDING END TERMINATION AND STRAIGHT THROUGH JOINTS		--	33KV BUS-1, 33KV BUS-2	LOT	01

SYSTEM PARAMETERS –

SL. NO.	DATA	220kV SYSTEM	33kV SYSTEM
01	NOMINAL VOLTAGE (kV)	220kV±10%	33kV±6%
02	FREQUENCY (Hz)	50±5%	50±3%
03	SYSTEM EARTHING	SOLIDLY EARTHED	SOLIDLY EARTHED
04	SHORT-TIME CURRENT RATING (kA/Sec)	50kA/3sec	31.5kA/1sec
05	RATED PEAK WITHSTAND CURRENT (kAp)	125	80
06	BASIC INSULATION LEVEL (kVP)	1050	170
07	RATED CURRENT AT 50°C (A)	2000	2500
08	RATED POWER FREQUENCY WITHSTAND VOLTAGE DRY/WET (kVrms)	460	70
09	LIGHTNING IMPULSE WITHSTAND VOLTAGE (KVp)	1050	170
10	CREEPAGE DISTANCE (mm/kV)	25	25
11	MINIMUM AMBIENT TEMPERATURE (°C)	-5°C	-5°C
12	MAXIMUM AMBIENT TEMPERATURE (°C)	+50.0°C	+50.0°C
13	EQUIPMENT DESIGN TEMPERATURE (°C)	+45.0°C	+45.0°C
14	AUXILIARY SUPPLY VOLTAGE (Vac)	415V,3 PHASE/ 240V,1 PHASE	415V,3 PHASE/ 240V,1 PHASE
15	PROETCTION & CONTROL SUPPLY (Vdc) 1. TRIP COIL SUPPLY 2. CLOSE COIL SUPPLY 3. SPRING CHARGING MOTOR SUPPLY	220 ±5% 220 -70% +110% 220 -80% +110% 220 -80% +110%	220 ±5% 220 -70% +110% 220 -80% +110% 220 -80% +110%

NOTES: –

1. BAY SEQUENCE FOR GIS TENTATIVE AND MAY CHANGE IN LINE WITH THE REQUIREMENTS OF SERVICE CONTINUITY AND STANDARD DESIGN OF OEM.
2. COMMON TARIFF METERING ROOM (1NO) SHALL BE PROVIDED FOR BOTH INCOMER BAYS.
3. LOCATION OF GIS CT IN BAY MAY CHANGE AS PER OEM RECOMMENDATIONS.
4. THE CABLE MODULE IN THE GIS SPARE OUTGOING BAYS, SUITABLE FOR CABLE TERMINATIONS SHALL BE BE PROVIDED FULLY EQUIPPED FOR CABLE TERMINATION WITH AVAILABILITY OF FEMALE CONTACT CONTACTS.
5. FOR INDIVIDUAL EQUIPMENT OF GIS & AIS SHALL BE IN LINE WITH TECHNICAL SPECIFICATION. DEVIATION IF ANY SHALL BE TAKEN UP SEPARATELY.
6. TRANSFORMER DETAILS SHALL BE UPDATED AS PER MANUFACTURE'S DRAWINGS.
7. CT/ VT PARAMETERS SHALL BE DETAILED IN SEPARATE DRAWING (DRG. NO. TB-411-510-002 220/33kV SWITCHYARD- KEY METERING & PROTECTON SINGLE LINE DIAGRAM).
8. SCHEDULE OF EQUIPMENT COVERS ONLY HV/ EHV EQUIPMENT FOR POWER FLOW. THE DETAILS OF OTHER AUXILIARY EQUIPMENT SHALL BE COVERED ON OTHER DRAWING/ DOCUMENTS, TO BE COVERED SEPARATELY.
9. THE DETAILS OF PANELS/ EQUIPMENT UNDER CUSTOMER SCOPE MAY CHANGE AS LATER STAGE.
10. 33kV GIC INCOMER PANELS/ ADAPTER PANELS IN SS-63 AND 33kV GIS PANELS IN SS-9 SHAL BE IN CUSTOMER SCOPE, HOWEVER TERMINATION OF 33kV XLPE CABLES SHALL BE DONE BY BHEL.
11. THE DETAILS OF 33kV XLPE CABLES AND ACCESSORIES ARE TENTATIVE AND ARE BASED ON INITIAL SITE SURVEY, IN CASE OF ADDITIONAL REQUIREMENT, SAME SHALL SUPPLIED AND EXECUTED BY BHEL ONLY.
12. LINE TRAP SHALL BE SUSPENSION TYPE ONLY, WHICH SHALL BE SUSPENDED FROM GANTRY/ BEAM.

REFERENCE DRAWING (S)/ DOCUMENT(S) –

SL. NO.	DRAWING/ DOCUMENT NO.	DRAWING TITLE
3.	ANNEXURE-7P	220kV GIS- SLD
2.	ANNEXURE-S-2/C-1/5	INTERCONNECTION SLD FOR PR
1.	ANNEXURE-S-2/C-1/6	INTERCONNECTION SLD FOR PNCP POWER EVACUATION FACILITY

PROJECT: LSTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY
LOA NO. RPRC182491/26286965 DTD.24.01.2020

OWNER: INDIAN OIL CORPORATION LIMITED

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	NAME	SIGN.	DATE
DRN.	PK	-sd-	03.02.2020
CHD.	DKS	-sd-	03.02.2020
APPD.	VK	-sd-	03.02.2020

REV.	DATE	ALTERED	CHECKED	APPROVED	ZONE
05	10.06.20	CHECKED	APPROVED		AS PER TCE/IOCL COMMENTS DTD.09.05.2020 & 09.05.2020.
04	07.05.20	CHECKED	APPROVED		AS PER TCE/IOCL COMMENTS DTD.30.04.2020 & 06.05.2020.
03	27.04.20	CHECKED	APPROVED		AS PER TCE/IOCL COMMENTS DTD.23.04.2020 & 22.04.2020.
02	22.04.20	PK / CHECKED DKS / APPROVED VK			AS PER TCE/IOCL COMMENTS DTD. 30.03.2020 & 22.04.2020
01	14.02.20	PK / CHECKED DKS / APPROVED VK			AS PER HVPNL/IOCL COMMENTS ON DTD. 13.02.2020 IN HVPNL OFFICE.

DEPT. CODE	UNTOL. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
TBEM 411	GR, -C/M/F-	-N.A.-	-N.A.-	-N.A.-	-N.A.-	-N.A.-

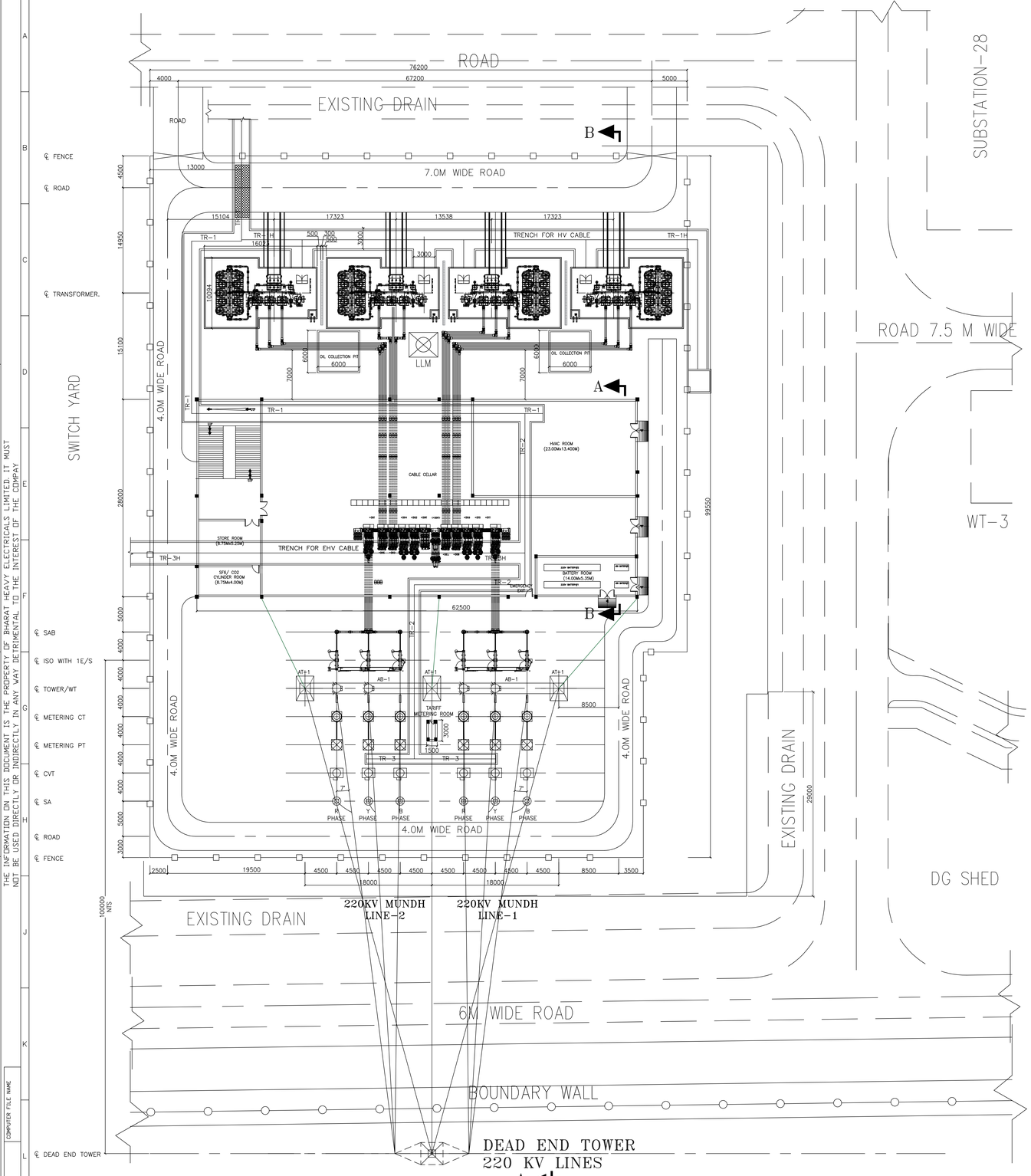
TITLE: 220/33KV SWITCHYARD-SINGLE LINE DIAGRAM

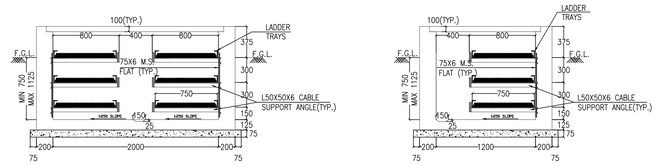
DRAWING/ DOCUMENT NO. TB-411-510-001 REV. 05

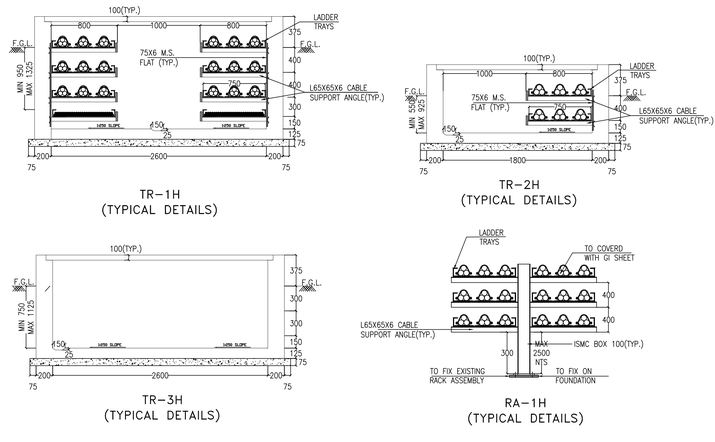
SHT. No 02 NO. OF SHT. 03

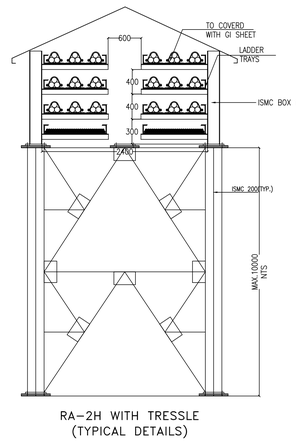
SIZE-A1

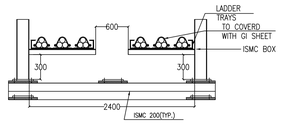
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

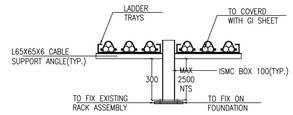


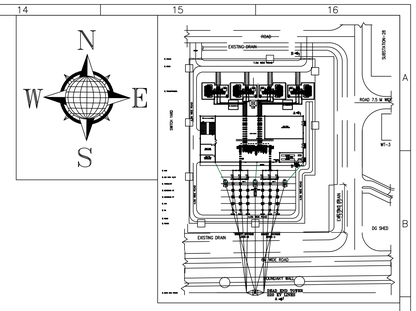












KEY PLAN

NOTES:–

1. ALL DIMENSIONS ARE IN mm.
2. THE LOCATION OF TRENCHES/ TRESSLE/ RACK ASSEMBLY MARKED IN THIS DRAWING MAY BE MODIFIED TO SUIT SITE CONDITIONS.
3. OPENINGS FOR TAKING OUT PIPES TO EQUIPMENT/ PANEL SHALL BE PROVIDED IN CABLE TRENCHES OPENING OF SIZE SUITABLE TO DIA. 50/110 PIPE SHALL BE PROVIDED BELOW TOP CABLE SUPPORT.
4. INSERTS MUST BE EMBEDDED FOR FIXING CABLE SUPPORT RACK ASSEMBLY.
5. POWER CABLES SHALL BE LAID IN TOP TIERS AND CONTROL CABLES IN BOTTOM TIERS, AS PER TECHNICAL SPECIFICATION
6. EARTH CONDUCTOR 50x6 GI FLAT SHALL BE RUN ALONG THE TOP TIER AND TO BE WELDED ON THE CABLE SUPPORT BEFORE INSTALLATION OF CABLES.
7. CROSSING AT ROAD SHALL BE IN BOX CULVERT.
8. FOR POWER & CONTROL SEPARATE PIPES SHALL BE USED CONSIDERING 60% VOID FOR EACH PIPE I.E., 40% FILLING CRITERIA. ACCORINGLY, ADDITIONAL PIPES (IF REQUIRED) WILL BE PROVIDED AS PER SITE CONDITION.
9. ALL OTHER DETAILS PERTAINING TO CIVIL WORKS SHALL REFLECT IN RESPECTIVE CIVIL DRAWINGS.
10. CONTROL CABLES & POWER CABLES MUST BE LAID IN SEPARATE PVC PIPES.
11. THE PURPOSE OF LAYOUT DRAWING IS FOR USE AS FOLLOWS:
    - TO BE USED AS CIVIL INPUT.
    - FOR INSTALLATION OF CABLE RACK ASSEMBLY AT SITE.
    - FOR CABLE LAYING AND ROUTING AT SITE.
12. CABLE RACK AND SUPPORTS SHALL BE PAINTED AFTER INSTALLATION WITH 2 COATS OF METEL PRIMER (COMPRISING OF RED OXIDE & ZINC CHROMATE IN A SYNTHETIC MEDIUM) FOLLOWED BY TWO FINISHING COAT OF ALUMINUM PAINT.
13. SUITABLE PULL OUT BOX SHALL BE PROVIDED IF REQUIRED.

LENGTH OF CABLE TRENCH/ CABLE TRESSLE/ RACK ASSEMBLY

S.NO.	SECTION	APPROX. LENGTH (IN METERS)
1.	TR-1	110
2.	TR-2	70
3.	TR-3	30
4.	RA-1	180
5.	TR-1H	100
6.	TR-2H	250
7.	TR-3H	60
8.	RA-1H	40
9.	RA-2H WITH TRESSLE	60
10.	TR-2H WITH BRIDGE	30
11.	TR-3H	4500

REFERENCE DRAWING (S)/ DOCUMENT(S) –

SL. NO.	DRAWING/ DOCUMENT NO.	DRAWING TITLE
2.	TB-411-316-011	220/33kV SWITCHYARD- LAYOUT PLAN & SECTION
1.	TB-411-510-001	220/33kV SWITCHYARD- SINGLE LINE DIAGRAM

PROJECT: LSTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY
LOA NO. RPRC182491/26286965 DTD.24.01.2020

OWNER: INDIAN OIL CORPORATION LIMITED

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION

	NAME	SIGN.	DATE
DRN.	PK		16.03.2020
CHD.	DKS		16.03.2020
APPD.	VK		16.03.2020

DEPT. TREM CODE 411	UNTOL. DIMS. OR. C/M/F	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 220/33KV SWITCHYARD– OUTDOOR CABLE TRENCH/ TRESSLE/ RACK ASSEMBLY LAYOUT

DRAWING/ DOCUMENT NO. TB-411-316-018 REV. 02

SHT. No 01 NO. OF SHT. 02

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD APPD			CHD APPD			CHD APPD			CHD APPD			CHD APPD			CHD APPD			CHD APPD			CHD APPD			CHD APPD			CHD APPD			CHD APPD
ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE

02 | 28.04.20 | ALTERED PK | CHD DKS | APPD VK | ZONE AS PER CUSTOMER/ CONSULTANT COMMENTS ON DTD. 20.04.2020.

01 | 12.04.20 | ALTERED PK | CHD DKS | APPD VK | ZONE AS PER TCE/IOCL COMMENTS ON DTD. 30.03.2020.

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

SIZE–A0

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

COMPUTER FILE NAME

REF. DRG. NO.

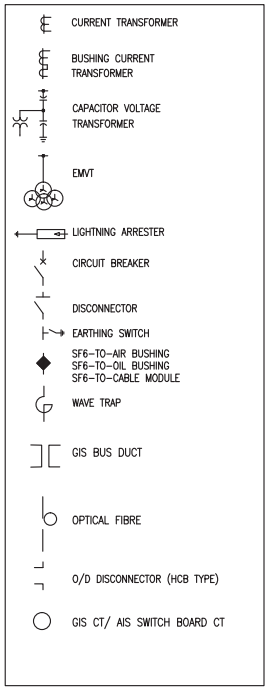
SIGN. AND DATE

INVENTORY NO

LEGEND

DEVICE	FUNCTION
87LD1/2	LINE DIFFERENTIAL PROTECTION MAIN-1/2
21M1/2	DIST. PROTECTION MAIN-1/2
79	AUTO-RECLOSE FUNCTION
25	CHECK SYNCHRONISING FUNCTION
DFL	DISTURBANCE/FAULT LOCATOR
98	VT FUSE FAIL RELAY
59	OVER VOLTAGE RELAY
67/67N	DIRECTIONAL IDMT PHASE O/C / E/F PROTECTION WITH HIGH SET FUNCTION
85	CARRIER-AIDED INER-TRIPPING FUNCTION
SER	SEQUENCE OF EVENT RECORDER
27	UNDER VOLTAGE PROTECTION
DR	DISTURBANCE RECORDER
BCU	BAY CONTROL UNIT
87B1/B2	BUSBAR DIFFERENTIAL PROTECTION MAIN-1/2 (WITH IN-BUILT CHECK ZONE)
50 LBB	LOCAL BREAKER BACKUP PROTECTION
EM M/C	ENERGY METER MAIN/CHECK
87T1/T2	TRANSFORMER DIFFERENTIAL PROTECTION MAIN-1/2
64T HV/LV	TRANSFORMER REF PROTECTION
99 HV/LV	TRANSFORMER OVER-FLUXING PROTECTION
50/50N	NON DIRECTIONAL INSTANTANEOUS PHASE O/C / E/F PROTECTION WITH HIGH SET FUNCTION
51/51N	NON DIRECTIONAL IDMT PHASE O/C / E/F PROTECTION WITH HIGH SET FUNCTION
63 PRTX	PRESSURE RELIEF DEVICE, TRIP
63 AX/TX	BUCHHOLZ RELAY, ALARM/TRIP
49W AX/TX	WINDING TEMPERATURE HIGH, ALARM/TRIP
49O AX/TX	OIL TEMPERATURE HIGH, ALARM/TRIP
OLAX	OIL LEVEL LOW, ALARM
SCAP	SYNCHRONISATION, CONTROL & ANNUNCIATION PANEL
LMS	LOAD MANAGEMENT SYSTEM
TRANSD PANEL	CENTRAL TRANSDUCER PANEL
51N HV/LV	TRANSFORMER STAND-BY E/F PROTECTION, HV/LV NEUTRAL
87CD	CABLE DIFFERENTIAL PROTECTION
MFM	MULTI-FUNCTION METER
OSR TX	OIL SURGE RELAY, TRIP
FTBS	FAST BUS TRANSFER RELAY
68	BLOCKING RELAY
195/295	TRIP CIRCUIT SUPERVISION
186/286	MASTER TRIP RELAY
80A/80B	PANEL DC SUPERVISION RELAY

SYMBOLS



NOTES (FOR IOCL PANIPAT END)

1. ALL PROTECTION FEATURES SHOWN IN THIS DRAWING SHALL BE PROVIDED IN THE OFFERED SYSTEM.
2. REFERENCE DRAWING: SINGLE LINE DIAGRAM FOR 220/33kV SWITCHYARD SINGLE LINE DIAGRAM DWG NO. TB-1-411-510-001, REV. 01
3. FOR THE 220 kV SYSTEM, pF RATING OF CVT SHALL BE 8800pF AND mH RATING OF WAVE TRAPS SHALL BE 1250A, 1.0mH, 31.5kA/1sec; IOCL/ HVPNL TO CONFIRM THE SAME.
4. DIFFERENTIAL cum DISTANCE PROTECTION RELAY AT IOCL END SHALL MATCH WITH THAT SUPPLIED FOR REMOTE END.
5. ---
6. ---
7. ---
8. ---
9. DIFFERENTIAL cum DISTANCE PROTECTION RELAY AT BOTH ENDS WILL BE CONNECTED THROUGH DIRECT FIBRE CONNECTION (SINGLE MODE).
10. OPGW, OPGW GANTRY BOX (JOINT BOX), FOTE (MULTIPLEXER SDH/PDH etc) ARE NOT IN BHEL/ IOCL SCOPE.
11. ---
12. ALL VT SELECTION SCHEMES SHALL BE AUTOMATIC CHANGEOVER SCHEMES BASED ON LOGICS DEVELOPED IN BCU.
13. CHECK SYNCH FEATURE ALONG WITH DEAD BUS CHARGING PROVISION SHALL BE KEPT FOR ALL 220kV BREAKERS AS PART OF BCU AS WELL AS SCAP PANEL.

TATA CONSULTING ENGINEERS LIMITED
VENDOR DOCUMENT REVIEW STATUS

- ☑ A. Document approved as submitted; proceed with fabrication/construction.
- ☐ B. Document approved subject to comments noted; proceed with fabrication/construction considering our comments.
- ☐ C. Our comments are noted on this marked up print.
- ☐ D. Our comments are noted in the memo attached to the forwarding transmittal Letter No. ..... Dated .....
- ☐ E. Correct original of this document to reflect our comments and resubmit for approval.
- ☐ F. Correct original of this document to reflect our comments and resubmitted for records.
- ☐ G. Document of this category are for information only and not for approval. Information furnished on the document is noted.
- ☐ H. Document reviewed against our previous comments and other revisions highlighted and identified by the vendor.
- ☐ I. Document returned without review.

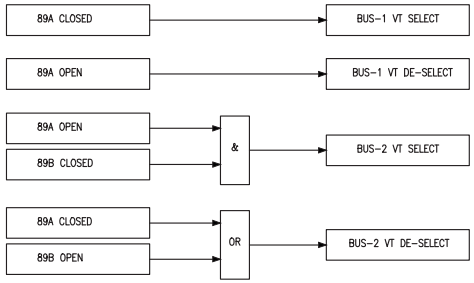
Approval conveyed herein neither relieves Vendor/Contractor of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system/performance requirements and conformity of supplies with Indian Statutory Laws as may be applicable, nor does it limit the Purchaser's rights under the contract.

Review ..... Date 04062020

NOTES (FOR REMOTE END - HVPNL MUNDH S/S)

1. ALL PROTECTION FEATURES SHOWN IN THIS DRAWING SHALL BE PROVIDED IN THE OFFERED SYSTEM.
2. ---
3. FOR THE 220 kV SYSTEM, pF RATING OF CVT SHALL BE 8800pF AND mH RATING OF WAVE TRAPS SHALL BE 1250A, 1.0mH, 31.5kA/1sec; IOCL/ HVPNL TO CONFIRM THE SAME.
4. DIFFERENTIAL cum DISTANCE PROTECTION RELAY AT MUNDH S/S END SHALL MATCH WITH THAT SUPPLIED FOR IOCL PANIPAT END.
5. REMOTE END PLCC ITEMS (WAVE TRAPS, DIGITAL PLCC TERMINALS, COUPLING DEVICE, ASSOCIATED DC SYSTEM) AT MUNDH S/S ARE IN THE SCOPE OF BHEL.
6. REMOTE END DIFFERENTIAL cum DISTANCE PROTECTION RELAY SHALL BE SUPPLIED LOOSE BY BHEL AND WILL BE INTEGRATED WITH EXISTING SAS AT MUNDH S/S.
7. HVPNL TO ENSURE ADEQUACY OF SPACE & FACILITIES TO INSTALL PLCC ITEMS AND DIFFERENTIAL cum DISTANCE PROTECTION RELAY AT REMOTE END (MUNDH S/S).
8. DIFFERENTIAL cum DISTANCE PROTECTION RELAY AT REMOTE END (MUNDH S/S) WILL BE MOUNTED IN RESPECTIVE PROTECTION PANEL OF HVPNL. SUPPLY OF PROTECTION PANELS IS NOT IN PRESENT SCOPE. HOWEVER, INSTALLATION, TESTING & COMMISSIONING AND INTEGRATION TO EXISTING SCADA IS IN BHEL SCOPE.
9. DIFFERENTIAL cum DISTANCE PROTECTION RELAY AT BOTH ENDS WILL BE CONNECTED THROUGH DIRECT FIBRE CONNECTION (SINGLE MODE).
10. OPGW, OPGW GANTRY BOX (JOINT BOX), FOTE (MULTIPLEXER SDH/PDH etc) ARE NOT IN BHEL/ IOCL SCOPE.
11. EXISTING DETAILS OF REMOTE END STATION TO BE INFORMED BY HVPNL (SLD, CT, VT DETAILS, SAS SCHEMES).
12. EXISTING BUS VT SELECTION CIRCUIT SHALL BE USED FOR EXTENDING VT INPUT TO 21M1/ M2 AT MUNDH SUBSTATION.

220kV BUS VT SELECTION LOGIC TO BE DEVELOPED IN BCU



FOR TENDER PURPOSE ONLY

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
04	04/06/2020	RD / CHD/APPD VK	03	28/05/2020	RD / CHD/APPD VK	02	23/05/2020	RD / CHD/APPD VK	01	29/04/2020	RD / CHD/APPD VK
ZONE	REVISED AS PER TCE & IOCL COMMENTS DT 03/06/2020		ZONE	REVISED AS PER TCE & IOCL COMMENTS DT 28/05/2020		ZONE	REVISED AS PER TCE & IOCL COMMENTS DT 04/05/2020		ZONE	REVISED AS PER TCE & IOCL COMMENTS DT 19/03/2020	

CUSTOMER: LSTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY
LOA NO. RPRC182491/26286965 DTD.24.01.2020

OWNER: INDIAN OIL CORPORATION LIMITED

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP

	NAME	SIGN.	DATE
DRN.	RD		12.03.2020
CHD.	RD		12.03.2020
APPD.	VK		12.03.2020

DEPT. TBEM	UNTOL. DIMS. GR.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
CODE 411	∅/M/F		N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 220/33KV SWITCHYARD- KEY METERING & PROTECTION SINGLE LINE DIAGRAM

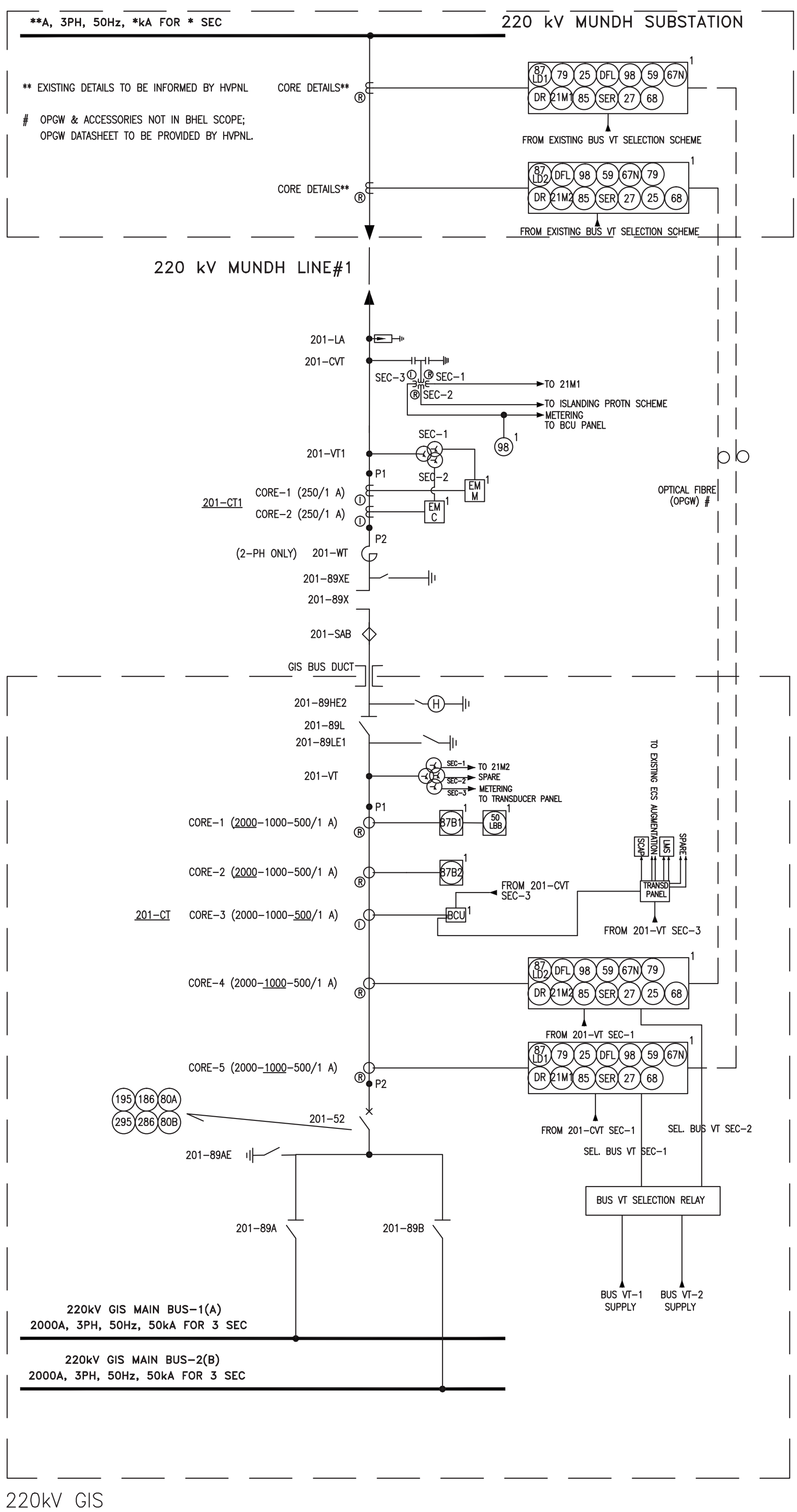
DRAWING/ DOCUMENT NO. TB-3-411-510-002 REV. 04

SHT. No 01 NO. OF SHT. 08

SIZE-A3

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

FIRST ANGLE PROJECTION



THIS DIAGRAM APPLICABLE FOR 220kV LINE BAY# 211 ALSO.

APPLICABLE FOR 220kV GRID INCOMER BAY# 1/2 FROM HVPNL

FOR TENDER PURPOSE ONLY

(ALL DIMENSIONS ARE IN mm)

REV.	DATE	ALTERED	CHD/APPD	RD	ZONE
04	04/06/2020	REVISED AS PER TCE & IOCL COMMENTS DT 03/06/2020	VK	RD	
03	28/05/2020	REVISED AS PER TCE & IOCL COMMENTS DT 28/05/2020	VK	RD	
02	23/05/2020	REVISED AS PER TCE & IOCL COMMENTS DT 04/05/2020	VK	RD	
01	29/04/2020	REVISED AS PER TCE & IOCL COMMENTS DT 19/03/2020	VK	RD	

CUSTOMER: LSTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY
LOA NO. RPRC182491/26286965 DTD.24.01.2020

OWNER: INDIAN OIL CORPORATION LIMITED

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

	NAME	SIGN.	DATE
DRN.	RD		12.03.2020
CHD.	RD		12.03.2020
APPD.	VK		12.03.2020

DEPT. CODE: TBEM 411
UNTOL. DIMS. GR.: 9/M/f
SCALE: N.T.S
WEIGHT (KG): N.A.
REF. TO ASSY. DRG.: N.A.
ITEM NO.: N.A.
NO. OF ITEMS: N.A.

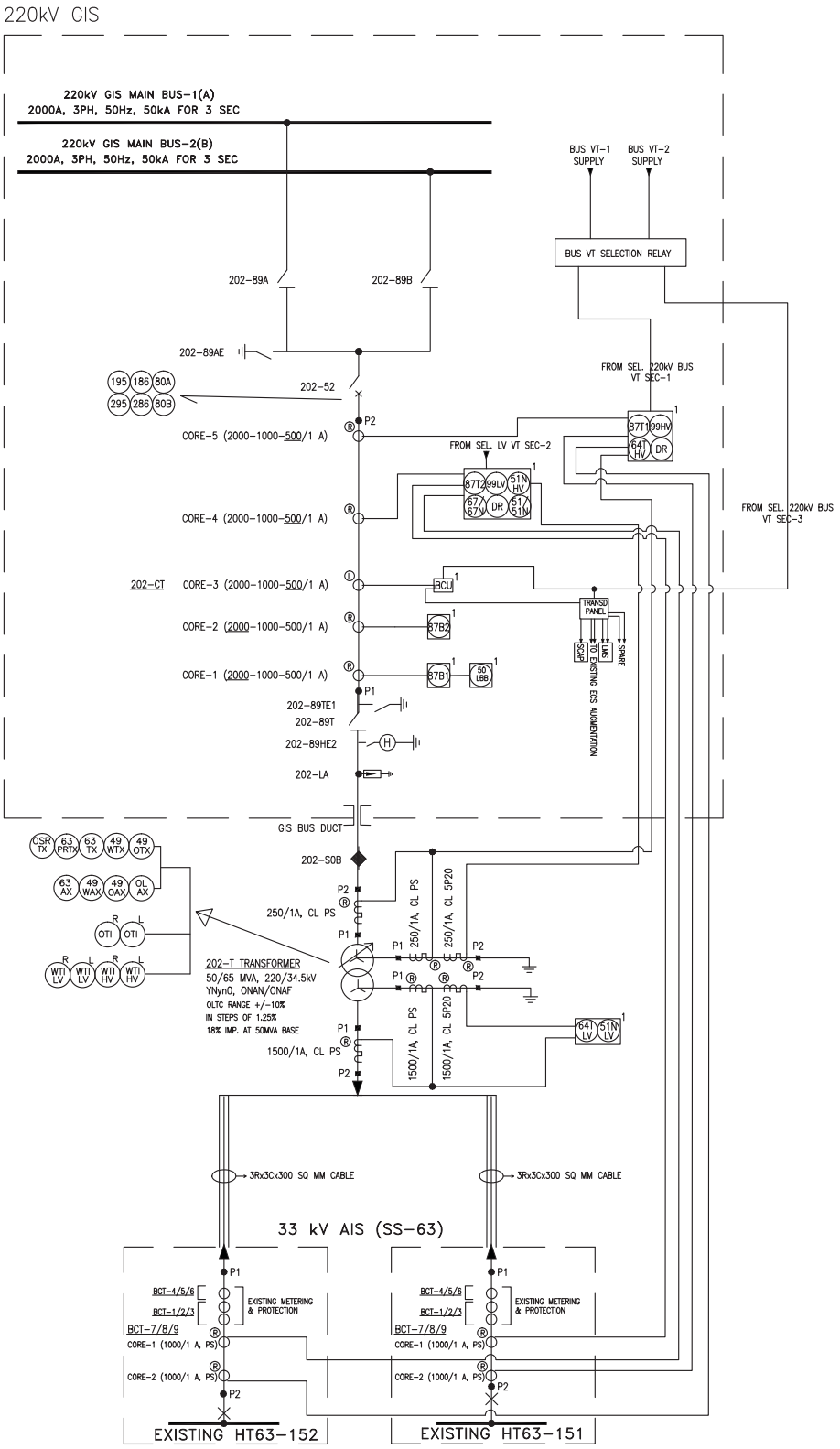
TITLE: 220/33kV SWITCHYARD- KEY METERING & PROTECTION SINGLE LINE DIAGRAM

DRAWING/ DOCUMENT NO.: TB-3-411-510-002
REV.: 04
SHT. No: 02
NO. OF SHT.: 08

SIZE-A3

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

ZONE	REV.	DATE	ALTERED	CHD/APPD
	04	04/06/2020	RD	VK
REVISED AS PER TCE & IOCL COMMENTS DT 03/06/2020				
	03	28/05/2020	RD	VK
REVISED AS PER TCE & IOCL COMMENTS DT 28/05/2020				
	02	23/05/2020	RD	VK
REVISED AS PER TCE & IOCL COMMENTS DT 04/05/2020				
	01	29/04/2020	RD	VK
REVISED AS PER TCE & IOCL COMMENTS DT 19/03/2020				



APPLICABLE FOR 220/34.5kV PR O/G TRAFO BAY# 1/2 (BAY-202 & 207)

FOR TENDER PURPOSE ONLY

CUSTOMER: ISTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY
LOA NO. RPRC182491/26286965 DTD.24.01.2020

OWNER: INDIAN OIL CORPORATION LIMITED

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP

DEPT: TBEM | CODE: 411 | TITLE: 220/33KV SWITCHYARD- KEY METERING & PROTECTION SINGLE LINE DIAGRAM

	NAME	SIGN.	DATE
DRN.	RD		12.03.2020
CHD.	RD		12.03.2020
APPD.	VK		12.03.2020

UNTOL DIMS: g/N/f | SCALE: N.T.S | WEIGHT (Kg): N.A.

REF. TO ASSY. DRG.: N.A. | ITEM NO.: N.A. | NO.OF ITEMS: N.A.

DRAWING/ DOCUMENT NO.: TB-3-411-510-002 | REV.: 04

SHT. No: 03 | NO. OF SHT.: 08

SIZE-A3

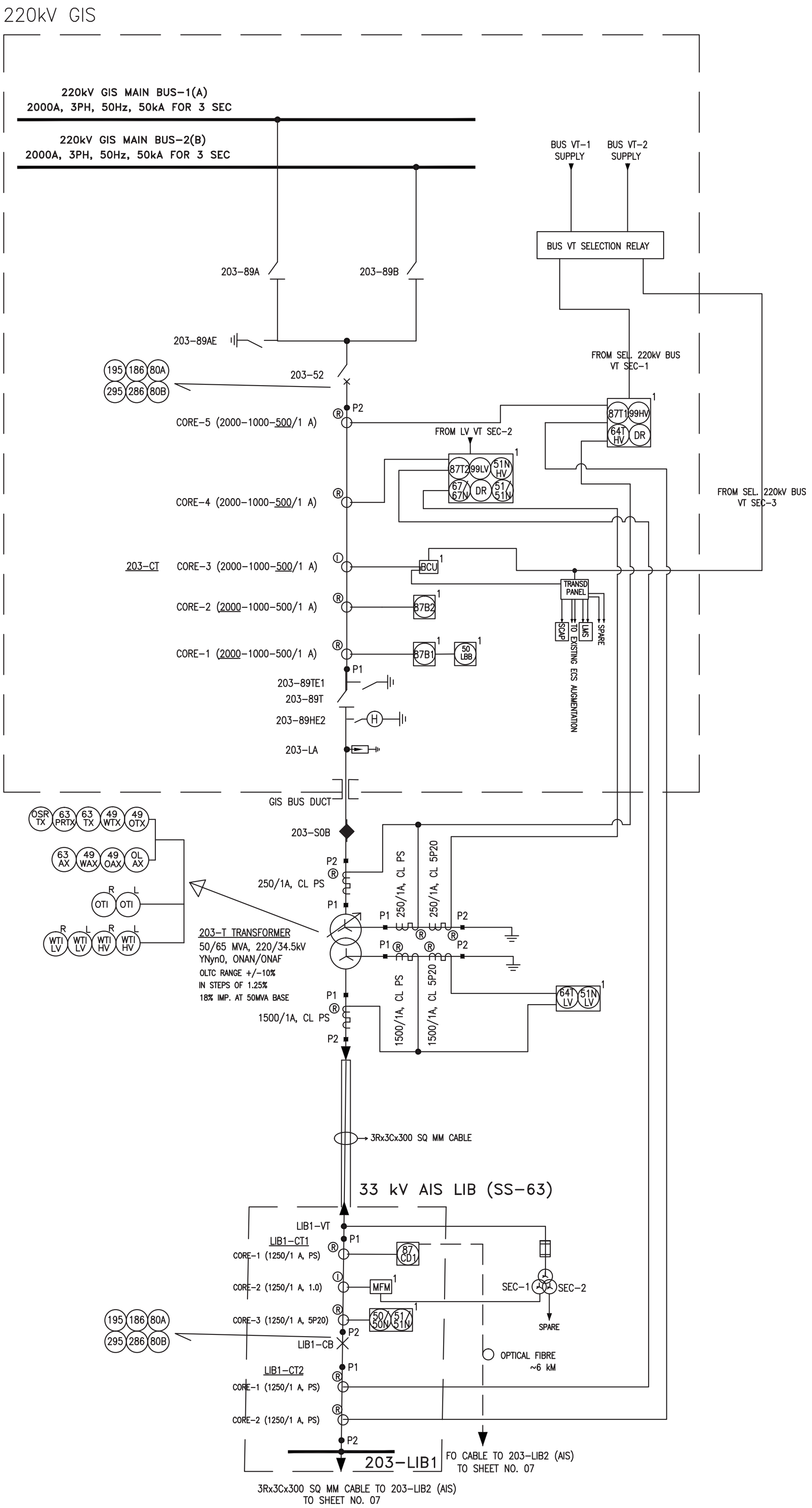
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

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

REV.	DATE	ALTERED		ZONE
04	04/06/2020	CHD/APPD	RD / VK	REVISED AS PER TCE & IOCL COMMENTS DT 03/06/2020
03	28/05/2020	CHD/APPD	RD / VK	REVISED AS PER TCE & IOCL COMMENTS DT 28/05/2020
02	23/05/2020	CHD/APPD	RD / VK	REVISED AS PER TCE & IOCL COMMENTS DT 04/05/2020
01	29/04/2020	CHD/APPD	RD / VK	REVISED AS PER TCE & IOCL COMMENTS DT 19/03/2020

FIRST ANGLE PROJECTION



APPLICABLE FOR 220/34.5kV PNCP O/G TRAFO BAY# 1/2 (BAY-203 & 208)

FOR TENDER PURPOSE ONLY

(ALL DIMENSIONS ARE IN mm)

CUSTOMER: LSTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY
LOA NO. RPRC182491/26286965 DTD.24.01.2020

OWNER: INDIAN OIL CORPORATION LIMITED

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

	NAME	SIGN.	DATE
DRN.	RD		12.03.2020
CHD.	RD		12.03.2020
APPD.	VK		12.03.2020

DEPT. TBEM CODE 411 | UNTOL. DIMS. GR. | SCALE N.T.S | WEIGHT (KG) N.A. | REF. TO ASSY. DRG. N.A. | ITEM NO. N.A. | NO. OF ITEMS N.A.

TITLE: 220/33kV SWITCHYARD- KEY METERING & PROTECTION SINGLE LINE DIAGRAM

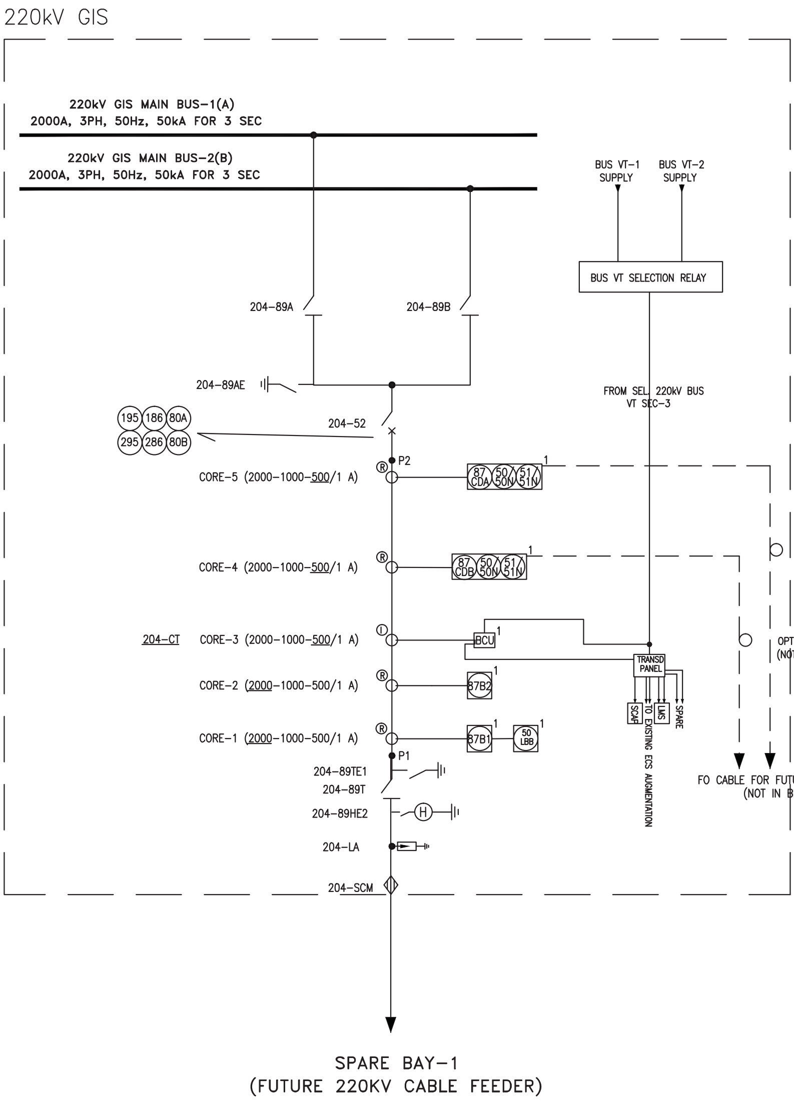
DRAWING/ DOCUMENT NO. TB-3-411-510-002 | REV. 04

SHT. No 04 | NO. OF SHT. 08

SIZE-A3

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

FIRST ANGLE PROJECTION



(ALL DIMENSIONS ARE IN mm)

APPLICABLE FOR 220kV SPARE BAY# 1/2/3/4 (BAY-204, 205, 209 & 210)

FOR TENDER PURPOSE ONLY

REV.	DATE	ALTERED	CHD/APPD	ZONE
04	04/06/2020	RD	VK	REVISED AS PER TCE & IOCL COMMENTS DT 03/06/2020
03	28/05/2020	RD	VK	REVISED AS PER TCE & IOCL COMMENTS DT 28/05/2020
02	23/05/2020	RD	VK	REVISED AS PER TCE & IOCL COMMENTS DT 04/05/2020
01	29/04/2020	RD	VK	REVISED AS PER TCE & IOCL COMMENTS DT 19/03/2020

CUSTOMER: LSTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY
LOA NO. RPRC182491/26286965 DTD.24.01.2020

OWNER: INDIAN OIL CORPORATION LIMITED

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

	NAME	SIGN.	DATE
DRN.	RD		12.03.2020
CHD.	RD		12.03.2020
APPD.	VK		12.03.2020

DEPT. TBEM | CODE 411 | SCALE N.T.S | WEIGHT (KG) N.A. | REF. TO ASSY. DRG. N.A. | ITEM NO. N.A. | NO. OF ITEMS N.A.

TITLE: 220/33kV SWITCHYARD- KEY METERING & PROTECTION SINGLE LINE DIAGRAM

DRAWING/ DOCUMENT NO. TB-3-411-510-002 | REV. 04

SHT. No 05 | NO. OF SHT. 08

SIZE-A3