

Section-1 Annexure.1

220kV GAS INSULATED
SWITCHGEAR
DATASHEETDocument No.
B269-999-16-50-DS-0031
Rev. No. C
Page 1 of 5

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

PURCHASER'S DATA

A Site Conditions			
1	Maximum Ambient Temperature	°C	50
2	Minimum Ambient Temperature	°C	5
3	Desian Ambient Temperature	°C	45
4	Relative Humiditv	%	90
5	Altitude Above MSL	m	1000
6	Environment		Hot, Humid & Corrosive
B Operating Conditions			
1	System Voltage		220 kV ± TP %
2	Frequency		50 Hz ± 3 %
3	Number of Phases		Three
4	System Fault Level		50KA for 3 Sec
5	System Earthing		Solidly Earthed
6	Auxilliary Power Suppy		
i.	- for space heaters,cubicle lamps etc		240 V AC TPN 10 %
ii	- for protection metering and control		110 V DC -10/+ 15 %
iii	- circuit breaker spring charging motor		110 V DC -10/+ 15 %
iv	- Motor drive for disconnectors and earth switches		110 V DC -10/+ 15 %
v	- high speed earth switch spring charging motor		110 V DC -10/+ 15 %
vi	- gas handling and filling unit / cart		415 V AC TPN ± 10%
7	Installation		
i.	GIS		Airconditioned
ii	LCC		Airconditioned
iii	CRP		Airconditioned
C Electrical Data			
1	Bus Bar System		Double
2	Bus bar rated current	A	2000
3	1 sec short circuit withstand capacity	kA	50
4	Rated peak withstand current	kA	135
5	Internal arc rating		50 kA for 0.3
6	Circuit Breaker		
i	Type of circuit breaker		SF6
ii	Duty cycle of Circuit Breaker		0-3 min-CO-3 min-CO
iii	Breaking capacity	kA	50
iv	Making capacity	kA	135
v	CB Operating Mechanism		Spring Charged or Electro Hydraulic 6-51-0066
vi	Shunt trip coil-1		110V DC
	Shunt trip coil -2		110V DC
vii	Mechanical indicator for breaker status		Required
viii	Pre-insertion resistor		Not Required
7	Disconnector & Earthing Switch		
i	Operating Machanism		Motorised
ii	Mechanical indicator for disconnector & earthswitch status		Required
iii	Viewing windows for disconnector and earthswitch		Required
iv	Mechanical interlock for disconnector & earthswitch		Required
v	Electrical interlock with associated circuit breaker		Required
8	High speed make-proof Earthing switch		

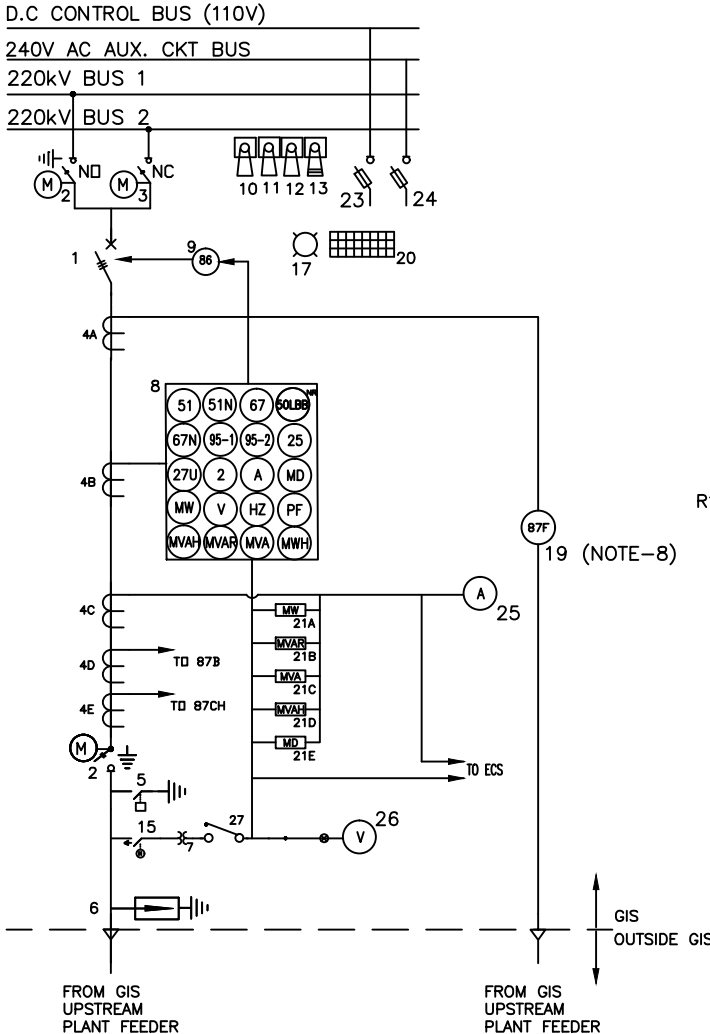
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By
C	27-SEP-2021	REVISED AND REISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
B	05-JUL-2021	REVISED AND REISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
A	12-MAY-2020	ISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR

Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery		Client	IOCL REFINERY DIVISION - HEAD OFFICE	
Unit	COMMON	Location	Panipat	Job No.	B269
				Unit No.	999
i	Operating Mechanism			Motorised	
ii	Mechanical indicator for High speed earthswitch status			Required	
iii	Electrical interlock with associated circuit breaker			Required	
D	Miscellaneous				
1	Paint Shade			RAL-7032	
2	Interface with ECS			Required	
3	SF6 Gas monitoring system			Required	
4	SF6 Gas Handling /filling unit			Required	
5	Spare SF6 gas			Required	
6	Quality of spare gas			10% of total gas as per 6.9.4 of 6-51-0066	
7	Mimic on LV compartment			Required	
8	Voltage Detectors			Required	

C	27-SEP-2021	REVISED AND REISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
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PROJECT: PANIPAT REFINERY EXPANSION(P-25) CLIENT: M/S IOCL	REV	DATE	PURPOSE	BY	CHKD	APPRV
	A	11.05.20	ISSUED WITH TENDER	AKG	HK	HK
	B	05.07.21	ISSUED WITH TENDER	AKG	HK	HK



- R1 PART OF NUMERICAL RELAY-1
R2 PART OF NUMERICAL RELAY-2
- NOTES:**
- ANTIPUMPING RELAY USED, IF ANY, SHALL BE CONSIDERED AS PART OF BREAKER MECHANISM.
 - THE ONE LINE DIAGRAM SHOWN ABOVE IS ONLY INDICATIVE. ALL THE ITEMS SPECIFIED UNDER "EQUIPMENT DATA" AND IN JOB SPECIFICATION SHALL BE IN VENDOR'S SCOPE.
 - ALL PROTECTIVE RELAYS SHALL BE NUMERICAL TYPE OF APPROVED MAKES. R2 METERING SHALL BE A PART OF NUMERICAL RELAY. SEPARATE ANALOGUE METERING DEVICES SHALL ALSO BE PROVIDED AS INDICATED.
 - VA BURDEN OF CT & PT SHALL BE DECIDED BY THE SWITCHGEAR VENDOR CONSIDERING VA BURDEN REQUIREMENTS FOR OWNER'S EQUIPMENTS AS WELL.
 - MIMIC DIAGRAM FOR OPERATION AND STATUS INDICATION OF CIRCUIT BREAKER AND ASSOCIATED DISCONNECTORS & EARTH SWITCH SHALL BE PROVIDED ON LCC. FOR CRP MIMIC SHALL BE PROVIDED IN RELAY/BCU.
 - THE COMPONENTS & EQUIPMENTS TO BE LOCATED ON GIS, LCC & CRP RESPECTIVELY SHALL BE AS SPECIFIED IN THE TENDER DOCUMENT.
 - THREE CORE PT SHALL BE PROVIDED. PT WITH ACCURACY CLASS 1.0 SHALL BE USED FOR MEASURING, PT WITH ACCURACY CLASS 3P SHALL BE USED FOR PROTECTION & OPEN DELTA PT SHALL BE USED FOR DETECTING EARTH FAULT AND PREVENTION OF FERRO RESONANCE.
 - 87F RELAY OF SAME MAKE/ MODEL SHALL BE LOOSE SUPPLIED BY VENDOR FOR INSTALLATION IN UPSTREAM FEEDER GIS CRP.
 - INTERCONNECTING CABLING BETWEEN GIS, LCC AND CRP SHALL BE SUPPLIED BY VENDOR AND SHALL BE ARMoured CABLE.
 - 220 KV CABLE TERMINATION KITS ARE NOT INCLUDED IN SCOPE OF VENDOR.

EQUIPMENT DATA			
ITEM NO.	NEMA NO.	QTY	DESCRIPTION
1	52	1	SF6 CIRCUIT BREAKER (TWO TRIP COILS)
2	--	2	3 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ON/ISOLATED/EARTHED ONE FOR BUS SIDE ONE FOR LINE SIDE
3	--	1	2 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ON/ISOLATED
4A	--	3	CT FOR 87F CLASS PS
4B	--	3	CT CLASS-5P10
4C	--	3	CT CLASS-1 (MIN. 10VA)
4D	--	3	CT FOR 87B CLASS PS
4E	--	3	CT FOR 87CH CLASS PS
5	--	1	HIGH SPEED MAKE PROOF EARTHING SWITCH
6	--	1	SURGE ARRESTOR
7	--	1	PT 220/√3/110/√3, WITH 4 POLE MCB (REFER NOTE-07)
8	67	1	DIRECTIONAL IDMTL O/C RELAY
	51N		IDMTL E/F RELAY (10-40%)
	25		SYNCHRONISING CHECK RELAY
	95-1/2		TRIP CIRCUIT SUPERVISION RELAY
	27		UNDERVOLTAGE RELAY
	2		TIMER
	67N		DIRECTIONAL IDMTL E/F RELAY
	51V		VOLTAGE RESTRAINED OVERCURRENT RELAY
	51		IDMTL O/C RELAY (50-200%)
	50LB B		LOCAL BREAKER BACKUP
9	86	1	TRIPPING RELAY - CONVENTIONAL VAJH TYPE
10	--	1	UPSTREAM BREAKER TRIP SWITCH (2 POSITION)(STAYPUT & LOCKABLE)
11	--	6	CONTROL SWITCH FOR DISCONNECTORS & EARTH SWITCHES
12	--	1	LOCAL/OFF/REMOTE SELECTOR SWITCH
13	52C/S	1	BREAKER CONTROL SWITCH (TNC) (LOCKABLE WITH SPRING RETURN TO NEUTRAL)
14	--	1	SOCKET AT PANEL BACK FOR CABLE TESTING,CURRENT & VOLTAGE INJECTION
15	--	1	3 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ON/ISOLATED/EARTHED
16	AS REQD		SF6 GAS MONITORING, ALARMS AND INDICATIONS
17	AS REQD		CLUSTER LED TYPE INDICATION LAMP
18	AS REQD		AUXILIARY RELAY
19	87F	2	FEEDER DIFFERENTIAL PROTECTION RELAY
20	AS REQD		WINDOW ALARM ANNUNCIATIONS
21A	--	1	MW METER
21B	--	1	MVAR METER
21C	--	1	MVA METER
21D	--	1	MVAH METER
21E	--	1	MAXIMUM DEMAND METER
22	2	SET	CUBICLE LAMP WITH MCB, DOOR SWITCH, PANEL SPACE HEATER & 3 PIN SOCKET WITH TOGGLE SWITCH FOR LCC & CRP
23	--	2	DP SWITCH 10A WITH FUSE FOR DC CONTROL SUPPLY FOR LCC & CRP
24	--	2	LV POWER SUPPLY SWITCH FUSE FOR LCC & CRP
25	--	3	AMMETER
26	--	3	VOLTMETER
27	--	3	4 POLE MCB, 10A, (FOR EACH PT CORE)



220KV GIS DATA SHEET
HARDWARE DATASHEET FOR INCOMER FROM PLANT FEEDER

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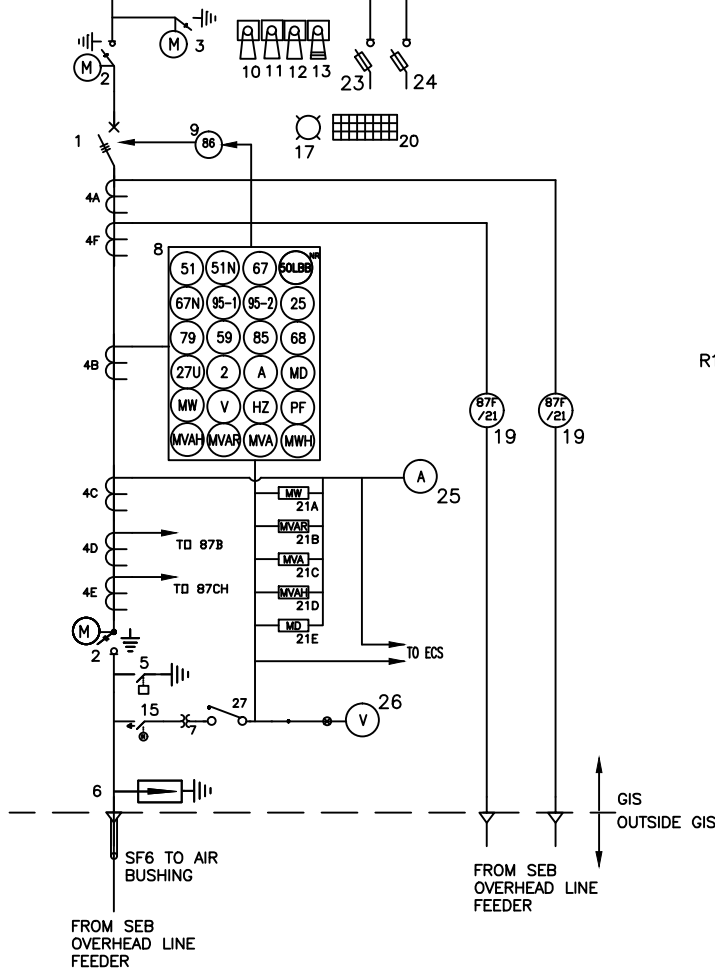
PROJECT: PANIPAT REFINERY EXPANSION(P-25)
CLIENT: M/S IOCL

REV	DATE	PURPOSE	BY	CHKD	APPRV
A	11.05.20	ISSUED WITH TENDER	AKG	HK	HK
B	05.07.21	ISSUED WITH TENDER	AKG	HK	HK

D.C CONTROL BUS (110V)

240V AC AUX. CKT BUS

220kV OUTGOING CABLE



R1 PART OF NUMERICAL RELAY-1
R2 PART OF NUMERICAL RELAY-2

NOTES:

- ANTIPUMPING RELAY USED, IF ANY, SHALL BE CONSIDERED AS PART OF BREAKER MECHANISM.
- THE ONE LINE DIAGRAM SHOWN ABOVE IS ONLY INDICATIVE. ALL THE ITEMS SPECIFIED UNDER "EQUIPMENT DATA" AND IN JOB SPECIFICATION SHALL BE IN VENDOR'S SCOPE.
- ALL PROTECTIVE RELAYS SHALL BE NUMERICAL TYPE OF APPROVED MAKES. METERING SHALL BE A PART OF NUMERICAL RELAY. SEPARATE ANALOGUE METERING DEVICES SHALL ALSO BE PROVIDED AS INDICATED.
- VA BURDEN OF CT & PT SHALL BE DECIDED BY THE SWITCHGEAR VENDOR CONSIDERING VA BURDEN REQUIREMENTS FOR OWNER'S EQUIPMENTS AS WELL..
- MIMIC DIAGRAM FOR OPERATION AND STATUS INDICATION OF CIRCUIT BREAKER AND ASSOCIATED DISCONNECTORS & EARTH SWITCH SHALL BE PROVIDED ON LCC. FOR CRP MIMIC SHALL BE PROVIDED IN RELAY/BCU.
- THE COMPONENTS & EQUIPMENTS TO BE LOCATED ON GIS, LCC & CRP RESPECTIVELY SHALL BE AS SPECIFIED IN THE TENDER DOCUMENT.
- THREE CORE PT SHALL BE PROVIDED. PT WITH ACCURACY CLASS 1.0 SHALL BE USED FOR MEASURING, PT WITH ACCURACY CLASS 3P SHALL BE USED FOR PROTECTION & OPEN DELTA PT SHALL BE USED FOR DETECTING EARTH FAULT AND PREVENTION OF FERRO RESONANCE.
- 87F/21 RELAY OF SAME MAKE/ MODEL SHALL BE LOOSE SUPPLIED BY VENDOR FOR INSTALLATION (BY OTEHRS) IN SEB SWITCHYARD CRP.
- INTERCONNECTING CABLING BETWEEN GIS, LCC AND CRP SHALL BE SUPPLIED BY VENDOR AND SHALL BE ARMoured CABLE.
- 220 KV CABLE TERMINATION KITS ARE NOT INCLUDED IN SCOPE OF VENDOR.

EQUIPMENT DATA

ITEM NO.	NEMA NO.	QTY	DESCRIPTION
1	52	1	SF6 CIRCUIT BREAKER (TWO TRIP COILS)
2	--	2	3 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ON/ISOLATED/EARTHED ONE FOR BUS SIDE ONE FOR LINE SIDE
3	--	1	2 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ISOLATED/EARTHED
4A	--	3	CT FOR 87F/21 CLASS PS
4B	--	3	CT CLASS-5P10
4C	--	3	CT CLASS-1 (MIN. 10VA)
4D	--	3	CT FOR 87B CLASS PS
4E	--	3	CT FOR 87CH CLASS PS
4F	--	3	CT FOR 87F/21 CLASS PS
5	--	1	HIGH SPEED MAKE PROOF EARTHING SWITCH
6	--	1	SURGE ARRESTOR
7	--	1	PT 220/√3/110/√3, WITH 4 POLE MCB (REFER NOTE-07)
8	87	2	DIRECTIONAL IDMTL O/C RELAY
	51N		IDMTL E/F RELAY (10-40%)
	25		SYNCHRONISING CHECK RELAY
	95-1/2		TRIP CIRCUIT SUPERVISION RELAY
	59		OVERVOLTAGE RELAY
	27		UNDERVOLTAGE RELAY
	79		AUTO RECLOSE FUNCTION
	85		CARRIER AIDED INTER TRIP
	68		BLOCKING RELAY
	2		TIMER
	87N		DIRECTIONAL IDMTL E/F RELAY
	51V		VOLTAGE RESTRAINED OVERCURRENT RELAY
	51		IDMTL O/C RELAY (50-200%)
	50LB		LOCAL BREAKER BACKUP
9	86	1	TRIPPING RELAY - CONVENTIONAL TYPE UPSTREAM BREAKER TRIP SWITCH (2 POSITION)(STAYPUT & LOCKABLE)
10	--	1	CONTROL SWITCH FOR DISCONNECTORS & EARTH SWITCHES
11	--	6	LOCAL/OFF/REMOTE SELECTOR SWITCH
12	--	1	BREAKER CONTROL SWITCH (TNC) (LOCKABLE WITH SPRING RETURN TO NEUTRAL)
13	52C/S	1	SOCKET AT PANEL BACK FOR CABLE TESTING,CURRENT & VOLTAGE INJECTION
14	--	1	3 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ON/ISOLATED/EARTHED
16	AS REQD		SF6 GAS MONITORING, ALARMS AND INDICATIONS
17	AS REQD		CLUSTER LED TYPE INDICATION LAMP
18	AS REQD		AUXILIARY RELAY
19	87F/21	4	FEEDER DIFFERENTIAL PROTECTION RELAY OR DISTANCE PROTECTION RELAY (EACH OF TWO DIFFERENT MAKES) (REFER NOTE-8)
20	AS REQD		WINDOW ALARM ANNUNCIATIONS
21A	--	1	MW METER
21B	--	1	MVAR METER
21C	--	1	MVA METER
21D	--	1	MVAH METER
21E	--	1	MAXIMUM DEMAND METER
22	2 SET		CUBICLE LAMP WITH MCB, DOOR SWITCH, PANEL SPACE HEATER & 3 PIN SOCKET WITH TOGGLE SWITCH FOR LCC & CRP
23	--	2	DP SWITCH 10A WITH FUSE FOR DC CONTROL SUPPLY FOR LCC & CRP
24	--	2	LV POWER SUPPLY SWITCH FUSE FOR LCC & CRP
25	--	3	AMMETER
26	--	3	VOLTMETER
27	--	3	4 POLE MCB, 10A, (FOR EACH PT CORE)
28	--	1	3 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ON/ISOLATED/EARTHED



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220KV GIS DATA SHEET

HARDWARE DATASHEET FOR INCOMER FROM OVERHEAD LINE

DATA SHEET

REV

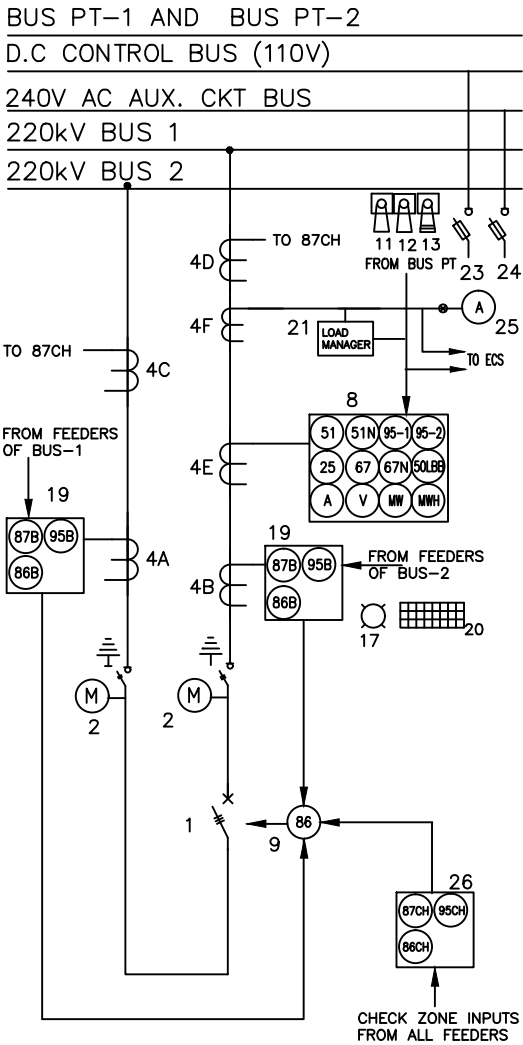
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PROJECT: PANIPAT REFINERY EXPANSION(P-25) CLIENT: M/S IOCL	REV	DATE	PURPOSE	BY	CHKD	APPRV
	A	11.05.20	ISSUED WITH TENDER	AKG	HK	HK
	B	05.07.21	ISSUED WITH TENDER	AKG	HK	HK



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

- NOTES:
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 - VA BURDEN OF CT & PT SHALL BE DECIDED BY THE SWITCHBOARD VENDOR CONSIDERING VA BURDEN REQUIREMENTS FOR OWNER'S EQUIPMENTS AS WELL.
 - MIMIC DIAGRAM FOR OPERATION AND STATUS INDICATION OF CIRCUIT BREAKER AND ASSOCIATED DISCONNECTORS & EARTH SWITCH SHALL BE PROVIDED ON LCC. FOR CRP MIMIC SHALL BE PROVIDED IN RELAY/BCU.
 - THE COMPONENTS & EQUIPMENTS TO BE LOCATED ON GIS, LCC & CRP RESPECTIVELY SHALL BE AS SPECIFIED IN THE SPECIFICATION.

EQUIPMENT DATA

ITEM NO.	NEMA NO.	QTY	DESCRIPTION
1	52	1	SF6 CIRCUIT BREAKER (TWO TRIP COIL)
2	--	2	3 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ON/ISOLATED/EARTHED
3	--	--	DELETED
4A	--	3	CT FOR 87B CLASS PS
4B	--	3	CT FOR 87B CLASS PS
4C	--	3	CT FOR 87CH CLASS PS
4D	--	3	CT FOR 87CH CLASS PS
4E	--	3	CT CLASS-5P10
4F	--	3	CT CLASS-1 (MIN. 10VA)
5	--	--	DELETED
6	--	--	DELETED
7	--	--	DELETED
8	67	1	DIRECTIONAL IDMTL O/C RELAY
	51N		IDMTL E/F RELAY (10-40%)
	25		SYNCHRONISING CHECK RELAY
	95-1/2		TRIP CIRCUIT SUPERVISION RELAY
	67N		DIRECTIONAL IDMTL E/F RELAY
	51		IDMTL O/C RELAY (50-200%)
	50LB		LOCAL BREAKER BACKUP
9	86	1	TRIPPING RELAY - CONVENTIONAL VAJH TYPE
10	--		DELETED
11	--	4	CONTROL SWITCH FOR DISCONNECTORS & EARTH SWITCHES
12	--	1	LOCAL/OFF/REMOTE SELECTOR SWITCH
13	52C/S	1	BREAKER CONTROL SWITCH (TNC) (LOCKABLE WITH SPRING RETURN TO NEUTRAL)
14	--	1	SOCKET AT PANEL BACK FOR CABLE TESTING,CURRENT & VOLTAGE INJECTION
15	--		DELETED
16	AS REQD		SF6 GAS MONITORING, ALARMS AND INDICATIONS
17	AS REQD		CLUSTER LED TYPE INDICATION LAMP
18	AS REQD		AUXILIARY RELAY
19	87B	2	BUSBAR DIFFERENTIAL PROTECTION RELAY LOW IMPEDANCE TYPE WITH MANUAL BYPASS
	95B		CT SUPERVISION RELAY
20	AS REQD		WINDOW ALARM ANNUNCIATIONS
21	--	1	LOAD MANAGER
22	--	2 SET	CUBICLE LAMP WITH MCB, DOOR SWITCH, PANEL SPACE HEATER & 3 PIN SOCKET WITH TOGGLE SWITCH FOR LCC & CRP
23	--	2	DP SWITCH 10A WITH FUSE FOR DC CONTROL SUPPLY FOR LCC & CRP
24	--	2	LV POWER SUPPLY SWITCH FUSE FOR LCC & CRP
25	--	1	AMMETER WITH 4 WAY A-S-S
26	87CH	1	BUSBAR DIFFERENTIAL PROTECTION RELAY LOW IMPEDANCE TYPE WITH MANUAL BYPASS
	95CH		CT SUPERVISION RELAY



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220KV GIS DATA SHEET

HARDWARE DATASHEET FOR BUS COUPLER/ BUS SECTIONALIZER

DATA SHEET

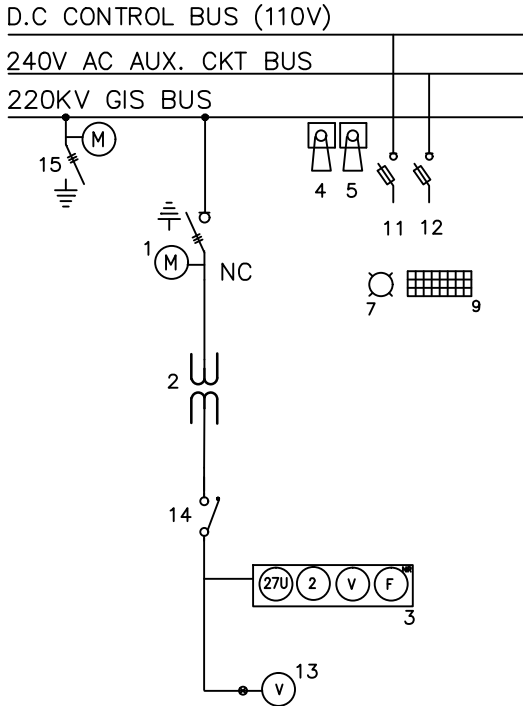
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	A	11.05.20	ISSUED WITH TENDER	AKG	HK	HK
	B	05.07.21	ISSUED WITH TENDER	AKG	HK	HK



EQUIPMENT DATA			
ITEM NO.	NEMA NO.	QTY	DESCRIPTION
1	--	1	3 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ON/ISOLATED/EARTHED
2	--	--	PT 220/√3/110/√3, WITH 4 POLE MCB
3	27		UNDervOLTAGE RELAY
	2		TIMER
4	--	2	CONTROL SWITCH FOR DISCONNECTORS & EARTH SWITCHES
5	--	1	LOCAL/OFF/REMOTE SELECTOR SWITCH
6	--	AS REQD	SF6 GAS MONITORING, ALARMS AND INDICATIONS
7	--	AS REQD	CLUSTER LED TYPE INDICATION LAMP
8	--	AS REQD	AUXILIARY RELAY
9	--	AS REQD	WINDOW ALARM ANNUNCIATIONS
10	--	2 SET	CUBICLE LAMP WITH MCB, DOOR SWITCH, PANEL SPACE HEATER & 3 PIN SOCKET WITH TOGGLE SWITCH FOR LCC & CRP
11	--	2	DP SWITCH 10A WITH FUSE FOR DC CONTROL SUPPLY FOR LCC & CRP
12	--	2	LV POWER SUPPLY SWITCH FUSE FOR LCC & CRP
13	--	1	VOLTMETER WITH 4 WAY V-S-S
14	--	3	4P MCB, 10A (FOR EACH CORE) ON SECONDARY SIDE OF PT
15	--	1	2 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ISOLATED/EARTHED

R1 PART OF NUMERICAL RELAY

NOTES:

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- ALL PROTECTIVE RELAYS SHALL BE NUMERICAL TYPE OF APPROVED MAKES. METERING SHALL BE A PART OF NUMERICAL RELAY. SEPARATE ANALOGUE METERING DEVICES SHALL ALSO PROVIDE AS INDICATED.
- VA BURDEN OF PT SHALL BE DECIDED BY THE SWITCHBOARD VENDOR CONSIDERING VA BURDEN REQUIREMENTS FOR OWNER'S EQUIPMENTS AS WELL.
- INDEPENDENT BUS PT PANEL SHALL BE PROVIDED FOR BOTH THE BUSES OF THE DOUBLE BUS GIS SWITCHBOARD.
- MIMIC DIAGRAM FOR OPERATION AND STATUS INDICATION OF ASSOCIATED DISCONNECTORS & EARTH SWITCH SHALL BE PROVIDED ON LCC. FOR CRP MIMIC SHALL BE PROVIDED IN RELAY/BCU.
- THE COMPONENTS & EQUIPMENTS TO BE LOCATED ON GIS, LCC & CRP RESPECTIVELY SHALL BE AS SPECIFIED IN THE SPECIFICATION.
- THREE CORE PT SHALL BE PROVIDED. PT WITH ACCURACY CLASS 1.0 SHALL BE USED FOR MEASURING, PT WITH ACCURACY CLASS 3P SHALL BE USED FOR PROTECTION & OPEN DELTA PT SHALL BE USED FOR DETECTING EARTH FAULT AND PREVENTION OF FERRO RESONANCE.
- DUAL CORE PT SHALL BE PROVIDED. PT WITH ACCURACY CLASS 0.2 SHALL BE USED FOR MEASUREMENT AT ECS, SCAP & VOLTMETER. PT WITH ACCURACY CLASS 3P SHALL BE USED FOR PROTECTION.



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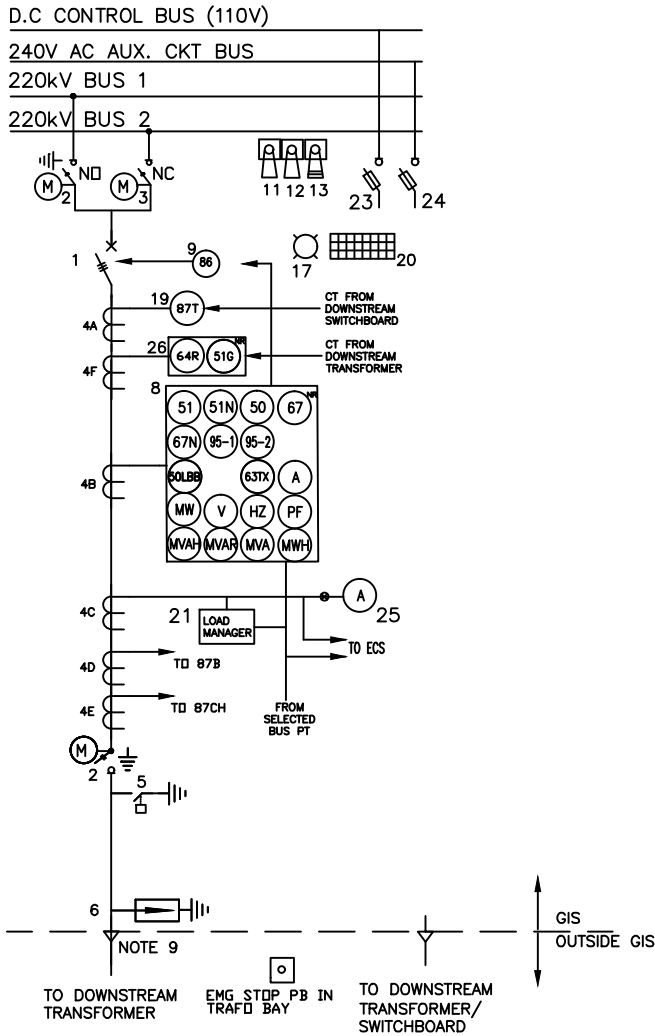
220KV GIS DATA SHEET
HARDWARE DATASHEET FOR BUS PT

DATA SHEET	REV
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Sht.1 OF 1	

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PROJECT: PANIPAT REFINERY EXPANSION(P-25) CLIENT: M/S IOCL	REV	DATE	PURPOSE	BY	CHKD	APPRV
	A	11.05.20	ISSUED WITH TENDER	AKG	HK	HK
	B	05.07.21	ISSUED WITH TENDER	AKG	HK	HK

BUS PT-1 AND BUS PT-2



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

- NOTES:**
- ANTIPUMPING RELAY USED, IF ANY, SHALL BE CONSIDERED AS PART OF BREAKER MECHANISM.
 - THE ONE LINE DIAGRAM SHOWN ABOVE IS ONLY INDICATIVE. ALL THE ITEMS SPECIFIED UNDER "EQUIPMENT DATA" AND IN JOB SPECIFICATION SHALL BE IN VENDOR'S SCOPE.
 - ALL PROTECTIVE RELAYS SHALL BE NUMERICAL TYPE OF APPROVED MAKES. METERING SHALL BE A PART OF NUMERICAL RELAY. SEPARATE ANALOGUE METERING DEVICES SHALL ALSO BE PROVIDED AS INDICATED.
 - VA BURDEN OF CT & PT SHALL BE DECIDED BY THE SWITCHGEAR VENDOR CONSIDERING VA BURDEN REQUIREMENTS FOR OWNER'S EQUIPMENTS AS WELL..
 - MIMIC DIAGRAM FOR OPERATION AND STATUS INDICATION OF CIRCUIT BREAKER AND ASSOCIATED DISCONNECTORS & EARTH SWITCH SHALL BE PROVIDED ON LCC. FOR CRP MIMIC SHALL BE PROVIDED IN RELAY/BCU.
 - THE COMPONENTS & EQUIPMENTS TO BE LOCATED ON GIS, LCC & CRP RESPECTIVELY SHALL BE AS SPECIFIED IN THE TENDER DOCUMENT.
 - RELAY FOR 87T AND 64R SHALL BE SEPARATE.
 - INTERCONNECTING CABLING BETWEEN GIS, LCC AND CRP SHALL BE SUPPLIED BY VENDOR AND SHALL BE ARMoured CABLE.
 - 220 KV CABLE TERMINATION KITS ARE NOT INCLUDED IN SCOPE OF VENDOR.

EQUIPMENT DATA

ITEM NO.	NEMA NO.	QTY	DESCRIPTION
1	52	1	SF6 CIRCUIT BREAKER (TWO TRIP COILS)
2	--	2	3 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ON/ISOLATED/EARTHED ONE FOR BUS SIDE ONE FOR LINE SIDE
3	--	1	2 POSN. DISCONNECTOR SWITCH WITH MOTORIZED/MANUAL OPERATION & MECHANICAL POSITION INDICATOR -ON/ISOLATED
4A	--	3	CT FOR 87T CLASS PS
4B	--	3	CT CLASS-5P10
4C	--	3	CT CLASS-1 (MIN. 10VA)
4D	--	3	CT FOR 87B CLASS PS
4E	--	3	CT FOR 87CH CLASS PS
4F	--	3	CT FOR 64R CLASS PS
5	--	1	HIGH SPEED MAKE PROOF EARTHING SWITCH
6	--	1	SURGE ARRESTOR
7	--	--	DELETED
8	51	1	IDMTL O/C RELAY (50-200%)
	51N		IDMTL E/F RELAY (10-40%)
	95-1/2		TRIP CIRCUIT SUPERVISION RELAY
	67		DIRECTIONAL IDMTL O/C RELAY
	67N		DIRECTIONAL IDMTL E/F RELAY
	50		INSTANTANEOUS O/C RELAY
	63TX		TRANSFORMER TROUBLE RELAY
9	86	1	TRIPPING RELAY - CONVENTIONAL VAJH TYPE
10	--		DELETED
11	--	6	CONTROL SWITCH FOR DISCONNECTORS & EARTH SWITCHES
12	--	1	LOCAL/OFF/REMOTE SELECTOR SWITCH
13	52C/S	1	BREAKER CONTROL SWITCH (TNC) (LOCKABLE WITH SPRING RETURN TO NEUTRAL)
14	--	1	SOCKET AT PANEL BACK FOR CABLE TESTING,CURRENT & VOLTAGE INJECTION
15	--		DELETED
16	--	AS REQD	SF6 GAS MONITORING, ALARMS AND INDICATIONS
17	--	AS REQD	CLUSTER LED TYPE INDICATION LAMP
18	--	AS REQD	AUXILIARY RELAY
19	87T	1	TRANSFORMER DIFFERENTIAL PROTECTION RELAY
20	--	AS REQD	WINDOW ALARM ANNUNCIATIONS
21	--	1	LOAD MANAGER
22	--	2 SET	CUBICLE LAMP WITH MCB, DOOR SWITCH, PANEL SPACE HEATER & 3 PIN SOCKET WITH TOGGLE SWITCH FOR LCC & CRP
23	--	2	DP SWITCH 10A WITH FUSE FOR DC CONTROL SUPPLY FOR LCC & CRP
24	--	2	LV POWER SUPPLY SWITCH FUSE FOR LCC & CRP
25	--	1	AMMETER WITH 4 WAY A-S-S
26	64R	1	RESTRICTED EARTH FAULT RELAY
	51G		IDMTL BACK UP EARTH FAULT RELAY



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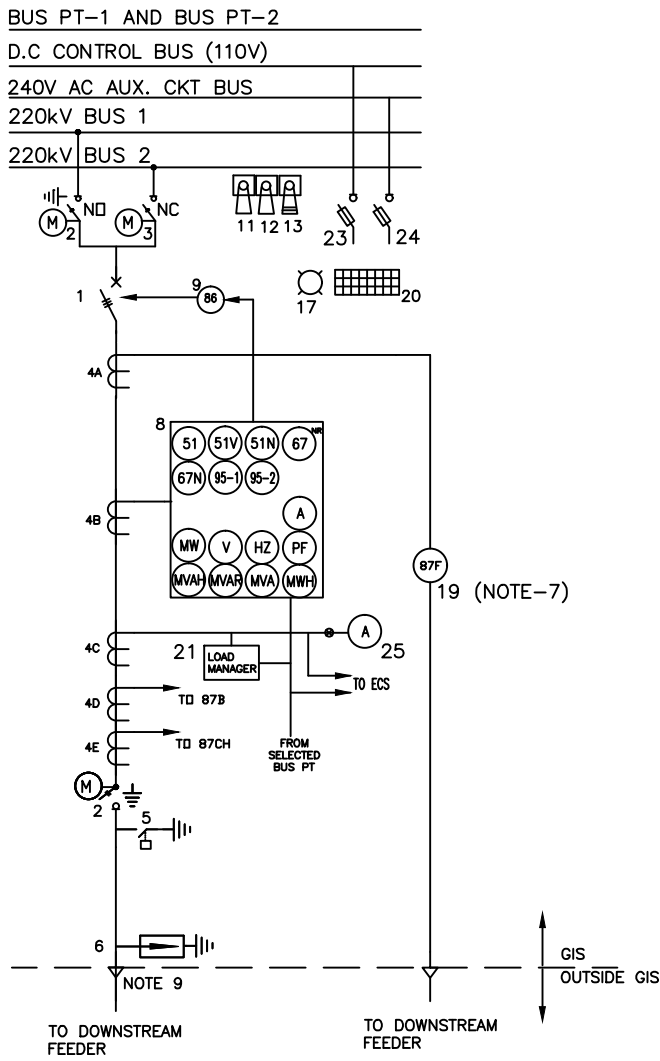
220KV GIS DATA SHEET
HARDWARE DATASHEET FOR OUTGOING TRANSFORMER FEEDER

DATA SHEET
B269-999-16-50-DS-0040
Sht.1 OF 1

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B

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	A	11.05.20	ISSUED WITH TENDER	AKG	HK	HK
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R1 PART OF NUMERICAL RELAY-1
R2 PART OF NUMERICAL RELAY-2

- NOTES:**
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 2. THE ONE LINE DIAGRAM SHOWN ABOVE IS ONLY INDICATIVE. ALL THE ITEMS SPECIFIED UNDER "EQUIPMENT DATA" AND IN JOB SPECIFICATION SHALL BE IN VENDOR'S SCOPE.
 3. ALL PROTECTIVE RELAYS SHALL BE NUMERICAL TYPE OF APPROVED MAKES. METERING SHALL BE A PART OF NUMERICAL RELAY. SEPARATE ANALOGUE METERING DEVICES SHALL ALSO BE PROVIDED AS INDICATED.
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 5. MIMIC DIAGRAM FOR OPERATION AND STATUS INDICATION OF CIRCUIT BREAKER AND ASSOCIATED DISCONNECTORS & EARTH SWITCH SHALL BE PROVIDED ON LCC. FOR CRP MIMIC SHALL BE PROVIDED IN RELAY/BCU.
 6. THE COMPONENTS & EQUIPMENTS TO BE LOCATED ON GIS, LCC & CRP RESPECTIVELY SHALL BE AS SPECIFIED IN THE TENDER DOCUMENT.
 7. 87F RELAY OF SAME MAKE/ MODEL SHALL BE LOOSE SUPPLIED BY VENDOR FOR INSTALLATION IN DOWNSTREAM SWITCHBOARD.
 8. INTERCONNECTING CABLING BETWEEN GIS, LCC AND CRP SHALL BE SUPPLIED BY VENDOR AND SHALL BE ARMoured CABLE.
 9. 220 KV CABLE TERMINATION KITS ARE NOT INCLUDED IN SCOPE OF VENDOR.

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4C	--	3	CT CLASS-1 (MIN. 10VA)
4D	--	3	CT FOR 87B CLASS PS
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7	--	--	DELETED
8	87	1	DIRECTIONAL IDMTL O/C RELAY
	51N		IDMTL E/F RELAY (10-40%)
	95-1/2		TRIP CIRCUIT SUPERVISION RELAY
	87N		DIRECTIONAL IDMTL E/F RELAY
	51V		VOLTAGE RESTRAINED OVERCURRENT RELAY
	51		IDMTL O/C RELAY (50-200%)
9	86	1	TRIPPING RELAY - CONVENTIONAL VAJH TYPE
10	--		DELETED
11	--	6	CONTROL SWITCH FOR DISCONNECTORS & EARTH SWITCHES
12	--	1	LOCAL/OFF/REMOTE SELECTOR SWITCH
13	52C/S	1	BREAKER CONTROL SWITCH (TNC) (LOCKABLE WITH SPRING RETURN TO NEUTRAL) SOCKET AT PANEL BACK FOR CABLE TESTING,CURRENT & VOLTAGE INJECTION
14	--	1	DELETED
15	--		DELETED
16	--	AS REQD	SF6 GAS MONITORING, ALARMS AND INDICATIONS
17	--	AS REQD	CLUSTER LED TYPE INDICATION LAMP
18	--	AS REQD	AUXILIARY RELAY
R2	19	87F	2 FEEDER DIFFERENTIAL PROTECTION RELAY
	20	--	AS REQD WINDOW ALARM ANNUNCIATIONS
	21	--	1 LOAD MANAGER
	22	--	2 SET CUBICLE LAMP WITH MCB, DOOR SWITCH, PANEL SPACE HEATER & 3 PIN SOCKET WITH TOGGLE SWITCH FOR LCC & CRP
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	24	--	2 LV POWER SUPPLY SWITCH FUSE FOR LCC & CRP
	25	--	1 AMMETER WITH 4 WAY A-S-S



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220KV GIS DATA SHEET
HARDWARE DATASHEET FOR OUTGOING PLANT FEEDER

DATA SHEET	REV
B269-999-16-50-DS-0041	B
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SECTION-2, Annexure_1

अतिरिक्त उच्च वोल्टेज वाले
गैस रोधित स्विचगियर
के लिए विनिर्देश

SPECIFICATION FOR EXTRA HIGH VOLTAGE GAS INSULATED SWITCHGEAR

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
1	29.03.2019	REVISED & ISSUED AS STANDARD SPECIFICATION	JAS	PG	BRB	RKT
0	30 01 2014	ISSUED AS STANDARD SPECIFICATION	AS	PG	UAP	SC

Approved by

Abbreviations:

A	: Ampere	ICT	: Interposing Current Transformer
AC	: Alternating Current	IEC	: International Electro technical Commission
AL	: Aluminium	IEEE	: Institute of Electrical & Electronics Engineers
ASME	: The American Society of Mechanical Engineers	IP	: Ingress Protection
BCU	: Bay Control Unit	IS	: Indian Standards
BIL	: Basic Insulation Level	kV	: Kilo Volt
BIS	: Bureau of Indian Standards	kW	: Kilo Watt
BS	: British Standards	kWh	: Kilo Watt Hour
CB	: Circuit Breaker	LCC	: Local Control Cabinet
CEA	: Central Electricity Authority	LED	: Light Emitting Diode
CENELEC	: Comité Européen de Normalisation Électrotechnique	MCB	: Miniature Circuit Breaker
CIGRE	: Conseil International des Grands Réseaux Électriques	NEMA	: National Electrical Manufacturers Association
CNT	: Close-Neutral-Trip	NC	: Normally Close
CO	: Close Open	NO	: Normally Open
CRCA	: Cold Rolled Cold Annealed	O	: Open
CRP	: Control Relay Panel	PO	: Purchase Order
CT	: Current Transformer	p.u	: per unit
Cu	: Copper	RAL	: Reichs-Ausschuss fur Lieferbedingungen
DC	: Direct Current	RIP	: Resin Impregnated Paper
EHV	: Extra High Voltage	SF ₆	: Sulphur Hexafluoride
EIL	: Engineers India Limited	SS	: Stainless Steel
EPDM	: Ethylene Propylene Diene Monomer	TRV	: Transient Recovery Voltage
FRLS	: Flame Retardant Low Smoke	VDE	: Verband Deutscher Elektrotechniker
GIS	: Gas Insulated Switchgear	VT	: Voltage Transformer
GIBD	: Gas Insulated Bus Duct	XLPE	: Cross Linked Poly Ethylene
HV	: High Voltage		
Hz	: Hertz		

Electrical Standards Committee

Convenor: Mr. B.R. Bhogal

Members: Ms. S. Anand
Mr. Parag Gupta
Mr. M.K. Sahu
Ms. N.S. Bhattacharya
Ms. N.P. Guha (Project)
Mr. Saeed Akhtar (Inspection)

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1.0 SCOPE

This specification covers the design, engineering, manufacture, testing, packing and supply of Extra High Voltage Gas Insulated Switchgear (GIS) & Gas insulated Bus duct (GIBD) for working voltages from 66 kV up to and including 400 kV complete with Local Control Cabinet (LCC), Control Relay Panel (CRP) and interconnecting cabling amongst GIS, LCC & CRP.

2.0 CODES AND STANDARDS

2.1 The GIS equipments / components used shall comply with the requirements of latest revision of the following standards and also the other Indian and International Standards as applicable, unless otherwise specified:

IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories
IS 2705	Current Transformers
IS 3156	Voltage Transformers
IS 4379	Identification of contents of industrial gas cylinders
IS 5082	Material data for aluminium bus bars
IS 5578	Guide for marking of insulated conductors
IS 11353	Guide for uniform system of marking and identification of conductors & apparatus terminals
IS 13703	Low voltage fuses for voltages not exceeding 1000V AC or 1500V DC
IEC 60059	IEC Standard Current Rating
IS/IEC 60060	High Voltage test techniques
IEC 60099 -4	Metal-oxide surge arresters without gaps for a.c. systems
IEC 60114	Recommendation for heat treated aluminium alloy bus bar material of Aluminium-Magnesium-Silicon type
IEC 60137	Bushings for alternating voltages above 1000 V
IEC 60255	Electrical Relays
IS/IEC 60270	High-voltage test techniques - Partial discharge measurements
IEC 60376	Specification of technical grade sulphur hexafluoride (SF ₆) for use in electrical equipment
IEC 60480	Guidelines for the checking and treatment of sulphur hexafluoride (SF ₆) taken from electrical equipment and specification for its re-use
IS/IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60694	Common specifications for high-voltage switchgear and controlgear standards
IEC 61243-1	Live working Voltage detectors: Capacitive type to be used for voltages exceeding 1 kV A.C.
IEC 61639	Direct connection between Power Transformers and gas insulated metal enclosed switchgear for rated voltage 72.5 kV and above
IEC 61869-1	Instrument transformers – General requirements
IEC 61869-2	Additional requirements for current transformers
IEC 61869-3	Additional requirements for inductive voltage transformers
IS/IEC 62271-1	High – Voltage Switchgear and Controlgear: Common specifications
IEC 62271-4	Handling procedures for sulphur hexafluoride (SF ₆) and its mixtures
IS/IEC 62271-100	Alternating current circuit-breakers
IS/IEC 62271-102	Alternating current disconnectors (isolators) and earthing switches
IEC 62271-104	Alternating current switches for rated voltages of 52 kV and above
IEC 62271-110	High-voltage switchgear and controlgear - Inductive load switching
IEC 62271-203	Gas Insulated metal-enclosed switchgear for rated Voltages above 52 kV
IEC 62271-209	Cable connections for gas-insulated metal-enclosed switchgear for

- rated voltages above 52 kV-Fluid filled and extruded insulation cables-Fluid filled and dry type cable terminations
IEC 62271-303 Use and handling of Sulphur hexafluoride (SF₆)
IEEE 80 IEEE Guide for safety in AC substation grounding
- 2.2** In case of imported equipment, standards of the country of origin shall be applicable, if these standards are equivalent or stringent than the applicable Indian standards.
- 2.3** The equipment shall also conform to the provisions of CEA regulations with latest amendments and other statutory regulations currently in force in the country.
- 2.4** In case Indian standards are not available for any equipment, standards issued by IEC/BS/VDE/IEEE/NEMA or equivalent agency shall be applicable.
- 2.5** In case of any contradiction between various referred standard/ specification/ data sheet and statutory regulation, most stringent requirements shall prevail. However, Owner's decision in this regard will be final and binding.
- 3.0 GENERAL REQUIREMENT**
- 3.1** The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.
- 3.2** Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment for at least 10 years from the date of supply.
- 3.3** Vendor shall give a notice of at least one year to the end user of equipment and EIL before phasing out the product/spares to enable the end user for placement of order for spares and services.
- 4.0 SITE CONDITIONS**
- 4.1** The EHV GIS, GIBD & accessories shall be suitable for installation and satisfactory operation in a pressurised substation or in a substation with restricted natural air ventilation in a tropical, humid and corrosive atmosphere.
- 4.2** The switchgear shall be designed to operate under site conditions as specified in the data sheets. If not specifically mentioned therein, a design ambient temperature of 40°C and an altitude not exceeding 1000 metres above mean sea level shall be considered.
- 4.3** All equipments are intended for continuous duty operation, as per nameplate rating under the specified ambient conditions, unless indicated otherwise.
- 5.0 DESIGN AND FABRICATION REQUIREMENTS**
- 5.1 Enclosure and Protection**
- 5.1.1** The switchgear shall be an indoor gas-insulated, metal enclosed design, assembled to form free standing, self supporting dead front structure. The degree of protection shall be at least IP4X for low voltage and drive mechanism compartments as specified in IS/IEC-60529. All openings, covers and doors shall be provided with suitable Neoprene / XLPE/ EPDM gaskets around the perimeter to make the switchgear dust and vermin proof.
- 5.1.2** LCC, drive mechanism, CRP frame shall be fabricated using 2 mm CRCA sheet steel while doors and covers shall be made from 1.6 mm thick CRCA sheet steel.

- 5.1.3 The switchgear assembly shall consist of completely separate, SF₆ gas filled pressurized sections housing various switchgear components. The switchgear gas enclosures shall be sectionalised, with gastight barriers between sections / compartments. Gas enclosures shall be designed and fabricated to comply with the requirements of the applicable pressure vessel codes to which it is subjected in service (ASME/ CENELEC code for pressure vessel).
- 5.1.4 Each gas-filled compartment shall be equipped with static filters (e.g. molecular sieve or activated alumina or other absorbent), pressure switches, filling & draining valve with automatic shut off and safety diaphragm. The filters shall be capable of absorbing any water vapour which may penetrate into the enclosures as well as the by-products of SF₆ created during interruption. Each gas compartment shall be fitted with separate non-return valve connectors for evacuating & filling the gas and checking the gas pressure etc.
- 5.1.5 The enclosures may be three phase enclosure or single phase enclosure as per the standard type tested design of the vendor.
- 5.1.6 The switchgear shall be of modular design and capable of extension in future by the addition of extra feeders without necessarily dismantling, moving or dislocating any major parts of existing switchgear bays. Design details for future extension shall be provided.
- 5.1.7 The enclosure for the SF₆ gas and associated circuit elements of enclosure shall be made from non magnetic material e.g. AL/AL alloy. Enclosures of the same phase shall be electrically interconnected, and shall be earthed at appropriate places. At appropriate points single phase enclosures should be connected to other phases, thus ensuring a return current path.
- 5.1.8 The enclosure shall be designed to practically eliminate the external electromagnetic field and thereby electro-dynamic stresses even under short circuit conditions.
- 5.1.9 It should be impossible to unwillingly touch live parts of the switchgear or to perform operations that lead to arcing faults without the use of tools or brute force.
- 5.1.10 All interlocks that prevent potentially dangerous mal-operations shall be constructed such that they cannot be operated easily, i.e. the operator shall use tools or brute force to over-ride them.
- 5.1.11 The switchgear earth buses shall have provision for connection to the plant earth grid running in the vicinity of the equipment.
- 5.1.12 The ladders, walkways and platforms with handrail shall be provided wherever necessary for access to the equipment. A portable ladder with adjustable height shall also be supplied for access to the equipment during operation & maintenance.
- 5.1.13 Any paints or other coatings that may be used shall be such that they will not deteriorate when exposed to the SF₆ gas and other vapours, arc products, etc. that may be present in the enclosures. They shall also not contain any substances which could contaminate the enclosed SF₆ gas or affect its insulating properties over a period of time.

5.2 Accessibility & Maintenance

- 5.2.1 Checking and removal of components shall be possible without disturbing adjacent equipment. All equipments shall be easily accessible. It shall be possible to set all measuring relays and instruments in-situ without de-energising the switchgear. All mounted equipment shall have identification tags of self sticking tapes at the rear also. In addition, identification numbers shall be painted on the panel wall to give a permanent identification mark.
- 5.2.2 All terminals shall be shrouded with plastic covers to prevent accidental contact.

- 5.2.3 GIS components shall be installed and arranged to facilitate realistic access for maintenance and removal of equipment, with a minimum amount of disturbance to other equipment meeting service continuity requirements.
- 5.2.4 It shall be generally possible to remove a circuit element (breaker, disconnect switch etc), without removing another element.
- 5.2.5 For routine inspection and possible repairs, all elements shall be accessible without removing support structures.
- 5.2.6 All special tools & tackles required for erection & maintenance of GIS & GIBD shall be provided by the vendor.

5.3 Service Continuity

- 5.3.1 The service continuity for GIS shall be ensured by appropriate sequence & location of feeders and by providing suitable gas compartment partitioning, additional gas buffer compartment, additional isolating links etc.
- 5.3.2 Following minimum requirements for service continuity shall be met:
- During a fault in any circuit breaker compartment, no bus bar is permitted to be out of service during maintenance, repair and replacement.
 - The bus bar enclosure shall be sectionalised in a manner that maintenance work in any section of bus bar can be carried out by isolating and evacuating that small section and not the entire bus. For fault in one bus bar & disconnect compartment, at the maximum the adjacent feeders are permitted to be out of service during maintenance and repair. However the complete healthy bus / other bus shall remain operational for double bus GIS.
 - During a fault in any compartment other than circuit breaker or bus bar & disconnect compartment, maximum affected feeder is permitted out of service during maintenance and repair.

5.4 Bus Bar

- 5.4.1 EHV GIS Bus configuration (Single Bus or Double Bus or One and half breaker scheme) shall be provided as specified in the data sheets/ Job specification.
- 5.4.2 Bus bars shall be of high conductivity electrolytic aluminium or copper.
- 5.4.3 The 3-phase bus bars shall be either housed in single phase enclosures or 3-phase enclosure as per vendor's design. All phase bus bars shall be of uniform cross-section and shall be sized to carry continuously the rated current specified in data sheet.
- 5.4.4 Bus bars and the supports shall be adequately sized and braced to withstand the specified short-circuit current without any permanent deformation. All bus supports shall be of non-hygroscopic, non-inflammable, non-carbonising material, resistant to acids and alkalies.
- 5.4.5 Bus bar earthing facilities for each section of the bus bars, completely interlocked with associated disconnectors & CBs of that section of bus bars including bus coupler / bus sectionaliser shall be provided.

5.5 Expansion and Flexible Connection for Enclosure/ Conductors

- 5.5.1 Expansion joints / flexible connections shall be provided in each metal enclosure and conductors to absorb the actual or relative thermal expansion and contraction of the bus bar & equipments as well as structures resulting from variations of temperature of the switchgear equipment.
- 5.5.2 The number and position of the expansion joints / flexible connections shall be decided by the vendor to ensure that complete installation is not subjected to any expansion stresses which could lead to failure of any piece of the GIS equipment, supporting structures.
- 5.5.3 The electrical connections for the conductor expansion joints / flexible connections shall be made by means of multiple contact connectors preferably same as that provided at the joints between the separate gas compartments.
- 5.5.4 In addition, metallic bellows (preferably of stainless steel) shall be provided for lateral and vertical alignment.

5.6 Cable Termination

- 5.6.1 The SF₆ GIS to XLPE cable terminations shall conform to IEC-62271-209.
- 5.6.2 All power cables and control cables will be connected from below through cut-outs in the floor or through cable trench. Plug in terminations (including plugs, sockets) and all accessories shall be provided for power cables for all feeders including spare feeders by vendor.
- 5.6.3 Isolating links shall be provided in cable termination module for disconnection between GIS and cable during cable testing. Further suitable arrangements of test plug / socket shall be provided which will permit full dielectric testing for outgoing cable of all cable feeders including primary current injection test for current transformers. The voltage rating of test plug / socket shall be as specified in data sheet / job specification.
- 5.6.4 Unless otherwise specified, all control cables shall enter from the bottom. Supporting facilities shall be provided for clamping of control cables.
- 5.6.5 Single compression nickel plated brass cable glands & tinned copper lugs shall be provided by vendor for all cables to GIS assembly, LCC & CRP.

5.7 Pressure Relief Device

- 5.7.1 Pressure relief devices shall be provided in the each gas sections/ compartment to protect the main gas enclosures from damage or distortion during the occurrence of abnormal pressure increase or shock waves generated by internal electrical fault arcs. Pressure relief shall be achieved either by means of diaphragms or plugs venting directly into the atmosphere in a controlled direction. If the pressure relief devices vent directly into the atmosphere, suitable guards and deflectors shall be provided to prevent pieces of the diaphragm or plug from flying out or any dangerous SF₆ arc product gases escaping, in a manner that could endanger personnel present there.
- 5.7.2 Pressure relief shall be provided for all EHV compartments including SF₆ gas & air insulated enclosures. Relief into cable cellar/ trench shall not be provided.
- 5.7.3 The set points for the pressure relief device shall be lower than pressure withstanding capability of the enclosure with sufficient margin.

5.8 Indication & Verification of Circuit Breaker, Disconnecter & Earth Switch Position

- 5.8.1 Mechanical indicators mounted external to the equipment shall be provided on all circuit breakers, disconnectors and earth-switches, which shall clearly show whether the earth switches/ CBs / disconnectors etc. are open or closed. The indicators shall be mechanically coupled directly to the main contact operating drive rod or linkages and shall be mounted in a position where they are clearly visible from the floor or the platform in the vicinity of the equipment.
- 5.8.2 Viewing windows shall be provided for all disconnectors and earth switches so that the switch contact positions can be verified by direct visual inspection. Viewing windows shall be of type, whereby the open / close position can be checked without any danger to the eyes even when a flashover occurs at that time. Wherever the inspection windows are not accessible, sight glass endoscope shall be provided.

5.9 Foundation Channels & Supporting Frame Works

- 5.9.1 The panels shall be suitable for installation on base frame supplied by vendor along with foundation bolts. Amply dimensioned oblong holes shall be provided at the bottom of the panels for their installation on the base frame. The panels shall be suitable for tack welding and bolting directly to the base frame. The panels with base frame shall be suitable for installation on panel supporting frame through tack welding.
- 5.9.2 All supporting steel structures above grade level for switchgear bays and all panels including SF₆/Air Bushing support, GIBD support, inspection platform etc. shall be provided by vendor.
- 5.9.3 Details of suitable embedment in the foundation floor as required for supporting the switchgear assembly and panels, necessary supporting framework, levelling screws, inspection platforms etc. to fasten the switchgear base frames to the embedments in foundation floor shall be provided by vendor. Vendor shall provide drawing showing all details of the embedded parts and installation details required on the floor.

5.10 Nameplates

- 5.10.1 Engraved nameplates shall preferably be of 3-ply (Black-White-Black) lamicoïd sheets or anodised aluminium. However back engraved perspex sheet nameplates are also acceptable. Nameplates shall be fastened by screws and not by adhesives. A weather proof and corrosion proof name plate shall be provided and shall conform to applicable standards.
- 5.10.2 A nameplate with the switchgear designation shall be fixed at the top of the central panel. A separate nameplate giving details of each feeder compartment of all panels shall be provided. Danger plate (Red) shall be provided at the front and rear for each panel.
- 5.10.3 Blank nameplates shall be provided for all spare feeders.
- 5.10.4 Each of the equipment devices including CB, Disconnecter switch, Earthing switch, CT, VT and busbars etc. mounted inside the switchgear shall be provided with proper nameplate and rating plate. All information as per the latest edition of relevant IEC standards shall be included. Special warning plates shall be provided on removable covers or doors giving access to cable terminals and bus bars.
- 5.10.5 Special warning labels shall be provided inside the switchgear also, wherever considered necessary. Identification tags shall be provided inside the panels matching with those shown on the circuit diagram.

5.11 Painting, Protective Finish / Corrosion Protection of Surfaces

- 5.11.1 The switchgear shall be treated and protected to withstand continuous operation under site conditions without sustaining corrosion or attacks from fungus or rodents. The protective finish shall prevent deterioration due to corrosion, humidity, temperature, ageing and weather etc. under site conditions.
- 5.11.2 All metal surfaces shall be thoroughly cleaned & degreased to remove mill scale, rust, grease and dirt. All exterior surfaces shall be cleaned and epoxy painted before leaving the factory with one coat of approved primer and two coats of approved equipment finish paint. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The under surface shall be prepared by applying a coat of phosphate paint and a coat of yellow zinc chromate primer. Alternately, vendor's standard paint procedure for manufacturing is also acceptable. The underside of all surfaces bearing upon the concrete foundation shall be given two coats of approved primer. The under surface shall be made free from all imperfections before undertaking the finishing coat.
- 5.11.3 The exterior surface finish of switchgear paint shade shall be RAL-7032 unless specified otherwise.
- 5.11.4 The finished panels shall be dried in stoving ovens in dust free atmosphere. Panel finish shall be free from imperfections like pinholes, orange peels, runoff paint etc. Vendor shall supply final paint (1 litre per switchboard) in non-returnable container for final touch up at site.
- 5.11.5 Supporting frame work shall be hot dip galvanised after fabrication.
- 5.11.6 All unpainted steel parts shall be Zinc passivated or suitably treated to prevent rust formation. If these parts are moving elements then they shall be greased.
- 5.11.7 Gas monitoring and service piping including all fittings and accessories shall be made of copper, brass or stainless steel.
- 5.11.8 Electrolytic corrosion shall be avoided in joints of different metals. Before the metal enclosed sections are joined together and charged with the SF₆ gas, they shall be thoroughly cleaned.

5.12 Auxiliary Cabling, Wiring and Terminals

- 5.12.1 Owner interface for remote control, metering, indication, alarm etc. of complete GIS equipment shall be at CRP only. Further external AC & DC control & auxiliary power supplies interface for complete GIS equipment shall be at designated LCC only.
- 5.12.2 All cables required amongst various components of GIS i.e. circuit breaker, disconnectors, earth switches, CT, VT, LCC, CRP etc. along with the cable glands & lugs shall be provided by the vendor. The cables shall be Cu conductor, FRLS, armoured type. These shall be suitable for directly laying in cable trays/ lined RCC trenches. Maximum distance between GIS/LCC and corresponding CRP shall be considered as 150 meters unless otherwise specified. Exact distances shall be informed during vendor drawing review based on the final locations of GIS/LCC and CRP.
- 5.12.3 Inside the cubicles, the wiring for control, signalling, protection and instrument circuits shall be done with FRLS type, copper conductor wire. The insulation grade shall be 660V. The wiring shall preferably be enclosed in plastic channels or neatly bunched together. Flexible conduits shall be provided for routing wiring between various compartments.
- 5.12.4 A minimum of 10% spare terminals shall be provided on each terminal block. Conductors shall be terminated with adequately sized compression-type lugs for connection to equipment terminals and strips. Stranded conductors shall be soldered at the ends before connections are made to the

terminals. Sufficient terminals shall be provided on each terminal block to ensure that not more than one outgoing wire is connected per terminal. Terminal strips shall preferably be separated from power circuits by metal barriers or enclosures. All spare contacts of CB, switches, auxiliary relays etc shall be wired up to the terminals.

- 5.12.5 Each wire shall be identified at both ends by correctly sized ferrules. The CT terminal blocks shall have shorting, isolation and injection test facilities whereas VT terminals shall have isolation and injection test facilities.
- 5.12.6 Copper conductor of cross section 1.5 mm^2 may normally be used for control fuse rating 10 amps or less. For 16 amps control fuse circuit, 2.5 mm^2 copper conductors shall be used. CT Circuit wiring shall be done with 2.5 mm^2 copper conductors.
- 5.12.7 All inter-panel control wiring within each shipping section shall be done at vendor works. The inter-panel wiring shall be taken through sleeves or suitable grommets. For inter-panel wiring between the shipping sections, wires in rolls of the required length, connected at one point, shall be supplied with the panel by vendor for connection at site.

5.13 Earthing

- 5.13.1 The earthing system shall be designed and provided as per IEEE-80 and CIGRE- 44 to protect operating staff against any hazardous touch voltages and electro-magnetic interferences. The earthing system shall ensure safe touch & step voltages in all the enclosures.
- 5.13.2 Vendor shall provide copper earth buses and copper earth conductors & associated hardware material for connecting all GIS equipment, earthing switches, surge arrestors, VT neutral, CT leg, enclosures, cabinets, boxes, supporting structure, platforms & hand rails, operating handles of disconnecter & earth switches etc. to the earth buses of GIS.
- 5.13.3 The GIS enclosures shall be of continuous design and shall meet the requirements as specified in clause no. 10 (special considerations for GIS) of IEEE- 80. The GIS shall be earthed at several points so that there shall be earthed cage around all the live parts. Wherever earth continuity is not maintained by GIS inherent design, each enclosure shall be effectively interconnected with 2 nos. Cu bonds of suitable size to bridge the flanges.
- 5.13.4 LCC, CRP, power and control cable sheaths and other noncurrent carrying metallic structures shall be connected to the earthing grid. At least two earthing paths shall be provided to connect each point to the GIS earth bus.
- 5.13.5 Minimum earth bus size of 300 mm^2 copper for earthing of GIS equipment shall be provided.
- 5.13.6 All flexible earthing leads shall be of copper.
- 5.13.7 The earthing of Surge arrestor shall be provided with green PVC coated Cu braided cable up to the main earth grid. The size of the conductor shall be such that all the energy is dissipated to the earth without getting overheated.

5.14 Interlocks

- 5.14.1 The interlock system shall positively prevent an Operator from reaching or creating unintentionally a dangerous or potentially dangerous condition.
- 5.14.2 All interlocks required between circuit breakers, disconnectors and earth switches shall be provided.

5.14.3 Specifically the following conditions shall be impossible to reach:

- a) Electrically and manually closing or opening of the disconnecter / earthing switch while the circuit breaker is closed.
- b) Electrical closing of disconnecter/ circuit breaker, while the earthing switch at the remote end is closed.
- c) Electrical closing of earthing switch while the remote end disconnecter/circuit breaker is in closed position.
- d) Electrical & manually closing of bus bar disconnectors of any circuit while the bus bar earthing switch is closed.

5.14.4 When the manual emergency cranks are used, it shall be impossible to control the devices electrically.

5.14.5 Bus VT Miniature Circuit Breaker (MCB) ON auxiliary contacts and under voltage relay contacts shall be monitored in the interlocking scheme to confirm the dead bus condition.

5.14.6 Bus-bar disconnectors of any circuit shall not close electrically or manually while a Bus-bar Earthing Switch is closed.

5.15 Space Heaters

5.15.1 CRP, LCC & drive mechanism box shall be provided with space heaters to prevent moisture condensation and maintain cubicle temperature 5°C above the ambient. The space heaters shall be controlled through a double pole MCB and thermostat. Space heaters shall be supplied from 240V AC auxiliary supply.

6.0 SWITCHGEAR COMPONENTS

6.1 Circuit Breakers

6.1.1 General

- a) The circuit breakers shall be in 3 phase enclosure or single phase enclosure as per vendor standard design. They shall be electrically, mechanically, hydraulically trip free as applicable and anti-pumping with both of the trip circuits connected.
- b) Pole discrepancy tripping shall be provided which shall detect discrepancy in opening of contacts. Local electrical operation shall be provided from the local control cabinet. An emergency manual trip device & mechanical operation counter shall be provided in the breaker kiosk. The breaker enclosure shall have provision for easy withdrawal of the interrupter assemblies.

6.1.2 Duty Cycle (Operating Mechanism)

- a) Circuit breaker shall be C2 - M2 class as per IEC 62271-100.
- b) Circuit breaker shall meet the duty requirements for any type of fault or fault location & also for line charging and dropping as applicable and perform make and break operations as per the stipulated duty cycles satisfactorily.
- c) The CB shall be suitable for carrying out the duty cycle of O-0.3 seconds-CO-3.0 minutes – CO.

6.1.3 Pre-Insertion Resistor (applicable for 400 kV GIS)

The circuit breakers for transmission line bay shall be provided with single step pre insertion closing resistors/Controlled switching devices to limit the switching surges to a value of less than 2.3 p.u. The value of the pre-insertion resistor and the duration of pre-insertion time shall be as designed by vendor.

6.1.4 Construction Features

- a) The circuit breakers shall be SF₆ type. The circuit breakers shall be of single pressure type / self blast type and shall utilise puffer cylinder for arc interruption. Each SF₆ CB pole shall preferably be with single interrupting chamber. Each SF₆ circuit breaker pole shall be provided with its own self-contained gas system.
- b) The service connections for gas handling shall be located on each pole tank to facilitate servicing. The breaker shall be designed to ensure that condensation of moisture is controlled by proper selection of organic insulating materials having low moisture absorbing characteristics, complete drying of container and breaker, selection of 'O' ring, etc.
- c) Materials such as activated alumina or molecular sieve shall be provided at appropriate locations as moisture absorbents. Also suitable absorbents for removing SF₆ arc products shall be employed.
- d) Breakers shall be so designed that when operated within their specified rating, the temperature of each part will be limited to values consistent with a long life for the material used. The temperature rise shall not exceed that indicated in IEC-62271-100 under specified ambient conditions.

6.1.5 Breaker Contacts

- a) Main contacts shall be of copper with silver plating and have ample area & contact pressure for carrying the rated current and the short time rated current of the breaker without excessive temperature rise which may cause pitting or welding. Contacts shall have a minimum of movable parts and adjustments to accomplish these results. Main contacts shall be the first to open and the last to close so that there will be little contact burning and wear.
- b) Arcing contacts, if provided, shall be the first to close and the last to open and shall be easily accessible for inspection and replacement. Tips of arcing and main contacts shall be silver faced or have tungsten alloy tipping. Provision shall be made for rapid dissipation of heat generated by the arc on opening.
- c) If multi-break interrupters are used, they shall be so designed and augmented that a fairly uniform voltage distribution is developed across them.

6.1.6 Operating Mechanism

- a) General Requirements
 - i. Circuit breaker shall be operated by spring charged mechanism or electro hydraulic mechanism or a combination of these.
 - ii. Main poles shall operate simultaneously. The design of the circuit breaker shall be such that contacts will not close automatically upon loss of gas / hydraulic pressure.

- iii. The mechanism shall be such that the failure of any auxiliary spring will not prevent tripping and will not cause trip or closing operation of the power operating devices.
- b) **Operating Mechanism Control**
- i. The close and trip circuits shall be designed to permit use of momentary-contact switches and push buttons.
 - ii. Two (2) independent tripping circuits, valves, pressure switches, and coils shall be provided for each operating mechanism.
 - iii. For all HV Variable frequency drive feeders, breaker shall be additionally provided with under voltage release. However, in case it is not possible to provide under voltage release in the standard design, as an alternative, one shunt trip coil shall be suitable for DC control supply while second shunt trip coil shall be suitable for external AC control supply. The control supply voltage level shall be as specified in datasheet.
 - iv. A local manual closing device shall also be provided for maintenance purpose. Direction of motion of handle shall be clearly and indelibly marked.
 - v. Electrical tripping shall be performed by shunt trip coils. Provisions shall be made for electrical control from LCC & CRP.
 - vi. The trip coils shall be suitable for trip circuit supervision during both open and close position of breaker.
 - vii. Breaker tripping, closing and spring charging devices shall be fed with DC control power supply. Closing coil and associated circuits shall operate correctly at all values of control voltage between 85% and 110% of the rated voltage. Shunt trip and associated circuits shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity of the circuit breaker at all values of supply voltage between 70% and 110% of rated voltage.
 - viii. Pressure switch contacts shall be suitable for direct use as permissive in closing and tripping circuits. Separate contacts shall be used for each of tripping and closing circuits.
 - ix. The auxiliary switch of the breaker shall be positively driven by the breaker operating rod.
 - x. The breakers shall have at least 6 normally open (NO) and 6 normally closed (NC) spare auxiliary contacts for Owner's use. If these are not available, auxiliary relays shall be used to multiply the auxiliary contacts of the breakers.
- c) **Hydraulic Operated Mechanism**
- i. Hydraulic operated mechanism shall comprise self contained operating unit with power cylinder, control valves, high and low pressure reservoir, pressure gauge, necessary piping, compressor and motor, etc. A hand pump set shall also be provided for emergency operation.
 - ii. The piping shall be seamless type and of non-corrodible material such as SS or Brass. The joints shall be welded except at the equipment terminal ends.
 - iii. Oil required for initial filling including make up of usual losses during commissioning and leakages shall be supplied by vendor.
- d) **Hydraulic Monitoring Device:**

- i. Hydraulic pressure system shall be monitored as follows:
 - "Hydraulic first level": this gives an alarm if, after a predetermined time interval, the hydraulic pressure is not returned to its nominal setting. Pressure switch contact to open for alarm.
 - "Hydraulic second level": this will give an alarm indication if the pressure drops below the minimum operable pressure, i.e. mechanism locks out.
 - Hydraulic motor Excessive start: alarm to be provided.
 - Hydraulic motor: excessive running of motor alarm to be provided.
 - ii. 'Motor on overload' condition shall be tripped and 'trip' and 'supply failure' conditions shall be annunciated. In the event that non bio-degradable fluids are used, containment trays shall be provided to prevent a spillage.
- e) Spring operated Mechanism
- i. Spring operated mechanism shall be complete with motor. Opening spring and closing spring with limit switch for automatic charging and other necessary accessories to make the mechanism a complete operating unit shall also be provided.
 - ii. Breaker operation shall be independent of the motor which shall be used solely for compressing the closing spring. Facility for manual charging of the closing spring shall also be provided.
 - iii. Closing action of circuit breaker shall compress the opening spring ready for tripping.
 - iv. When closing springs are discharged after closing a breaker, closing springs shall automatically be charged for the next operation and an indication of this shall be provided in the LCC.
 - v. Provisions shall be made to prevent a closing operation of the breaker when the spring is in the partial charged condition.
 - vi. A mechanical indicator shall be provided to indicate the status of the spring. The indication shall be visible with the doors of the mechanism cabinet closed.
 - vii. Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of closing springs when the breaker is in closed position.
 - viii. The spring operating mechanism shall have adequate energy stored in the operating spring to close and latch the circuit breaker against the rated making current and also to provide the required energy for the tripping mechanism in case the tripping energy is derived from the operating mechanism.

6.2 Disconnectors & Earthing Switches

6.2.1 General

- a) Disconnectors and Earthing switches shall be of single-pole, group operated type, installed in the switchgear to provide electrical isolation with one motor operated mechanism per three poles. The disconnectors and earth switches shall conform to IEC- 62271-102.
- b) Disconnector shall also be able to make and break rated bus transfer current at rated bus transfer voltage which appears during transfer between bus bars in accordance with Annexure –B of IEC: 62271-102.
- c) The disconnector shall be M1 class operated.

- d) High speed make proof earthing switches shall be E1 class operated. Safety earthing switches shall be E0 class operated.
- e) Electric motor shall be suitable for DC control supply and shall be equipped with a manual operating mechanism for emergency use. The motor shall be protected against over current and short circuit. The associated circuits shall operate correctly under all values of supply voltage between 85% and 110% of rated voltage.
- f) Disconnectors shall be suitable to make and break the charging currents during their opening and closing. The contact shielding shall also be designed to prevent restrikes and high local stresses caused by transient recovery voltages when these currents are interrupted.

6.2.2 Constructional Features

- a) The disconnector shall be provided with high current carrying contact surfaces of silver faced copper/silver faced aluminium.
- b) Arrangement shall be provided to permit manual operation of the disconnectors & earthing switches. Whenever the manual handle is inserted into the drive mechanism, it shall not be possible to control the device electrically. Manual operating handle shall be provided with pad lock. The contacts shall be both mechanically and electrically disconnected during the manual operation.
- c) The disconnectors shall be arranged in such a way that all the three phases operate simultaneously. All the parts of the operating mechanism shall be able to withstand starting torque of the motor mechanism without damage until the motor overload protection operates.
- d) The disconnectors and safety earthing switches shall have a mechanical key (pad locking key) and electrical inter-locks to prevent closing of the earthing switches when disconnectors are in the closed position and to prevent closing of the disconnector when the earthing switches are in the closed position.
- e) The disconnectors & earth switches shall be capable of being padlocked in both fully open and fully closed positions with the operating motor automatically disengaged. The padlock shall be visible and directly lock the final output shaft of the operating mechanism.
- f) One man shall be able to operate the disconnector /earthing switch (when manually operated) without undue effort.

6.2.3 Operating Mechanism Control

- a) Disconnectors and earthing switches shall be motor operated, with limit switches and controlled from the LCC and CRP. Connections, interlocking requirements and auxiliary switches shall be provided as per the requirements.
- b) The disconnector operations shall be inter-locked electrically with the associated circuit breakers in such a way that the disconnector control is inoperative if the circuit breaker is closed.
- c) Each disconnector, earth switch shall have at least 4 normally open (NO) and 4 normally closed (NC) spare auxiliary contacts for Owner's use.

6.2.4 Additional Requirements for Safety Earthing Switches

- a) Earthing switch, whenever possible can form an integral part of each pole of the disconnector. Two independent earthing pads each with flexible copper braids and suitable connectors for the specified size of earth conductor lead shall be provided at the hinge end of the earthing switch.

- b) Interlocks shall be provided so that manual operation of the earthing switches or insertion of the manual operating device will disable the electrical control circuits.

6.2.5 Additional Requirements for High Speed Make Proof Earthing Switches

- a) High speed make proof earthing switch shall have make proof contacts and high speed stored energy operating mechanism to enable them suitable to close on to a fault.
- b) High speed earth switches shall be motor driven stored energy operated. After removal of the earthing initiated by a fault making earth switch, it shall be possible to re-energize the system without first carrying out the maintenance.
- c) The short circuit making current rating of each earthing switch shall be at least equal to its peak withstand current rating as applicable. The switches shall have inductive/ capacitive current switching capacity as per IEC62271-102.
- d) All portions of the earthing switches and operating mechanism required for connection to earth shall be connected together utilizing copper conductor.
- e) The main earthing connection on earthing switch shall be rated to carry the peak withstand current rating of the switch for 1 sec. and shall be equipped with a silver plated terminal connector suitable for steel strap of adequate design for connection to the earthing grid.

6.3 Surge Arrestors

6.3.1 The surge arrestors shall conform in general to IEC 60099-4.

6.3.2 The surge arrester shall be of heavy duty station class and gapless (Metal oxide) type without any series or shunt gaps.

6.3.3 The surge arresters shall be capable of discharging over-voltages occurring during switching, lightning impulse etc.

6.3.4 The surge arresters shall be provided with a discharge counter located at an accessible position.

6.3.5 The nonlinear blocks shall be of sintered metal oxide material. These shall be provided in such a way so as to obtain robust construction, with excellent mechanical and electrical properties even after repeated operations.

6.4 Local Control Cabinet

6.4.1 Local Control Cabinet (LCC) for each bay shall be supplied. LCCs shall be either separate free-standing floor mounted type panel or mounted on GIS assembly as per vendor's standard design. If separate LCCs are provided, these will be located next to GIS.

6.4.2 LCC shall be in dust and vermin proof hot dipped galvanised sheet steel construction. Hinged doors giving access to the components shall be provided.

6.4.3 Local control of all CBs, disconnectors & earthing switches shall be possible from LCC through control switches & selector switches with all associated interlocks. Local/ off / Remote selector switch shall be provided in LCC panel. LCC panels shall house alarms and facia annunciation etc. of GIS including GIS gas pressure system. The LCC shall also be used for termination of CT and PT cables from GIS bay.

6.4.4 Two (2) numbers of 415V, TPN, 50 Hz, power supply feeders will be provided by Owner at one location in the LCC for complete switchgear. Further power supply distribution for each LCC and to CRP shall be done by vendor.

- 6.4.5 Two (2) numbers of DC supply feeders will be provided by Owner at one location in the LCC for complete switchgear. Further DC power supply to each LCC and to each CRP shall be done by vendor.
- 6.4.6 The incoming external control supplies (AC & DC) shall be monitored continuously and alarm shall be given on failure. Vendor shall supply all necessary equipment and control for automatic change over from one source of control supply to the other in the event of failure of one source / contactor drop out.
- 6.4.7 An isolating switch for disconnection of power supply, open/close push buttons, magnetic contactor with thermal overload relays and HRC link type fuses for short circuit protection shall be provided in LCC for each individual motor of CB, disconnecter and earth switch.
- 6.4.8 Local Alarm & Annunciation**
- a) Alarm contacts shall be provided for monitoring of all vital systems of each circuit breaker and SF₆ gas system.
 - b) Window type alarm annunciation shall be provided on LCC of each bay for the various abnormal conditions.
 - c) Potential free electrical contacts shall be provided for remote alarm / indication of all alarm condition. These contacts shall be in addition to those required for local indication. These shall be wired to the terminal blocks in the LCC.
 - d) The following minimum number of abnormal conditions shall be annunciated.
 - i. Gas refill level for each gas compartment of the bay. (low gas pressure)
 - ii. Breaker Block level for each gas compartment of the bay. (low low gas pressure)
 - iii. Zone isolation level for each gas compartment of the bay.
 - iv. Over pressure for each gas compartment of the bay.
 - e) In addition to the minimum abnormal conditions listed above, any other abnormal condition as per the vendor shall also be annunciated.
 - f) Mimic diagram preferably shall be provided.
- 6.4.9 All current transformer leads shall be terminated on shorting type terminal blocks in the LCC and shall be accessible at all times. All voltage transformer leads shall be terminated and protected by MCB.
- 6.4.10 All other devices shall be wired to terminal blocks provided in the LCC. The terminal blocks shall have minimum 10% spare terminals per cabinet.

6.5 Control Relay Panels

- 6.5.1 Separate Control Relay Panel (CRP) for each bay shall be supplied to facilitate control of circuit breakers, disconnectors, earth switches and metering, protection etc.
- 6.5.2 CRP shall be free-standing floor mounted type panel and shall be located either in GIS hall or in a separate room from GIS. CRP shall be in dust and vermin proof hot dipped galvanised sheet steel construction preferably modular swing rack type.
- 6.5.3 A mimic diagram shall be provided on the front of the panel with control switches and position indicators for CB, disconnecter and earth switches. The panel shall be dead front type with front

door having clear glass cut-out of adequate size so that mimic diagram, annunciator windows, indicating lamps are clearly visible from outside.

6.5.4 CRP shall house bay control units (BCUs) and protection relays. These panels shall also house the various selector switches, auxiliary relays, timers, local indications, alarms and facia annunciation window etc. to realise various interlocks as per requirement among circuit breakers, disconnectors and earth switches and for breaker pole discrepancy, anti-pumping etc. It shall include the following as minimum:

- a) Local / remote selection switch
- b) CNT control switch for breaker
- c) Breaker ON, OFF, Trip-1, Trip-2, Trip circuit healthy indications
- d) Disconnector & earth switches ON, OFF control switches & indications
- e) Upstream breaker ON, OFF indication (for incomers)
- f) DC supply healthy indication
- g) Spring charging devices status
- h) Aux. relays / other devices as required by the design.

6.5.5 Completely separate and isolated circuits shall be used for each operating mechanism control, trip-1, trip-2, close, alarms and auxiliary devices. Close and trip circuits shall be kept isolated to their final mechanical or electrical actuators from the CRP terminals.

6.5.6 Trip circuit-1 & trip circuit-2 shall be individually monitored for continuity under open and closed condition of breaker. Closing circuit shall be monitored under open condition of breaker.

6.5.7 The contacts and signals originating from/going to the GIS, associated auxiliary and monitoring equipment shall be wired up to the CRP for external use.

6.5.8 Measuring Instruments

Meters shall be of electronic or induction- disk type, flush-mounted on the cubicle door. All analogue instruments shall be of square pattern, 96 x 96 mm, flush-mounted type. Measuring instruments, shunts, transducers, CTs, VTs, etc, shall be provided as specified in data sheet. The accuracy class for all instruments shall be 1.0 unless otherwise specified.

Digital meters shall also be acceptable, provided specific approval of EIL/Owner for make and model is obtained. All digital meters shall be highly reliable, accurate, and compact and self powered. Digital meter data shall be saved in case of power failure. Field programming from front of the meter shall be possible and shall have RS232/485 port in case specified in the job specification / data sheet.

- a) Ammeters and Voltmeters

Analogue meters shall be of moving-iron type. The range shall be indicated on the drawings.

- b) kW / kWh Meters

The kW / kWh meters shall be suitable to measure unbalanced loads on a 3-phase, 3-wire system. The kW meters shall operate on a VT secondary voltage of 110 V.

- c) Frequency Meters

These shall be of direct-reading or digital type and shall operate on a VT secondary voltage of 110V. The standard range shall be 45-50-55 Hz.

- d) Power Factor Meters

Power factor meters shall operate on a VT secondary voltage of 110 V. The standard range shall be 0.5 lead-1.0-0.5 lag.

6.5.9 Relays

- a) Type of relay i.e. electromechanical, static or numerical / bay control unit shall be as defined in datasheet / job specification.
- b) All electromechanical protective relays shall be back-connected, of drawout type, suitable for flush mounting, and fitted with dust-tight covers. Alternatively, "plug-in" type relays will also be acceptable. Auxiliary relays are acceptable in fixed execution.
- c) The protective relay cases shall have a provision for insertion of a test plug at the front for testing and calibration using an external power supply without disconnecting the permanent wiring. The insertions of the test plug shall automatically short circuit the CTs and permit extension of external power supply to the relay.
- d) All protective relays shall have hand reset facility and clear operating indication, e.g. flags for electro-mechanical type relays or light emitting diodes for static/numerical type relays. It shall be possible to reset the flag without opening the relay case.
- e) All tripping relays shall be of lockout type with hand-reset contacts, and shall be suitable to operate on the specified voltage. These relays shall have self coil cut off contacts, and shall be provided with hand-reset operation indicators. Tripping relays will be acceptable in non-drawout cases.
- f) The tripping relay shall be suitable for satisfactory operation from 50% to 110% of the specified control supply voltage.
- g) Numerical relays /bay control unit shall be equipped with communication port to work as an integrated part of the substation automation system. Multifunctional device (bay control and protection unit) shall be with control, indication, metering, protection, mimic, communication/ interface functions.
- h) Stabilizing resistors shall be provided along with relays, wherever required, to limit the secondary voltage of current transformer to safe level during maximum internal fault condition. Further Stabilizing resistors shall be provided with relays including numerical relays in residual earth fault connections to prevent any spurious tripping during starting.

6.5.10 Alarm & Annunciation

- a) Potential free electrical contacts shall be provided for remote alarm / indication of all alarm/trip condition. These contacts shall be in addition to those required for local indication at LCC. These shall be wired to the terminal blocks in the CRP.
- b) The following minimum no. of abnormal conditions shall be annunciated.
 - i. Hydraulic motor overload / circuit trouble
 - ii. Hydraulic first level (low hydraulic pressure)
 - iii. Hydraulic second level (Low-Low Hydraulic pressure)
 - iv. Disconnecter/ earth switch motor overload (one per each bay)
 - v. Circuit breaker motor overload (one per each bay)
 - vi. DC control supply failure
 - vii. Common gas alarm for the bay
- c) In addition to the minimum abnormal conditions listed above, any other abnormal condition as per the vendor shall also be annunciated.

6.5.11 Clustered LED type indicating light with minimum 8mm diameter size shall be provided for indications. The LED shall have a low glow voltage protection and shall not glow on voltage leakage.

6.5.12 All other devices shall be wired to terminal blocks provided in the CRP. The terminal blocks shall have not less than 10% spare terminals per panel.

6.6 Current Transformers

6.6.1 The current transformers and accessories shall conform to IEC: 61869-1&2 and other relevant standards.

6.6.2 The CT short time rating shall be equal to that of the switchgear. The CT ratings shall be as shown in the data sheet. Protective CTs shall have an accuracy class of 5P and an accuracy limit factor greater than 10. CTs for instruments shall have an accuracy class of 1.0 and an accuracy limit factor less than 5.0. For numerical relays having protection and metering functions, dual rated CT shall be provided suitable for protection class and metering class. One leg of CTs shall be earthed.

6.6.3 The current transformers shall be of metal- enclosed and shall be given tropicalised treatment for satisfactory operation in hot and humid climate. The current transformers shall have effective electromagnetic shields to protect against high frequency transients.

6.6.4 The CT secondary terminals shall be brought outside the EHV enclosures through a bushing of 1.1 kV class and mounted in accessible terminal box. All secondary leads shall be wired to shorting type terminals on the terminal strip in the local control cabinet of each breaker bay. All terminals shall be shrouded with plastic covers to prevent accidental contact.

6.6.5 All CTs shall be star connected. Interposing CT (ICT) shall be provided (if required) for differential protection of transformers having star-delta connection.

6.6.6 The polarity of the primary and secondary windings of each current transformer shall clearly be indicated.

6.7 Voltage Transformers

6.7.1 The voltage transformers shall conform to IEC 61869-1&3.

6.7.2 The voltage transformers shall be of inductive type, non-resistant and shall be contained in their own compartment. The voltage transformers shall be effectively shielded against high frequency electromagnetic transients.

6.7.3 Voltage transformer secondary shall be protected by 4 pole MCB for all the windings. The secondary terminals of the VT's shall be terminated to the stud type non-disconnecting terminal blocks in the secondary boxes.

6.7.4 The terminals of the secondary winding shall be brought out of the enclosure through 1.1 kV class bushing. Secondary terminals of each phase shall be located in accessible earthed terminal box on the VT enclosure itself. Neutral side of HV winding shall be brought out through a bushing rated for at least 1.1 kV class and located in a terminal box.

6.8 Auxiliary equipment

6.8.1 Auxiliary Relays and Contactors

- a) Auxiliary relays and contactors shall generally be used for inter-locking and multiplying contacts. Auxiliary contacts shall be capable of carrying the maximum anticipated current.

6.8.2 Control Switches

- a) All control switches shall be rotary type, having a cam-operated contact mechanism. Circuit breaker control switches shall be 3-position CNT, spring return to neutral from both Close and Trip positions. They shall have pistol-grip handles.
- b) The Local/off/remote switch shall be three positions type, lockable, key free in remote positions only with the following functions:
- Local position (the breaker, disconnecter and earthing switches can only be operated locally by its control switches).
 - Off position (the breaker, disconnecter and earthing switches cannot be operated electrically).
 - Remote position (the breaker and disconnecter can only be operated from Remote).
- c) Ammeter selector switches shall have a make-before-break feature on its contacts. The selector switch shall generally have four positions, three positions for reading 3-phase currents and the fourth position for OFF. The voltmeter selector switch shall also have four positions, three positions shall be used to measure phase-to-phase voltages and the fourth position shall be for OFF.

6.9 SF₆ Gas

- 6.9.1 SF₆ gas shall comply with the requirements of IEC 60376, 60376A & 60376B as a minimum & should be suitable in all respects for use in the switchgear under all operating conditions. The high pressure cylinders in which SF₆ gas is supplied & stored at site shall comply with the requirements of IS:4379. The cylinders shall also meet the Indian Boilers Regulations.
- 6.9.2 SF₆ gas necessary for initial filling (including entire losses, if any, during HV testing, Pre-commissioning / commissioning) and make-up gas for leakages of the complete switchgear shall be supplied by vendor.
- 6.9.3 The initial gas pressure or density at the time of charging the equipment shall provide a 10% margin above the allowable operating pressure for the plant to be safely operated for a reasonably long period before recharging is necessary.
- 6.9.4 SF₆ gas shall be tested for purity, dew point, air, hydrolysable fluorides and water contents as per IS 13072/IEC 60376, 60376A & 60376B and test certificates shall be furnished indicating all test results as per IEC standards for each lot of SF₆ gas.
- 6.9.5 In addition 10% of total gas requirement shall be supplied in separate non-returnable cylinders as spare requirement by vendor.

6.10 SF₆ Gas Monitoring Devices and Alarm Circuits

- 6.10.1 All gas compartments shall have their own independent gas supervision and alarm systems. There shall not be any interconnection between different gas compartments for the purpose of gas monitoring.
- 6.10.2 Individual temperature compensated gas pressure gauge(s)/ density device(s) shall be provided in each of the gas compartments which will continuously & automatically monitor and indicate the state of gas density as follows:

- a) Compartments except circuit breaker
- i. 'Gas Refill' level
This will be used to annunciate on the LCC and CRP the need for the gas refilling.
 - ii. 'Zone Trip' level
This is the minimum level at which the vendor will guarantee the insulation rating of the assembly (i.e. one minute power frequency voltage, BIL specified). At this pressure level it will be annunciated on the LCC/ CRP so that manual tripping of the circuit should be done.
- b) Circuit Breaker
- i. 'Gas Refill' level
This will be used to annunciate on the LCC and CRP the need for the gas refilling.
 - ii. 'Breaker Block' level
This is the minimum gas density at which the vendor will guarantee the rated fault interrupting capability of the breaker. Beyond this level the device contacts lock out the breaker (trip and close operation) circuits and annunciate the condition on the LCC & CRP for the need of manual zone tripping.
- c) High pressure interlock and monitoring device shall be provided.
- d) Necessary contacts for remote annunciation shall be provided.
- 6.10.3 Vendor shall provide an independent pressure switch for isolation of the particular zone. This alarm level shall be provided to indicate abnormal pressure rise in the gas compartment.
- 6.10.4 Pressure switches and pressure gauges / density devices shall be located at accessible location suitable for viewing.
- 6.10.5 It shall be possible to test all gas monitoring devices without de-energising the primary equipment and without reducing pressure in the main section.
- 6.10.6 **Gas Leakage Loss**
- a) Maximum guaranteed gas leakage loss of the switchgear shall be in no case be more than 0.5% per year over the life time of the switchgear. Initial filling of equipment shall guarantee gas service period of not less than 10 years.
 - b) All gas seals shall be designed to ensure that leakage rates are kept to an absolute minimum under all normal pressure, temperature, electrical load and fault conditions. All gas seals located in the flanges of the equipment enclosures shall be of the O -ring type.
- 6.11 SF₆ Gas Handling Unit / Service Cart**
- 6.11.1 Portable SF₆ gas handling & processing unit suitable for evacuating, liquefying, evaporating, filling, drying and purifying SF₆ gas during the initial installation, subsequent maintenance and future extension of GIS shall be provided. The cart shall be equipped with rubber wheels and shall be easily manoeuvrable within the building.
- 6.11.2 The unit shall be self-contained suitable for 415 V AC, 3-phase, 50 Hz power supply and fully equipped with an electric vacuum pump, gas compressor, gas drier, gas filter, refrigeration unit, evaporator, gas storage tank, full instrumentation for measuring vacuum, compressor inlet

temperature, tank pressure and temperature, valving and piping to perform the following operations as a minimum requirement:

- Evacuation from a gas filled compartment using the vacuum pump,
- Transfer of SF₆ gas from a system at some positive or negative pressure to the storage tank via the gas drier and filter,
- Recirculation of SF₆ gas in the storage tank through the drier,
- Recirculation of SF₆ gas in any Switchgear or bus duct compartment through the drier and filter,
- Evaporating and filling SF₆ gas,
- Drawing off and liquefying SF₆ gas,
- A combination operation of filling SF₆ gas into a gas system and evacuating a second, gas system using the vacuum pump.

6.11.3 The unit shall be complete with all necessary instrumentation and control which may include instruments such as decomposition tester, hygrometer, and test unit for the density monitors, precision pressure / density gauge and vacuum gauge.

6.11.4 The unit shall include necessary gas cylinders for replenishment and for temporary storage of the evacuated SF₆ gas. The capacity of the storage facilities shall at least be sufficient for storing the maximum quantity of gas that could be removed from the largest compartment of GIS + 10% extra SF₆ gas when carrying out maintenance or repair work on the switchgear and associated equipment.

6.11.5 Adequate length of hoses shall be provided for filling of SF₆ gas in any of the gas compartment with the help of service cart.

6.12 Insulators & Gas Seals

6.12.1 The support insulators and section barriers/ insulators shall be of solid moulded composite epoxy resin. They shall be free from all voids and with smooth surface and the design shall be such so as to reduce the electrical stresses in the insulators to a minimum.

6.12.2 Gas section barriers including seals to the conductor and enclosure wall shall be gas-tight and shall be capable of withstanding the maximum differential pressure that could occur across the barrier, i.e. with a vacuum drawn on one side of the barrier and on the other side, at least twice the rated gas service pressure that can exist under normal operating and maintenance conditions or the maximum gas over-pressure, equal to the operating pressure of the relief devices, that could be attained with internal arc fault.

6.12.3 All gas seals shall be designed to ensure that leakage rates are kept to specified minimum under all pressure, temperature, electrical load and fault conditions.

6.13 Voltage Detectors (applicable for 220 kV and above)

Each outgoing & incoming bays and main bus bars shall include capacitive type voltage detectors for each phase to indicate phases "ALIVE". The unit shall also be suitable for interlocking of earthing switches (voltage free condition).

6.14 Outdoor SF₆ – Air Bushings

6.14.1 Outdoor SF₆ – Air bushings, for the connection of conventional external conductors to the GIS shall generally be in accordance with the requirements of IEC 60137 as applicable.

6.14.2 Bushing type shall be any of the following:

- a) Condenser type bushings, liquid filled with liquid level gauges clearly visible from ground level, preferably of the direct reading prismatic type or the magnetic type. Other types of liquid level gauges will be accepted if specifically approved.
- b) The bushings with composite insulators (Silicone rubber) or with porcelain insulators with all surfaces free from imperfections. The internal insulation of the bushings shall be resin impregnated paper winding (RIP body) or compressed SF₆ gas. The internal and external electrical field of the bushings shall be controlled by a capacitive grading body /grading shields. The RIP body shall consist of resin impregnated paper insulation with concentric aluminium layers. The space between the RIP body and the insulator shall be filled with insulating foam compound or compressed SF₆ gas. Air bushings shall comply with the relevant IEC standards.

6.14.3 Bushings shall be designed to have ample mechanical strength and rigidity for the conditions under which they will be used. Outdoor bushings shall be capable of withstanding a cantilever force applied to the terminal.

6.14.4 All current carrying parts shall be of Copper. Hardware used for current carrying parts (such as nuts, bolts etc.) shall be SS304 Grade or brass. All current carrying contact surfaces shall be silver faced.

6.14.5 The flange shall be made of weather resistant, corrosion proof material. Suitable arrangement for connection of flange to earth shall be provided. If required, corona ring shall be provided which will be of Copper / Brass.

6.14.6 Porcelain shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Glazing of the porcelain shall be of uniform brown colour free from blisters, burns and similar other defects.

6.14.7 The parameters characterising the SF₆- Air bushing profile shall be such that it is suitable for "Very heavy" pollution level (salt contamination) prevailing at the site and also suitable for fixed type hot line washing. The creepage distance over the external surface of outdoor bushings shall not be less than 31 mm/kV.

6.14.8 Puncture strength of bushings shall be greater than the dry flash-over value. When operating at normal rated voltage, there shall be no electric discharge between the conductors and bushing which would cause corrosion / erosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action.

6.14.9 All joints shall be air-tight. Surface of the joints shall be trued-up; porcelain parts by grinding and metal parts by machining. Bushing design shall be so as to ensure uniform compressive pressure on the joints.

6.15 Gas Insulated Bus Duct

6.15.1 The Gas insulated bus duct shall be 3-phase enclosure or single phase enclosure as per vendor standard design comprising of straight lengths, bends, elbows, gas seals and accessories such as flanges, gaskets, fixing hardware etc.

6.15.2 Bus bars shall be of high conductivity electrolytic aluminium or copper.

6.15.3 The enclosure for the bus duct shall be made from non-magnetic material e.g., AL/AL Alloy.

- 6.15.4 The bus duct shall be capable to withstand the mechanical and thermal stresses due to short circuit currents, as well as thermal expansion and contraction created by temperature cycling.
- 6.15.5 The bus duct shall be suitable for outdoor installation.
- 6.15.6 The bus duct shall not be supported from the wall when crossing from indoor to outdoor. Necessary accessories supports etc. including wall frame assemblies shall form part of supply. Necessary bellows (if required) with sealing arrangements shall be provided.

7.0 INSPECTION, TESTING AND ACCEPTANCE

- 7.1 Vendor shall have valid type test certificates to verify the making and breaking capacity of the switching devices & other primary components and other test certificates as per relevant IEC standards.
- 7.2 During fabrication, the switchgear shall be subjected to inspection by EIL / Owner or by an agency authorised by the Owner, to assess the progress of work, as well as to ascertain that only quality raw material is used. The vendor shall furnish all necessary information concerning the supply to EIL / Owner's inspectors.
- 7.3 All switchgear components (CBs, disconnectors, earthing switches etc) shall be tested in accordance with the latest relevant standards. Test certificates for each switchgear component shall be submitted prior to delivery.
- 7.4 Type test certificates / reports shall be considered acceptable if they are in compliance with the latest applicable relevant Standards and conducted at recognized laboratory. If the type test reports submitted are not in accordance with the above requirements, Owner/EIL reserves the right to ask for the type tests to be repeated in the vendor's premises or other recognized place. The recognized laboratory shall issue the relevant type test certificates upon successful testing.
- 7.5 Switchgears and their components shall be subjected to routine tests as per the relevant IEC standards. Routine test certificates shall be submitted for EIL/Owner's review and approval before shipment of the switchgear components. The routine tests for the switchgear shall also include the functional tests for the associated LCC & CRP.
- 7.6 For testing requirements, refer Inspection & Test Plan Spec no. 6-81-1066.

8.0 PACKING AND DESPATCH

- 8.1 The equipment shall be carefully packed for transport by sea, rail and road in such a manner that it is protected against the climatic conditions and for any damage during transportation, transit and storage.
- 8.2 The SF₆ equipment shall be shipped in the largest factory assembled units within transport and loading limitations and considering handling facilities on site to reduce the erection and installation work on site to a minimum. Where possible all items of equipment or factory assembled units shall be boxed in substantial crates or containers to facilitate handling in a safe and secure manner. Should the units be considered too large for packing in crates, they shall be suitably lagged and protected to prevent damage to any part, particularly small projections, during transport and handling. Special lugs or protective supports shall be provided for lifting to prevent slings and other lifting equipment from causing damage. Each crate, container or shipping unit shall be marked clearly on the outside to show where the weight is bearing and the correct position for the slings.

- 8.3 Each individual piece to be shipped, whether crate, container or large unit, shall be marked special notations such as 'Fragile', 'This side up', 'Center of gravity', 'Weight', 'Owner's particulars', 'PO no.' etc., and other details as per purchase order.
- 8.4 The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains and high ambient temperature. In order to prevent movement of equipment within the crates, proper packing supports shall be provided.
- 8.5 Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. This applies particularly to the equipment of which each gas section shall be sealed and pressurized prior to shipping. Either dry nitrogen/air or dry SF₆ gas shall be used and the pressure shall be such as to ensure that, allowing for reasonable leakage, it will always be greater than the atmospheric pressure for all variations in ambient temperature and the atmospheric pressure encountered during shipment to site and calculating the pressure to which the sections shall be filled to ensure positive pressure at all times during shipment.
- 8.6 All blanking plates, caps, seals, etc., necessary for sealing the gas sections during shipment to site shall be provided. All parts liable to rust shall receive a coat of anti rusting composition and shall be suitably protected. Any seals, gaskets, 'O' rings, etc. that will be used as part of the arrangement for sealing off gas sections for shipment to site shall not be used in the final installation of equipment at site. Vendor to provide quantity of components accordingly considering permanent installation.
- 8.7 Valves and other gas couplings associated with the switchgear gas systems shall be adequately protected against damage from any bumps or physical blows. They shall also be capped to prevent ingress of dirt or moisture or damage to any coupling, pipes, threads or special fittings.
- 8.8 A set of instruction manuals for erection, testing and commissioning, a set of operating & maintenance manuals and a set of final drawings shall be enclosed in a waterproof cover and supplied along with the shipment.

ENGINEERING DESIGN BASIS ELECTRICAL

JOB NO: **B269**
PROJECT: **PANIPAT REFINERY EXPANSION (P-25) PROJECT**
CLIENT: **INDIAN OIL CORPORATION LIMITED (IOCL)**

EIL SIGNATURE:

CLIENT SIGNATURE:



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Rev. No.	Date	Purpose	Prepared by	Reviewed by	Approved by

Legend: ***Bold italic*** text denotes change with respect to previous revision.

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1.0 SCOPE

This electrical design basis defines the design requirements agreed by owner/clients in addition to EIL standard design philosophy for electrical facilities no. 6-51-0099. In case of any conflict between statutory requirements, this design basis and standard design philosophy, the most stringent requirement shall govern.

2.0 ABBREVIATIONS, CODES & STANDARDS / PUBLICATIONS

2.1 ABBREVIATIONS

Code	Description
AC	Alternating Current
ACB	Air Circuit Breaker
APFC	Automatic Power Factor Correction
ASB	Auxiliary Service Board
ATS	Auto Transfer Scheme
CB	Circuit Breaker
CBCT	Core Balance Current Transformer
CEA	Central Electricity Authority
CT	Current Transformer
DC	Direct Current
DCP	Data Concentrator Panel
DG	Diesel Generator
DGMS	Director General Mines Safety
DOL	Direct On Line
EHV	Extra High Voltage
ELCB	Earth Leakage Circuit Breaker
DMPR	Digital Motor Protection Relay
EPC	Emergency Power Control Center
EPMCC	Emergency Power cum Motor Control Center
FBT	Fast Bus Transfer
FRLS	Flame Retardent Low Smoke
FS	Fire Survival
GI	Galvanised Iron
GIBD	Gas Insulated Bus Duct
GIS	Gas Insulated Switchboards
GTG	Gas Turbine Generator
HMI	Human Machine Interface
HSR	High Availability Seamless Redundancy
HV	High Voltage
IEC	International Electro-Technical Commission
LDB	Lighting Distribution Board
LV	Low Voltage
MCC	Motor Control Centre
MCCB	Moulded Case Circuit Breaker
MOV	Motor Operated Valve
MPCB	Motor Protection Circuit Breaker
MV	Medium Voltage
NA	Not Applicable
NGR	Neutral Grounding Resistor
NGT	Neutral Grounding Transformer
OLTC	On Load Tap Changer

Code	Description
PCC	Power Control Centre
PESO	Petroleum & Explosive Safety Organisation
PLC	Programmable Logic Control
PMCC	Power Cum Motor Control Centre
PRP	Parallel Redundancy Protocol
PT	Potential Transformer
PTB	Physikalisch-Technische Bundesanstalt
PVC	Polyvinyl Chloride
RCC	Reinforce Cement Concrete
RSTP	Rapid Spanning Tree Protocol
SAS	Substation Automation System
SFU	Switch Fuse Unit
SPN	Single Phase & Neutral
SPV	Solar Photo Voltic
STG	Steam Turbine Generator
TP	Three Phase
TPN	Three Phase & Neutral
UPS	Uninterrupted Power Supply
VCB	Vacuum Circuit Breaker
VFD	Variable Frequency Drive
XLPE	Cross Link Poly Ethylene

2.2 CODES & STANDARDS / PUBLICATIONS

The main codes and standards, considered as minimum requirements, as applicable, are as follows -

S.No.	Description	Standards / Codes	Edition
1	Code of practice for the fire safety of buildings - Electrical Installations.	IS-1646	Latest
2	Code of practice for selection: installation and maintenance of automatic fire detection and alarm system.	IS-2189	Latest
3	Code of practice for the protection of buildings and allied structures against lightning.	IS/IEC-62305	Latest
4	Code of practice for fire safety of industrial buildings - Electrical generating and distributing stations.	IS-3034	Latest
5	Code of practice for Earthing.	IS-3043	Latest
6	Code of practice for Interior Illumination.	IS-3646	Latest
7	Application guide for Insulation Coordination.	IS-3716	Latest
8	Code of practice for installation and maintenance of electrical equipment in mines	IS-4051	Latest
9	Guide for safety procedures and practices in electrical work	IS-5216	Latest
10	Guide for selection of electrical equipment for hazardous areas.	IS-16724	Latest

S.No.	Description	Standards / Codes	Edition
11	Classification of hazardous areas(other than mines) having flammable gases and vapours for electrical installations.	IS-5572	Latest
12	Code of practice for Industrial Lighting.	IS-6665	Latest
13	Guide for Control of undesirable static electricity.	IS-7689	Latest
14	Guide for improvement of power factor - consumer's installations.	IS-7752	Latest
15	Application guide for on load tap changers.	IS-8478	Latest
16	Reference ambient temperature for electrical equipment	IS-9676	Latest
17	Code of practice for selection, installation and maintenance of transformer.	IS-10028	Latest
18	Code of practice for selection, installation and maintenance for switchgear and control gear.	IS-10118	Latest
19	Application guide for Power Transformer.	IS-10561	Latest
20	Voltage bands for electrical installations including preferred voltages and frequencies.	IS-12360	Latest
21	Guide for short circuit calculations in three phase AC systems.	IS-13234	Latest
22	Code of practice for the selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres.	IS-13408(Part-1)	Latest
23	Guide to the use of electrical apparatus for potentially explosive atmospheres in the presence of combustible dusts	IS- 15142	Latest
24	National Electrical Code (NEC) - BIS Publication.	SP-30	Latest
25	Recommended practices on static electricity	OISD-STD-110	Latest
26	Classification of Area for electrical installation at Hydrocarbon Processing and handling facilities	OISD STD-113	Latest
27	Inspection and safe practices during electrical installation	OISD-STD-147	Latest
28	Design aspects for safety in electrical systems	OISD STD-149	Latest
29	Fire Protection System for Electrical Installations	OISD STD 173	Latest
30	Lightning Protection	OISD STD-180	Latest
31	Electrical apparatus for explosive gas atmospheres - General requirements.	IS/IEC 60079-0	Latest

S.No.	Description	Standards / Codes	Edition
32	Equipment protection flameproof enclosures "d"	IS/IEC 60079-1	Latest
33	Electrical apparatus for explosive gas atmospheres - Intrinsic safety "i"	IS/IEC 60079-11	Latest
34	Electrical apparatus for explosive gas atmospheres Increased safety type "e"	IS/IEC 60079-7	Latest
35	Electrical apparatus for explosive gas atmospheres - Oil immersion "o"	IS/IEC 60079-6	Latest
36	Electrical Apparatus for explosive gas atmospheres - Powder filling "q"	IS/IEC 60079-5	Latest
37	Material characteristics for gas and vapour classification - section 1 - Test methods and data.	IS/IEC 60079-20-1	Latest
39	Energy Efficient induction motors- Three phase squirrel cage	IS 12615	Lateat
40	Outdoor Type Oil Immersed Distribution Transformers Upto and including 2500 kVA, 33kV	IS 1180	Latest
41	Electrical apparatus for use in the presence of combustible dust : General Requirements	IS/IEC 60079-31	Latest
42	Electrical apparatus for use in the presence of combustible dust : Classification of areas where combustible dusts are or may be present	IS/IEC 60079-31	Latest
43	Electrical apparatus for use in the presence of combustible dust : Selection and installation	IS 16724 & IEC 60079-14	Latest
44	Explosive atmospheres - Equipment protection by type of protection "n"	IEC 60079-15	Latest
45	IEEE recommended practice and requirements for harmonic control in electric power systems	IEEE-519	Latest

3.0 GENERAL / DESIGN CONSIDERATIONS

S.No.	Project Philosophy
1	LV - Low Voltage. The voltage which does not normally exceeds 250 V.
2	MV - Medium Voltage. The voltage which normally exceeds 250 V and does not exceeds 650 V.
3	HV - High Voltage. The voltage which normally exceeds 650 V but does not exceed 33 kV.
4	EHV - Extra High Voltage. The voltage which exceeds 33 kV under normal condition.
5	Canopy shall be provided for all outdoor equipments except transformers and Capacitor Banks.

S.No.	Project Philosophy
6	Circuit breaker provided for PCC/EPCC/MCC Incomer & Buscoupler shall be of 4 Pole type.

4.0 SPECIFIC DESIGN REQUIREMENTS

S.No.	Project Philosophy
1	Spare capacity of exchange of new PA System shall be considered as 30%.
2	Each DGFAP panel and each loop shall have 30% spare capacity.
3	Transformers and Switchboards shall have 20% spare capacity.
4	DC system shall have 25% spare capacity for future load growth and DCDB shall have 20% spare feeders.
5	UPS system shall have 20% spare capacity for future load growth and ACDB shall have 20% spare feeders.
6	Separate DC systems shall be provided for switchgear protection and critical lighting
7	UPS ACDB shall be with two incomers and one buscoupler.
8	DCDB shall be provided with two incomers and one bus coupler.
9	Incomers and buscoupler of MCC shall be provided with ACB and numerical relays with auto-changeover facility.
10	Dummy panel shall be provided in switchboards where switchboard is located over the expansion joint in substation building.
11	Window type CT shall be provided in HV switchboards for CT Primary rating more than 150A.
12	HV switchboards shall be provided with thermography window for infrared electrical inspection.
13	All HV Switchgear shall be provided with online wireless temperature monitoring facility. The passive sensor should be wireless, battery less, dielectrically safe, robust to high voltage, high electromagnetic field, and harsh environment. It should take direct measurement on critical point. This facility shall be interfaced with ECS.
14	All large capacity motors/feeders in MV Switchgear shall be provided with online wireless temperature monitoring facility. The passive sensor should be wireless, battery less, dielectrically safe, robust to high voltage, high electromagnetic field, and harsh environment. It should take direct measurement on critical point. This facility shall be interfaced with ECS.
15	All contacts used for breaker status (ON/OFF/SERVICE) shall be independent of availability of DC supply.
16	Transformers rated above 2.5 MVA shall be provided with air bag for conservators.
17	In general the rating of distribution transformers shall be standardised to 2500kVA except for cases where power requirements are very small
18	OLTC with RTCC facility shall be provided for main power transformers (66/6.9kV) and (33/6.9kV) only.
19	In every outdoor transformer bay/yard one no. 100A outlet shall be provided for oil filtration and other maintenance requirements.
20	Road crossings a) Road crossings where large number of cables cross the roads, shall be provided using Cable culverts. At road crossings where few cables cross the roads, Electrical road crossings (ERC) using 150mm PVC/RCC pipes may be provided. The ERC shall have minimum 30% spare pipes. The pipes shall be embedded in concrete. b) Minimum 6 nos. 150mm pipes shall be provided in ERC at any road crossing.
21	Flooring of substation switchgear hall shall be painted with insulating paint. Rubber mats shall also be provided around switchboards as per CEA safety regulations
22	Cable cellar floor shall be raised 500mm above approach road level.

S.No.	Project Philosophy
23	In all Substations/ MCC rooms, space for future extension of all GIS, HV Switchboards, PCCs, MCCs and ASBs shall be provided. Minimum space for two vertical panel extension on each side (for each Bus section) or four vertical panel extension space on one side (in exceptional cases) shall be provided.
24	MV motors for safe & hazardous area shall be IE3 as per IS 12615:2011.
25	For each sync. Motor 2 Nos ON status signals shall be provided from the Switchboard to Excitor panel for the motor.
26	For all HV Motors, RTD/BTD output shall be taken directly to DCS. DCS shall have provision for data logging, trending and generation of trip command based on input received from these motor based RTD/BTD.
27	Redundancy with dual excitation channel along with redundant PLC shall be provided for excitor where single sync. drive process equipment without any standby equipment is provided.
28	For sync. motors redundant UPS control supply and redundant UPS supply or PMG based supply for excitation system shall be provided. Also AI (4-20mA) to ECS for excitation current monitoring shall be provided
29	All monitoring signals from substation to SRR/Control room for critical inputs related to process control shall be hardwired to DCS/PLC. Other feedbacks to DCS which are used only for indication shall be routed through ECS panels over serial link. All control signals shall be as per instrumentation philosophy.
30	For all plant feeders, following signal exchange shall be done through OFC cable being used for feeder differential protection, in place of Cu cable connectivity : a.) Inter-trip command to remote substation b.) Breaker Status from upstream to downstream & vice-versa. c.) Close per missives from upstream to downstream & vice-versa.
31	Intertrip signals between interconnected switchboards within a substation shall be hardwired along with parallel operation through GOOSE messaging.
32	Auto-changeover logic to be built in the numerical relays of HV & MV switchboards shall use hardwired inputs to/ from the relays. Additionally parallel logic using GOOSE messaging shall also be used for Auto changeover logic in HV & MV switchboards.
33	Terminals for all spare cores of instrument interface cables shall be considered while sizing the number of terminals in the common substation marshalling panel.
34	Each process unit shall be provided with minimum 5nos. 3 phase, 4 wire, 415V, 400A flameproof (Ex-d) power supply DB for hydro-jetting and other miscellaneous utilities
35	All Emergency Stop/Stop pushbuttons on LCS/LCP/Switchboard shall be provided with protective covers to avoid accidental operation
36	63A Welding receptacles shall be provided in 30m radius with provision of same on alternate floor of tech structures.
37	Fixed type 240/24V sealed transformer units with plug sockets shall be provided near manholes of column and vessels.
38	Dual pushbutton stations with logic to press both for transformer trip shall be provided in the transformer bays. Push buttons shall be provided with covers.
39	All Cards shall be provided with G3 conformal coating for numerical relays, UPS & VFDs at all location.
40	All safe area pushbutton station shall be of polycarbonate or similar metallurgy.
41	HV & MV Switchboard shall not be provided with marshalling panels in panel lineup. Each substation shall have standalone floor mounted marshalling panels separate for ECS & DCS interface.
42	220kV, 66kV Switchboards shall be suitable for short circuit withstand capacity for 3 Secs

S.No.	Project Philosophy
43	<p>An independent ECS system may be provided for P-25 system complete in all respect along with following provisions.</p> <p>a) One Gate way terminal on OPC protocol with hardwired I/Os (60 digital Input, 30 Analogue input, 60 digital output & 30 Analogue output) shall be provided for PR side future integration.</p> <p>b) One Gate way terminal on OPC protocol with hardwired I/Os (60 digital Input, 30 Analogue input, 60 digital output & 30 Analogue output) shall be provided for PNCP side future integration.</p>
44	<p>Equipment numbering philosophy for electrical equipment in refinery area shall be as listed below (@@@ - denotes substation number) :</p> <p>220/69kV Power Trafo : TR-@@@011 66/11kV Power Trafo : TR-@@@021 66/6.9kV Power Trafo : TR-@@@031 6.6/0.433kV Dist Trafo : TR-@@@041 415/415V Normal/Emg. Ltg Trafo : TR-@@@061 220kV GIS Isolator : HV-@@@101 66kV GIS : HV-@@@111 6.6kV Switchboard : HV-@@@201 415V Normal/Emg. Power : PCC-@@@301 415V Normal/Emg. Power MCC : MCC-@@@311 415V Normal/Emg. Lighting : LB-@@@331 415V Aux. Power : ASB-@@@351 Normal Lighting Panel : LP-@@@501 Emg. Lighting Panel : ELP-@@@531 Power Panels : PP-@@@601 Space Heater Panels : SHP-@@@631 Power Panels for instrumentation : PPI-@@@661 110V DCDB : DCDB-@@@701 110V UPD : ACDB-@@@711 ECS Panels : IFP/IRP-@@@901 Marshalling Panels : DCSMB/ECSMB-@@@911 Tag number indicated above is for the first equipment in the series of that type.</p>
45	<p>Substation number for new PPU in PNCP shall be SS-62 and equipment numbering philosophy for electrical equipment shall be as listed below</p> <p>Type : Tag 11kV : HV-6222 33/6.9kV Power Trafo : TR-6201/02/03-- 6.6/0.433kV Dist Trafo : TR-6211/12/13-- 415/415V Normal/Emg. Ltg Trafo : TR-6261/62-- 6.6kV Switchboard : HV-6221 415V Normal/Emg. Power : PCC-6231/32-- 415V Normal/Emg. Power MCC : MCC-6241/42-- 415V Normal/Emg. Lighting : LDB-6252/53-- 415V Aux. Power : ASB-6251 110V DCDB : DCDB-6271 110V UPD : ACDB-6275</p> <p>Tag number of any other switchboard in addition to above shall be provided in similar lines.</p>
46	Refer Annexure-1 for typical configuration for DC System.
47	Refer Annexure-2 for typical configuration for UPS System.
48	Refer Annexure-3 for typical block diagram for ECS System in Substation.

S.No.	Project Philosophy
49	Refer Annexure-4 for typical scheme for Auto-change over scheme for DC control supply to switchboards.

5.0 OWNER / CLIENT SPECIFIC REQUIREMENTS

5.1 SITE CONDITIONS

S.No.	Description	Selected Option	Available Options
1	Equipment design temperature (IS-9676)	45 DEG C	
2	Relative humidity	90%	
3	Soil Resistivity	As per soil investigation report	
4	Minimum temperature. for battery sizing	5 DEG C	
5	Altitude above mean sea level	Less than 1000m above MSL	
6	Maximum temp	50 DEG C	
7	Minimum temp	5 DEG C	
8	Siesmic Zone	Refer Structural Design Basis	

Notes :

- 1.) Minimum temperature to be considered for electrical heat tracing shall be 5 DEG. C
- 2.) Pollution level for all outdoor electrical equipments shall be considered as "Heavy"

5.2 POWER SOURCE DETAILS

S.No.	Description	Selected Option	Available Options
1	Power System	From Existing & New System	
2	Grid Supply		
2.1	Name of sub station	Mundh	
2.2	Number of feeders	2 Nos	
2.3	Length of feeder	35km	
2.4	Type /size of conductor/ cable size	ACSR / ZEBRA CONDUCTOR	
2.5	Voltage	220kV \pm 10 %	
2.6	Frequency	50Hz \pm 3 %	
2.7	Maximum fault level		
2.7.1	3 Phase fault	50 kA, 3 sec	
2.7.2	1 Phase fault	\$ kA, sec	
2.7.3	X/R Ratio	\$	
2.8	Minimum fault level	\$ kA, sec	
2.9	Design fault level	\$ kA, Sec	
2.10	Basic Insulation Level	\$ kV	
2.11	System neutral Earthing	Solidly Earthed	
2.12	Minimum power factor	\$	
2.13	Parallel operation of incomers	\$	
2.14	PLCC requirement	\$	

S.No.	Description	Selected Option	Available Options
3	CPP and its configuration		Not envisaged (below clauses not applicable)
3.1	Type of Generator		
3.1.1	Number of Generator		
3.1.2	Rating of Generator/Voltage/P.f		
3.1.3	Requirement of Generator Circuit Breaker		
3.2	Parallel operation with grid		
3.3	Type of Neutral Earthing for Generators		
3.4	Black Start DG Envisaged		
4	Emergency generator	@ Centralised	
4.1	Generator Voltage	@ kV	
4.2	Parallel operation with other sources	Momentary Paralleling	
4.3	Auto Starting	Yes	
4.4	Type of Emergency Generator	Diesel	
5	Solar Power System		
5.1	Solar PV System	\$ Provided	
5.2	Buildings on which solar power system to be mounted	Non Plant Buildings, Admin Building, Warehouse, Substations, Safe area Control Rooms	
5.3	Technology	Silicon Crystalline (Mono/Poly)	
5.4	Battery	Not provided	
5.5	Connectivity	Local Switchboard	
5.6	Monitoring System	ModBus serial link with ECS for data logging/Monitoring.	
5.7	Location of Inverter	Installed in switchgear hall either floor or wall mounted	

Notes:-

\$- data to be provided/ confirmed by Client.

@- details to be finalised during detail engineering.

Details provided above is for existing grid supply. Details for new grid supply shall be provided by client

5.3 POWER SUPPLY DISTRIBUTION SYSTEM

5.3.1 VOLTAGE AND FREQUENCY VARIATION

S.No.	Description	Selected Option	Available Options
1	AC System		
1.1	Voltage	220kV/66kV/33kV/6.6kV/415V ± 10% (Note-1&5)	
1.2	Frequency	50 Hz ± 3%	
2	DC System		

S.No.	Description	Selected Option	Available Options
2.1	Electrical protection and Control system	110V +15%/-10% (Refer Note-4)	
2.2	DC critical Lighting system	220V +15%/-10%	
2.3	Instrumentation Power Supplies	Refer Instrumentation Design Basis	

Note:-

\$- data to be provided/ confirmed by Client.

- 1.) Voltage variation for 220kV shall be as per grid norms.
- 2.) Separate DC systems for lighting and protection & control to be provided in substation.
- 3.) Refer section 5.6.10 of this document for design voltage/frequency variation for motors.
- 4.) For PNCP, 220V DC System shall be considered for electrical protection & control system.
- 5.) 66kV shall be considered for primary power distribution in P-25 facilities on the refinery side. 33kV shall be considered for primary power distribution for new PPU in PNCP based on existing philosophy.

5.3.2 UTILISATION VOLTAGE

S.No.	Description	Selected Option	Available Options
1	Primary EHV/HV distribution voltage	220kV/66kV/33kV (Refer to note-3)	
2	Secondary HV distribution voltage	6.6kV	
3	Primary EHV/HV distribution system neutral Earthing	Solidly Earthed	
4	Secondary HV distribution system Neutral Earthing	NGR	
5	HV motor voltage for DOL	6.6kV (For motors rating > 160kW)	
6	MV motor voltage	415 V AC (except VFD motor without bypass) (For motors rating 0.18<=kW<=160)	
7	AC Motors	240V AC (except MOVs) (For motors rating < 0.18kW)	
8	DC Motor	As per equipment supplier standard	
9	Motor operated valves	415V AC, TP	
10	Battery chargers incoming power supply	415V AC,TPN	
11	UPS System incoming power supply	415V AC,TPN	
12	AC Lighting/Power Panels	415V AC,TPN	
13	Auxiliary Boards incoming power supply	415V AC,TPN	
14	Welding Receptacles	415V AC,TPN	
15	Bulk loads like Process Heaters etc	415V AC,TP	
16	Normal Lighting/Emergency Lighting	240V AC,SPN	

S.No.	Description	Selected Option	Available Options
17	LAN UPS	240V AC, SPN	

Notes :

- 1.) Input power supply for VFDs upto 315kW without bypass shall be 415V AC and for VFDs above 315kW shall be 6.6kV AC. However power supply for VFDs with bypass shall be 415V upto 160kW and 6.6kV for VFDs above 160kW.
- 2.) Power supply for Air-conditioning for Control Rooms / Satellite Rack Rooms shall be taken from normal supply.
- 3.) 66kV shall be considered for primary power distribution in P-25 facilities on the refinery side. 33kV shall be considered for primary power distribution for new PPU in PNCP based on existing philosophy.

5.3.3 UTILISATION VOLTAGE FOR CRITICAL SUPPLIES

S.No.	Description	Selected Option	Available Options
1	Switchgear protection control power supply	110V DC 220V DC for PNCP PPU (Note-1)	
2	Critical lighting power supply	220V DC (Note-2)	
3	Input power supply for Plant communication system	110V AC UPS	
4	Input power supply Fire alarm system power supply	240V AC UPS SPN (DGFAP/CFAP/RP to be provided with Dedicated battery backup)	
5	Power supply for electrical annunciation panel	NA (Part of SAS HMI)	
6	Normal Instrumentation power supply	Refer Instrumentation design basis	
7	Critical instrumentation power supply	Refer Instrumentation design basis	
8	Instrumentation Shut-down system power supply	Refer Instrumentation design basis	

5.3.4 OPERATING PHILOSOPHY

S.No.	Description	Selected Option	Available Options
1	Auto/Manual transfer at primary distribution voltage bus with momentary paralleling	No	
2	Auto/Manual transfer at secondary distribution voltage bus with momentary paralleling	Yes (FBT on 6.6kV Bus)	
3	Auto /Manual transfer at MV with momentary paralleling		
3.1	At PCC/EPC/EPMCC Level	Yes	
3.2	At MCC/ASB/LDB Level	Yes- MCC (Note-1) No- ASB/LDB	

S.No.	Description	Selected Option	Available Options
4	Continuous Parallel operation of Incomers		
4.1	Primary EHV/HV voltage	220kV & 66kV & 33kV	
4.2	Secondary HV voltage	No	
4.3	PCC/PMCC	No	
5	Power Factor Correction	Required (through local APFC Panel)	
5.1	Power factor improvement capacitors- location	6.6kV bus	
5.2	Minimum P.F. to be maintained at Transformer Primary	0.95 (at primary of power transformers of respective substation)	
5.3	Monitoring at Transformer Primary	Yes	
6	Load shedding	Yes	
6.1	Voltage level for Load Shedding	All 6.6kV and incomers, buscoupler & outgoing breaker power/motor feeders for PCC at 0.415kV.	

Note:-

1.) Only for MCCs for process units. Not applicable for package MCCs e.g. A/C, Pressurisation etc., however same shall be provided with 2 Incomers with mechanical interlock.

5.4 CONTROL-PROTECTION - METERING

5.4.1 CONTROL PHILOSOPHY

S.No.	Description	Selected Option	Available Options
1	Location of Relays for Generator	NA	
2	Location of Relays for Outdoor Switchyard	NA	
3	Location of Protection relays for EHV/HV switchgear		
3.1	Primary voltage EHV/HV switch gear	On CRP for EHV GIS On switchgear for others	
3.2	Secondary Voltage HV switchgear	On switchgear	
4	EHV/HV Switchgear control		
4.1	Generator	NA	
4.2	Outdoor Switchyard	NA	
4.3	Primary voltage EHV/HV switch gear	On switchgear & ECS	
4.4	Secondary Voltage HV switchgear	On switchgear & ECS for all feeders except motor feeder. (refer Note-2)	
5	Numerical Protection/Monitoring system for		
5.1	EHV system	Yes	

S.No.	Description	Selected Option	Available Options
5.2	HV Switchboard	Yes	
5.3	PMCC/PCC	Yes	
5.4	MCC	Yes (only for incomers and Bus Coupler)	
6	Control and logic through numerical relays	Yes	
7	Hardwired synchronization control panel-SCAP	NA	
7.1	Synchronizing trolley required	NA	
7.2	Type of Panel	NA	
7.3	Extent of Coverage on SCAP	NA	
8	Type of annunciation panel	HMI	
9	Load shedding panel	Power contingency load shedding shall be part of ECS System Frequency based load shedding shall be provided in each substation.	
10	Method of motor starting		
10.1	HV Motors	Direct on line (For motor rated upto 2MW)	
10.2	HV Motors	Refer Note 1 below	
10.3	MV Motors	DOL up to motor rating 160kW (VFD if required as per process requirement)	
11	Starting MVA limitation conditions for Motors		
11.1	HV Motors	To be decided during detailed engg.	
11.2	MV Motors	As per std specifications (values in IS 12615:2011 + IS/IEC tolerance)	

Notes:

- 1.) Dedicated transformer/ V/F controlled soft starter shall be considered for starting large HV motors if essential/unavoidable as per system design requirement/equipment design limitation based on the electrical system study.
- 2.) All incomers, buscouplers & outgoing transformer feeders shall be provided with Local/ECS selector switch. Close from ECS shall be provided through this selector switch. In case of Incomers & buscouplers, close control from ECS shall be for manual dead-bus or momentary parallel close conditions only. Auto changeover logic shall be provided in switchboard only and same shall operate in the "Local" position of Local/ECS selector switch provided on incomer/buscoupler.

5.4.2 POWER ISOLATION FOR TRANSFORMERS LOCATED REMOTELY AWAY FROM HV SUBSTATION

S.No.	Description	Selected Option	Available Options
1	Push button in transformer bay for tripping remote breaker	Yes	

S.No.	Description	Selected Option	Available Options
2	Local power isolating device	NO	
3	Type	NA	
4	Protection relay required	NA	

5.4.3 RELAY PROTECTION SYSTEM

5.4.3.1 PROTECTION DEVICES FOR POWER DISTRIBUTION SYSTEM

Protection devices for power distribution system shall be as indicated below -
(Figure inside bracket refers to points against Sr. No. under clause 5.4.3.3)
(YES - Applicable)

S.No.	Relay Description	Relay No.	HV Transformer Feeder - Sec. Winding Volt=>3.3kv	HV Transformer Feeder - Sec. Winding Volt<=0.433kv	HV Motor Feeder	Outgoing Breaker Feeder - HV Plant Feeder	Outgoing Breaker Feeder - MV PCC/PMCC	Incomer - EHV/HV	Incomer - MV PCC/PMCC
1	IDMTL over-current relay	51	YES	YES	-	YES	YES	YES (1)	YES
2	IDMTL earth-fault relay	51N	YES(2)	YES	-	YES	YES	YES (1)	YES
3	51G backup earth-fault relay (Earthed neutral)	51G(11)			-	-	-	YES	YES
4	Motor protection relay with (50, 50N,46, 49, 50L/R,86,95)	99(31)	-	-	YES(3)	-	YES(3)	-	-
5	Instantaneous restricted earth-fault relay (Earthed side)	64R(11)	-	-	-	-	-	YES(24)	YES
6	Instantaneous over-current relay	50	YES	YES	-	-	-	-	-
7	Instantaneous earth-fault relay	50N	YES(4)	YES	-	-	-	-	-
8	Differential protection relay	87	YES(5)	-	YES(6)	YES(7)	-	-	-

S.No.	Relay Description	Relay No.	HV Transformer Feeder - Sec. Winding Volt=>3.3kv	HV Transformer Feeder - Sec. Winding Volt<=0.433kv	HV Motor Feeder	Outgoing Breaker Feeder - HV Plant Feeder	Outgoing Breaker Feeder - MV PCC/PMCC	Incomer - EHV/HV	Incomer - MV PCC/PMCC
9	High speed tripping relay	86(20)	YES	YES	YES	YES	YES	YES	YES
10	Trip circuit supervision relay	95(8)	YES	YES	YES	YES	YES	YES	YES
11	Transformer auxiliary relay	63	YES	YES	-	-	-	-	-
12	Under-voltage relay with timer	27/2	-	-	YES	-	YES(3)	YES(9)	YES(9)
13	Check synchronisation relay	25	-	-	-	-	-	YES(10)	YES(10)
14	CBCT based sensitive earth fault protection	50N	YES	YES	YES	-	YES (Motor Feeders)	-	-
15	Voltage restrained overcurrent with local breaker backup	51V + LBB	YES(34)					YES(34)	

5.4.3.2 POWER GENERATION AND EXTERNAL POWER SUPPLY

S.No.	Relay Description	NEMA Code	Generator	Generator Transformer	EHV Incomer	EHV Transformer	Syn. Motor
1	Distance protection	21			YES		
2	Synchronous check	25	YES	YES	YES		
3	Under voltage with timer	27	YES		YES		YES
4	Reverse power	32	YES				YES
5	Low power flow	37	YES				

S.No.	Relay Description	NEMA Code	Generator	Generator Transformer	EHV Incomer	EHV Transformer	Syn. Motor
6	Loss of excitation	40	YES				YES
7	Negative sequence	46	YES				YES
8	Over current	50				YES	YES
9	Earth fault relay	50N				YES	YES
10	Over current	51			YES	YES	
11	Voltage restrained	51V	YES	YES			
12	Earth Fault back up	51G	YES	YES		YES	
13	Over current E/F	51N		YES	YES	YES	
14	Over voltage with timer	59	YES		YES		YES
15	VT failure	60	YES				YES
16	Auxiliary relay for transformer	63TX		YES		YES	
17	Transformer Restricted Earth Fault	64R	YES(26)	YES		YES	
18	Stator back up earth fault	64G	YES				
19	Generator Rotor Earth fault	64R	YES				YES
20	Directional O/C	67			YES		
21	Directional E/F	67N			YES		
22	Under frequency/df/dt	81	YES		YES		YES
23	Tripping relay	86	YES	YES	YES	YES	YES
24	Gen differential	87G	YES				
25	Gen and Transformer differential	87GT		YES			
26	Transformer differential	87T		YES		YES	
27	Feeder differential	87F				YES	

S.No.	Relay Description	NEMA Code	Generator	Generator Transformer	EHV Incomer	EHV Transformer	Syn. Motor
28	Bus bar differential and check	87B/ 87CH		YES			
29	Trip circuit supervision	95	YES	YES	YES	YES	
30	Dead bus charging relay	98	YES	YES	YES		
31	Over fluxing	99	YES	YES			
32	Out of step	78	YES				YES

5.4.3.3 RELAY PROTECTION PHILOSOPHY

S.No.	Project Philosophy
1	In case of HV switchboards with continuous parallel operation of incomers, 67 and 67N (Directional IDMTL over current and earth fault) relays for the incomers shall be provided.
2	Instantaneous earth fault (50N) shall be provided only for transformer with delta primary.
3	For breaker fed motor feeders only. Following protections shall also be provided in the numerical protection relays for motors a) No. of start b) Stall protection - with provision for separate settings for start and running condition c) Undervoltage protection - including three phase PT input and Bus PT secondary MCB feedback along with check for current variation
4	Directional IDMTL earth fault (67N) shall be provided for transformer with star primary.
5	For transformers rated 5 MVA and above.
6	For motors rated 1500 kW and above, excluding VFD fed motors.
7	To be provided for all EHV & HV plant feeders. A plant feeder implies outgoing feeders from one switchboard to another switchboard of same voltage level. Feeder differential relay shall be provided with OFC for communication between the two relays.
8	Both 95B & 95 relay shall be provided as part of the numerical relay for HV/ MV feeders wherever numerical relays are provided.
9	For HV & MV switchboards wherever auto-changeover feature is provided. Additionally buscoupler provided in these switchboards shall be provided with Closing coil supervision scheme.
10	For switchgears where continuous or momentary paralleling of Incomers is envisaged, check synchronising relay shall be provided.
11	51G and 64R relays for input transformer of VFD system shall be decided by VFD Manufacturer.
12	The bus tie feeders in HV switchboards shall be provided with 51, 51N, 86 and 95 relays.
13	HV capacitor bank feeders shall be provided with 51, 51N, 59 (over voltage), 60 (Neutral displacement), 86 and 95 relays.

S.No.	Project Philosophy
14	The following feeders shall be provided with timers for delayed tripping on bus under voltage while the under voltage relay shall be common for the bus a. HV and MV capacitor feeders b. HV and MV breaker controlled motor feeders c. Contactor controlled motor feeders with DC control supply. Numerical relays where ever provided for motor and capacitor feeders shall use in built under voltage relay and timer for delayed tripping on bus under voltage.
15	One no. DC supply supervision relay (80) shall be provided for each incoming DC supply to the switchboard.
16	In case of numerical relays, all relays shall be comprehensive units including all protection, metering & control and communication over IEC-61850 protocol.
17	Under voltage and over voltage function along with associated timer shall be part of the numerical relays.
18	FBT / Auto changeover logic between Incomers and bus coupler shall be built in the numerical relay.
19	Tripping relays (86) shall be conventional electromechanical VAJH or VAJS high burden type only. ABB make PQ8 shall not be used
20	2 Nos. of 86 relays shall be considered for HV and MV breaker fed motors for ease of differentiating between process & electric trip. Master Tripping relays shall be VAJH relay and Process trip relay shall be VAJS relay.
21	Breaker control switch shall be hardwired type.
22	Stand by earth fault relay 51G (part of separate 64R relay) shall be provided in the incomer of switchboard fed from transformers and same shall operate 86 relay of incomer & trip coil of upstream transformer feeder (without 86 relay). 51G protection shall have selectable IDMT characteristics including IEC LTI curves.
23	Restricted earth fault relay 64R shall be provided for transformer rating ≥ 1.25 MVA in the incomer of switchboard fed from transformers with secondary winding connected in star. Same shall operate trip coil of incomer without operating the 86 relay & shall operate 86 relay of upstream transformer feeder.
24	Relay 51V voltage controlled over current relay shall be provided on specific requirement considering the rating of the outgoing feeders with respect to the Incomer rating. Generally this relay shall be provided wherever CT primary current of outgoing feeders is exceeding 40% of the CT primary current of the Incomer.
25	415V DG set shall be provided with protection but not limited to 51V,51G,40,46,86,95,80,64R etc for generator rated above 500KVA and Generator rated less than 500KVA shall have 51V,51G,40,46,86,95,80 unless otherwise agreed with the owner.
26	Relay 87 and 64R shall be separate numerical relay. Hence shall not be part of main comprehensive numerical relay. CT for 87 and 64R can be clubbed, as two core of single CT.
27	EHV switchboards shall be provided with low impedance type bus bar differential protection system with provision of manual bypass. Check zone relay (87CH) shall be provided as a separate relay.
28	All HV switchboards (6.6kV) shall be provided with One set of 87B (Bus differential - High impedance type with manual bypass feature) relay with CT supervision relay and 95 B (Bus wire supervision) for each bus section.

S.No.	Project Philosophy
29	<p>Feeders for all MV motors rated upto 55kW shall be provided with Digital MPR.</p> <p>DMPR relay shall have following features which are listed below:</p> <ol style="list-style-type: none"> 1) Multi-Protection : thermal overload(different curves/thermal constant), Stall(settable), Lock rotor(settable), phase unbalance, phase reversed Asymmetry, Ground fault (with option of instantaneous trip time), Short circuit (with option of instantaneous trip time) 2) Display for causes of the type of fault and values 3 phase & earth element current in digital ampere meter 3) Display for running three phase current, Motor load (%) 4) CT ratio shall be settable in Digital MPR 5) Feeders for all MV motors above 11 kW shall be provided with CBCT+ELR. CBCT shall be mounted on the drawout module only. DMPR & ELR shall be considered as a single relay for these cases.
30	Stabilizing resistor shall be provided in residual earth fault connection for all motors and transformers even in case of numerical relays to avoid spurious tripping during starting.
31	All HV/MV Motors with numerical relays shall have provision for "Ready to start" monitoring facility which can provided alarm output contact for interfacing with DCS/PLC. This shall monitor the healthiness of relay/control system/spring charge condition of breaker and interlocks/stop command etc. Interface with DCS/PLC shall be as per interface requirements.
32	Undervoltage tripping shall be blocked in case of PT fuse failure in motor protection relays.
33	All the control switches provided for electrical control shall be non-lockable type.
34	Only for incoming and outgoing feeders on primary distribution boards(EHV & 33kV)
35	Relay logic shall be designed such that it is ensured that no trip will be generated in case of DC failure & restoration.
36	<p>For transformer feeders having supply from remote substation, OFC based remote I/O module / teleprotection shall be used to share following signals:</p> <ol style="list-style-type: none"> a) Transformer incipient faults (Buchholz/OTI/WTI) b) Direct intertrip c) Status (ON/OFF/ Trip)

5.4.4 METERING

5.4.4.1 METERING DEVICES IN EHV, HV AND MV SWITCHBOARDS

The metering devices in EHV, HV and MV switchboards shall be as below:

Type of metering : Analogue/As part of the Numerical relay

(Figure inside bracket refers to note below) (YES - Applicable)

S.No.	Feeder Type	A	V	Hz	PF	MW	MWH	HM	MVAR	MVAH	MVA
1	Grid Incomers	YES	YES	YES	YES	YES(2)	YES	-	YES(2)	YES(2)	YES(1,2)
2	Grid Bus Tie	YES									
3	Grid Transformer	YES				YES	YES				
4	Grid Bus P.T.		YES								
5	EHV/HV Incomer	YES	YES	YES	YES	YES	YES	-	YES	YES	YES
6	EHV/HV Bus Tie	YES	-	-	-	-	-	-	-	-	-
7	EHV/HV Transformer	YES	-	-	-	YES	YES	-	-	-	-
8	EHV/HV Bus P.T.	-	YES	-	-	-	-	-	-	-	-
9	EHV/HV Plant Feeder	YES	-	-	-	-	YES	-	-	-	-
10	EHV/HV Motor	YES	-	-	-	-	YES(kWh)	YES	-	-	-
11	EHV/HV Capacitor	YES	YES	-	-	-	-	-	YES	-	-
12	PCC/PMCC Incomer	YES	YES	-	YES	-	YES(kWh)	-	-	-	-
13	PCC/PMCC Bus Tie	YES	-	-	-	-	-	-	-	-	-
14	PCC Bus P.T.	-	YES	-	-	-	-	-	-	-	-
15	ACB Outgoing (Non motor)	YES	-	-	-	-	YES(kWh)	-	-	-	-
16	MV Motor (>55kW)	YES	-	-	-	-	-	-	-	-	-
17	MCC/ASB Incomer	YES	YES	-	-	-	-	-	-	-	-
18	MCCB/SFU O/G(250A)	YES	-	-	-	-	YES(kWh)	-	-	-	-
19	LDB Incomer	YES	YES	-	-	-	YES(kWh)	-	-	-	-
20	DG Set-MV	YES	YES	YES	YES	YES(kW)	YES(kWh)	YES	-	-	-

Notes:

- 1.) MVA meter in EHV external power supply Incomers shall include maximum demand indication also.
- 2.) Separate MW, MVAR, MVA and MVAH meters shall be provided for EHV external power supply Incomers only.
- 3.) Seperate 3 nos. voltmeter and 3 nos. ammeter shall be provided for EHV external power supply incomers.
- 4.) All metering shall be part of numerical relay in case of feeders having numerical relays.
- 5.) Field ammeters shall be provided for all motors rated above 5.5kW. However feeders for all packages Aux. Motor driven pumps and heaters shall be provided with ammeter irrespective of the motor ratings. For PPU in PNCP, motor feeders of all ratings shall have provision of field ammeter.
- 6.) Ammeter (size 48mm x 48mm) shall be provided in space heater circuit of breaker fed HV & MV motors.
- 7.) Digital mutli-function meters shall be provided in all feeders of 6.6kV switchboards. This shall be in addition to metering as part of numerical relays.
- 8.) Digital mutli-function meters shall be provided in incomers, buscoupler & outgoing breaker feeders (except motor feeders) for MV PCC with communication over RS-485 or fibre optic cable, preferably with IEC protocol. This shall be in addition to metering as part of numerical relays for energy management functions.
- 9.) HV Motor feeders shall be provided with 4-20mA current/voltage transducers (as required) for feedback to DCS.
- 10.) Power factor meter shall be provided for synchronous motors in addition to the metering provided for induction motors.
- 11.) Digital mutli-function meters with communication over RS-485 or fibre optic cable, preferably with IEC protocol shall be provided in incomers of UPS ACDB.

5.4.4.2 METERING FOR GENERATOR AND GENERATOR TRANSFORMER

S.No.	Meter	HV Generator	Generator transformer
1	Ammeter (3 nos.)	YES	YES
2	Voltmeter (3 nos.)	YES	YES
3	MW meter	YES	YES
4	MVAR meter	YES	
5	MVA meter	YES	
6	MWH meter	YES	YES
7	MVARH meter	YES	
8	Power factor	YES	YES
9	Frequency meter	YES	

5.5 SUBSTATION DESIGN

5.5.1 SUBSTATION AUTOMATION SYSTEM

S.No.	Description	Selected Option	Available Options
1	Substation Automation System (SAS)	Required	
2	Communication protocol for relay network	IEC 61850	
3	System architecture	IEC 61850 RSTP	
4	Data concentrator for SAS	Not Required	
5	Communication with other devices		
5.1	Communication with ECS	Yes	
5.1.1	Protocol for communication with ECS	IEC 61850	
5.2	Communication with DCS	Part of ECS RTU (Refer Note-3)	
5.2.1	Protocol for communication with DCS	Modbus TCP/IP	
5.3	Communication with VFD & UPS	Part of ECS RTU	
5.3.1	Protocol for communication with VFD & UPS	Modbus TCP/IP	
6	HMI for SAS	Common operator cum engineering workstation	
7	Laptop	Separate for each switchboard system for each substation	
8	Local storage of data	part of HMI	
9	Relay parameterization	SAS HMI	

- 1.) All functionalities of engineering workstations shall be provided in the LAPTOP.
- 2.) Common HMI (for EHV, HV & MV) shall be provided in each substation for monitoring purpose as part of ECS.
- 3.) For feedbacks to DCS which are used only for indication.
- 4.) Separate UPS for SAS HMI is not required. UPS power shall be provided from common UPS within substation building.

5.5.2 EHV SWITCHYARD

S.No.	Description	Selected Option	Available Options
1	Type	\$ Outdoor	
2	Type of bus	\$ String - Moose Conductor	
3	Structure for outdoor	\$ Galvanised	
4	Bus material	\$ Aluminium	

Notes:-

\$- data to be provided/ confirmed by Client

5.5.3 SUBSTATION FEATURES

S.No.	Description	EHV	HV	MV	MCC/Elec. Room
1	Elevated with trays in cable cellar	NA	YES	YES	NO
2	Raised with internal trenches	YES	NO	NO	YES
3	All top cable entry with trays below ceiling	NO	NO	NO	NO
4	Pressurisation against ingress of dust	NA	NA	NA	NO (NOTE-2)
5	Air-conditioned room for operator	YES (NOTE-5)	YES (NOTE-5)	YES (NOTE-5)	NA
6	Roof slab for (Refer Note-6)				
6.1	Power transformer	YES	YES	NA	
6.2	Distribution transformer	NA	YES	YES	
7	Air conditioning of switchgear hall and provision of false ceiling.	YES	YES	YES	NO
8	EOT crane in sub-station	YES	NO	NO	NO
9	Electrical Store/Maintenance Room	YES - 2NOS (NOTE-7)	YES - 2NOS (NOTE-7)	YES - 1NO (NOTE-7)	NO
10	Washrooms & water filters	YES	YES	YES	NO

Notes :

- 1.) Column HV is defined as "Substation having full fledged HV Switchboard having incomer, buscoupler and outgoing switchboards".
- 2.) Not required for MCC rooms located in safe area/ utilities not handling hydrocarbons/ combustible dust.
- 3.) Exhaust fans shall be provided on the two ends of the cable cellar for each substation.
- 4.) Lift for substations with more than two floors shall be provided.
- 5.) Size of operator room shall be 3mx3m. HMIs shall be installed in this room. Room shall be part of switchgear hall with glass partition. CRP & LCC for 220kV GIS shall be installed in the GIS hall.
- 6.) Concrete roof slab on outdoor bays shall be provided at switchgear hall roof level.
- 7.) Maintenance rooms shall be of size 6mx6m.
- 8.) Fire proof sealing system as per IEC-60332 shall be provided below the switchboards in substations and above ground entry points of cables to substations.

9.) Temperature & humidity monitoring for each substation and connected battery charger room/VFD room shall be provided with display and 4-20mA transmitter for interface with ECS.

5.5.4 SPECIFIC EQUIPMENT LOCATIONS

S.No.	Description	Selected Option	Available Options
1	Batteries in substation and control Rooms	Separate room	
2	Battery charger in substation	Switchgear Hall	
3	Battery charger in control room	Air conditioned room	
4	Variable speed drive panels	Switchgear Hall	
5	Thyristor controlled panels	Switchgear Hall	
6	UPS System	Air conditioned room in control room or Satellite rack Room Switchgear hall in substation	
7	Lead-Acid and Nickel-Cadmium	Separate room	
8	Location of VRLA battery	Air conditioned room	
9	Annunciation panel	Part of HMI in Operator room	
10	Energy saver panel with Lighting transformers	Panel mounted type lighting transformer	
11	GIS Hall	Air Conditioned	

- 1.) Battery room shall be preferably located in corner side at switchgear floor of the substation building.
- 2.) Battery charger for Instrumentation shall be placed in air-conditioned UPS room in control room.
- 3.) Electrical equipment installed in battery room such as exhaust fan, lighting, battery circuit breakers, receptacles shall be of flameproof enclosure type and certified for gas group IIC classified locations. Heat detectors installed in battery room shall be of intrinsically safe type and shall be provided with Zener barriers.
- 4.) Capacitor panels along with APFCR shall be indoor type, installed in switchgear hall. Dry type series reactor installed inside panel shall be provided with the capacitor banks.
- 5.) All electronic equipment like VFDs, thyristor panels etc shall preferably be located in a separate room (part of air conditioned switch gear room) with glass partition based on space availability.

5.6 EQUIPMENT DESIGN

5.6.1 EHV DESIGN

5.6.1.1 EHV OUTDOOR SWITCHYARD

S.No.	Description	Selected Option	Available Options
1	Bus bar system	\$ NA (Part of EHV GIS)	
2	Circuit breaker type	\$ SF6	
3	Isolator type	\$ Centre rotating	

Notes:-

\$- data to be provided/ confirmed by Client

5.6.1.2 EHV SWITCHBOARD

S.No.	Description	Selected Option	Available Options
1	Execution	Fixed	
2	Type of Switchgear	GIS SF6	
3	Busbar	Double	
4	Circuit Breaker Type	VCB/SF6	

Notes :

- 1.) Local control cabinet for 220kV GIS shall be separate free standing type and for 66kV GIS it shall be part of GIS panel.
- 2.) Breaker scheme for GIS shall be informed by client. \$
- 3.) All breakers shall have double trip coils fed from same control supply. Each coil shall have separate trip circuit supervision and tripping scheme/trip fuses.

5.6.2 HV SWITCHBOARD

S.No.	Description	Selected Option	Available Options
1	Execution	Fixed for 33kV/ Drawout for others	
2	Type of switchgear	Gas insulated for 33kV/ Air Insulated for others	
3	Bus bar	Single bus	
4	Circuit breaker type	VCB	
5	Motor Control	Breaker	

Notes : -

- 1.) Breaker compartment shall be provided with non-metallic shutters.
- 2.) HV switchboards shall be provided with thermography window for infrared electrical inspection.
- 3.) Internal Arc classification for HV switchboards shall be 40kA for 0.2sec.
- 4.) Fast Bus Transfer (FBT) shall be provided for 6.6kV HV Switchboards.
- 5.) Double bus tie circuit breaker shall be provided in all HV Switchboards (6.6kV). Second buscoupler shall be without any kind of numerical relay and shall be provided with Electro mechanical type Trip circuit supervision relay. Status of second buscoupler shall be used in interlock of Auto changeover logic, which shall be implemented in the first buscoupler with numerical relay. There shall not be any feeder in between the both bus coupler.
- 6.) AIS type HV switchboards shall be provided with 4 nos. Non-hygroscopic phase barriers and shrouds shall be provided at uncovered portion of bus-bars. All breakers and cable compartment shall have phase barriers (4 nos. each).

5.6.3 CURRENT TRANSFORMER (CT)/POTENTIAL TRANSFORMER (PT)

S.No.	Description	Selected Option	Available Options
1	CT Secondary		
1.1	General Protection	1A	
1.2	Special protection(87,64R,51G etc)	1A	
1.3	Metering	1A for conventional and remote metering	

S.No.	Description	Selected Option	Available Options
2	PT Secondary	110V AC	

5.6.4 TRANSFORMERS (POWER/DISTRIBUTION)

S.No.	Transformer	Voltage Ratio	Vector Group	Tap Changer	Cooling
1	Grid power transformer / Grid Supply Transformer	220/69kV	YNyn0	OLTC	ONAN/ONAF
2	Generator unit transformer	NA	YNd 11	Off-circuit	ONAN/ONAF
3	Intermediate power transformer	66/6.9kV, 33/6.9kV (Refer Note-8)	Dyn 1	OLTC	ONAN/ONAF
4	Dedicated (e.g. for VFD)		As Req'd.	Off-circuit	ONAN
5	Distribution transformer (<= 2500 KVA)	6.6/0.433kV	Dyn 11	Off-circuit	ONAN
6	Tie Transformer	66/66kV	YNyn0	OLTC	ONAN/ONAF

Notes :

- 1.) Provision of Oil Soak Pit & Oil Collection Pit for transformers shall be as follows:
 - a) Oil quantity <= 2000L: Not Required
 - b) 2000L < Oil Quantity <= 9000L: Soak Pit
 - c) Oil Quantity > 9000L: Soak Pit + Collection Pit
- 2.) EHV transformer shall be provided with both NIFPS & HWWS based fire fighting system. For all other power transformers rated above 10MVA or with oil quantity greater than 2000 Liters, HWWS based fire fighting system shall be provided. Deluge valve assembly shall be provided canopy/shed.
- 3.) Bucholz relay, OTI & WTI shall be provided with reed type switches in place of mercury switches.
- 4.) Online De-hydration facility shall be provided in all transformers rated greater than 5MVA.
- 5.) Dedicated panel mounted transformers provided for VFDs shall have maximum efficiency at operating load of motor.
- 6.) EHV Side terminal box for EHV power transformer shall be of oil filled type only.
- 7.) OLTC for Grid transformer shall have RTCC panel with Dual redundant AVR facility.
- 8.) 66/6.9kV transformer is applicable for refinery side facilities. 33/6.9kV transformer is applicable for PNCP side facilities.

5.6.5 MV SWITCHBOARD

S.No.	Description	Selected Option	Available Options
1	PCC / PMCC		
1.1	Breaker panels	Drawout Single front	
1.2	Contactors feeders	Drawout Single Front (See Note-1)	
2	MCC	Drawout Single Front (See Note-1)	
3	ASB	Drawout Single Front (See Note-1)	

S.No.	Description	Selected Option	Available Options
4	LDB	Drawout Single Front (See Note-1)	
5	Motors		
5.1	PMCC	Above 55 kW Up to 160 kW	
5.2	MCC	Up to 55 kW	
6	Type of switchboard for small package (AC system, Pressurisation system, Bagging plant etc)	Compartmentalised Fixed type	

Note:-

- 1.) MCCs, ASB, LDB may be considered Double Front where required due to space limitations in the building.
- 2.) Rating of MCC shall be limited upto 1250A.
- 3.) Switchboards upto 4000A shall be naturally cooled. No force cooling shall be accepted.
- 4.) For PCC/PMCC/EPCC internal arc protection system shall be provided.

5.6.6 MEDIUM VOLTAGE MOTOR STARTER TYPE

S.No.	Description	Selected Option	Available Options
1	Contactora and switch fuse with overload relay	NA	
2	Contactora, switch fuse and overload relay with CBCT for earth fault protection	Above 11kW & up to 55KW with DMPR where Overload relay, ELR shall be part of DMPR (Refer Note 1)	
3	Contactora and switch fuse with motor protection relay	Upto 11kW with DMPR where Overload relay shall be part of DMPR	
4	Air circuit breaker with motor protection relay	Above 55kW up to 160KW (Refer Note 1)	
5	Contactora and MCCB with overload relay	NA	
6	Contactora, MCCB and overload relay with CBCT for earth fault protection	NA	

- 1.) All motor feeders above 11kW shall be provided with CBCT based earth fault protection.

5.6.7 MEDIUM VOLTAGE OUTGOING FEEDER TYPE

S.No.	Description	Selected Option	Available Options
1	Switch fuse	Up to 100A	
2	Switch fuse with Contactora and CBCT for earth fault protection	Above 100A and upto 250A. 32/63A for Aux. Heater Feeders	

S.No.	Description	Selected Option	Available Options
3	MCCB with Contactor and CBCT for earth fault protection	NA	
4	MCCB	NA	

Note:-

- 1.) Feeders of all other ratings not listed above shall be provided with ACB.

5.6.8 MOTOR CONTROLS (AS PER PROCESS PACKAGE & OPERATING PHILOSOPHY)

S.No.	Description	Selected Option	Available Options
1	Auto/OFF/Manual switch	Control room	
2	Local/OFF/Remote switch	Near motor	
3	Process interlock	PLC(Note-1)	
4	Reacceleration equipment	Switchgear (Note-3)	

Note:-

- 1.) To be made available at Switchgear as per instrumentation philosophy.
- 2.) For contactor fed motors and where required by OEM of a system "STOP" shall be "Break or Open to Trip". For all other motors, Field Stop PB, EPB Commands and DCS stop / process trip command shall be of "make or close to trip" type.
- 3.) Electronic TRUE OFF Delay & ON Delay timers shall be provided. Aux supply shall not be used for timers.

5.6.9 CONTROL SUPPLY VOLTAGE

S.No.	Description	Selected Option	Available Options
1	Breaker control	110V DC 220V DC for PPU in PNCP	
2	Breaker spring charging	110V DC 220V DC for PPU in PNCP	
3	Contactor feeder	240V AC	
4	Control supply for earth fault relay in contactor feeder(Note 1)	240V AC	
5	Control supply for contactor motor starter	Control Transformer	
6	Control transformer for each feeder	Yes	

Notes:

- 1.) Control supply shall be derived from for incoming supply to the feeder module.
- 2.) Control supply for thyristor based heater panels for process heaters, ECS Panels, LAN, HMIs in substation, VFDs & Soft starters shall be 230V AC supplied from dedicated UPS installed in the substation.
- 3.) Common 220V DC system shall be used for both control & lighting in offsite MCC rooms.
- 4.) Each bus section of a switchboard shall be provided with independent control supply. Provision for bumpless auto transfer in case of loss of one supply shall be provided. There shall also be provision for manual transfer. Monitoring of failure of supply, availability of source and monitoring auto status shall be provided.

5.6.10 MOTORS

S.No.	Motors	High voltage	415 volts
1	Enclosure		
1.1	Indoor	IP55	IP55
1.2	Outdoor	IP55	IP55
2	Insulation class	F (Temp. Rise limited to B)	F (Temp. Rise limited to B)
3	Anti-condensation heater	Yes	22 kW and Above
4	Additional canopy (outdoor motors)	Yes	Yes
5	Design voltage variation	±10%	±10%
6	Design frequency variation	±3%	±3%
7	Combined voltage / frequency variation (Design)	±10 % Any combination of above	±10 % Any combination of above
8	Winding/Bearing RTD	6 nos. duplex winding RTDs 2 nos. bearing RTDs (Note-4&5)	PTC thermistors (Note-6)

Notes :

- 1.) Motors for MOV actuator shall have H class of insulation with temperature rise limited to class-B.
- 2.) HV motors terminal box shall be phase segregated. Other variations shall be considered in case of limited availability.
- 3.) MV motors for hazardous and safe area shall have efficiency class as IE3 as per IS 12615:2011.
- 4.) Dual dial type temperature indicator without contacts, mounted on motor body, for bearing temperature should be provided for all HV motors.
- 5.) Refer Clause 4 Note 26 for RTD/BTD configuration.
- 6.) To be provided for all VFD driven MV motors. Also for other MV motors wherever required for process/DCS monitoring.

5.6.11 UPS SYSTEM

S.No.	Description	Selected Option	Available Options
1	Redundancy	100%	
2	Type of redundancy	Parallel redundant with individual bypass	
3	Back-up time	120 minutes	
4	Bypass transfer control	Auto	
5	Separate fault diagnostic unit (Note 1)	YES	
6	Battery type	Ni-Cd (2X100% configuration in all options)	
7	Type of UPS	Rectifiers : Diode/SCR Invertor : IGBT	
8	UPS Output Supply	Single Phase	
9	UPS Output Voltage	110V AC (Final voltage shall be as per Instrumentation Design Basis)	

Notes :

- 1.) Separate Fault Diagnostic Unit(FDU) is not required in case UPS system is serial connected to HMI and fault diagnostic can be done from HMI. However UPS shall be provided with self powered disturbance recorder with internal battery backup.
- 2.) 1No. 230V 20KVA UPS in parallel redundant with bypass configuration (2x50% battery banks) shall be provided for feeding CFAP, fire alarm HMI and other miscellaneous equipment as per client requirements in the fire station.
- 3.) Complete redundancy shall be provided in UPS till the distribution board level.
- 4.) Refer Clause 4 Note 7 for ACDB configuration.
- 5.) ACDB outgoing feeders shall SFU type with semiconducting fuses.
- 6.) In case of space constraint, ACDB shall be split and different sections shall be connected through busduct as required.
- 7.) Dedicated UPS with 230V AC output shall be installed in the substation for providing control supply to thyristor based heater panels for process heaters, ECS Panels, LAN, SAS HMIs, VFDs & Soft starters installed in substation. In case of common substation for different process units, separate UPS system for the above shall be provided for different units where separate HV switchboards are provided for different units.
- 8.) Online battery bank monitoring system shall be provided for main process UPS batteries. Provision for individual cell temperature, cell voltage & cell impedance shall be monitored and common alarm shall be provided for each category. Battery monitoring system shall have connectivity with ECS system and remote alarm facilities.

5.6.12 COMMUNICATION SYSTEM

S.No.	Description	Selected Option	Available Options
1	Plant Communication System	Yes	
2	Telephone System	Yes (Refer Note-1 & 2)	
3	Telephone system and plant Communication system	Separate	
4	Interface of Communication system		
4.1	With fire alarm system	Yes	
4.2	With telephone system	Yes	

Notes :

- 1.) Basic telephone handset with minimal display shall be procured through Building/Package contractor. Special purpose handsets with advanced functions shall be procured by Client at their end.
- 2.) Flameproof telephones in high noise area shall be provided with along with acoustic hood/soundproof booth in field area as per space availability.
- 3.) PA System for PPU in PNCP shall be hooked up to the existing system at PNCP.
- 4.) Telephone exchange for new plant shall be integrated with existing telephone system at the refinery complex (PR).

5.6.13 FIRE DETECTION AND ALARM SYSTEM

S.No.	Description	Selected Option	Available Options
1	Type	Analogue addressable	
2	Name of buildings to be provided with Detectors	Control room, sub-station, SRR, other buildings as required.	
3	Detection System	Break Glass, Multi sensor detection	
4	Type of manual call point	Without call back facility	
5	Qty of Siren and location	During detail engineering	

S.No.	Description	Selected Option	Available Options
6	Power supply for Siren	Main Sirens : 415V AC For small indoor siren : during detailed engineering	
7	Siren range	16 Km(Diametrically)	
8	Response indicator for rooms and concealed area for Addressable Fire alarm system	No	

Notes :

- 1.) HMI for Fire Alarm System shall be provided along with CFAP in Main Fire Station.
- 2.) Heat detectors installed in battery room shall be of intrinsically safe type and shall be provided with Zener barrier.
- 3.) Fire Alarm System for PPU in PNCP shall be hooked up to the existing system at PNCP.
- 4.) Repeater panel of new FA system of P-25 shall be provided in PR Fire station.
- 5.) 4 Nos DC sirens shall be provided in P-25 project areas (refinery area only). One siren shall be located on Fire station and other shall be distributed geographically.

5.6.14 DC SYSTEM

S.No.	Description	Selected Option	Available Options
1	Battery type		
1.1	Switchgear Protection Control and critical lighting	Ni-Cd	
1.2	Instrumentation System	Ni-Cd	
1.3	Diesel Engine Starting	Lead Acid	
1.4	DC Motors	As per equipment supplier"s recommendation	
1.5	Fire alarm system	VRLA	
1.6	Telephone system	Ni-Cd	
1.7	End Cell Voltage		
1.7.1	Lead Acid Battery	1.85 VOLT	
1.7.2	VRLA Battery	1.75 VOLT	
1.7.3	Ni-Cd Battery	1.16 VOLT	
2	Battery backup time		
2.1	Switchgear Protection and Control	120 minutes	
2.2	DC Critical lighting	120 minutes	
2.3	Instrumentation	120 minutes	
2.4	Diesel Engine Starting	10 starts (FW pumps) & 6 starts (others)	
2.5	DC Motors	As per equipment manufacturer's recommendation	
3	Battery Configuration	2X50%	

Notes :

- 1.) Refer Clause 4 Note 8, for DCDB configuration.
- 2.) DCDB outgoing feeders shall be SFU type with HRC fuses
- 3.) Battery chargers shall be SMPS based and shall be of Dual FCBC Charger type.
- 4.) Common online cell booster suitable for largest battery rating shall be provided in each substation & SRR building for similar battery systems.
- 5.) DC Earth fault monitoring relay shall be provided on the battery charger and DCDB shall

be provided with a voltmeter & selector switch which have facility to check DC positive to negative, positive to earth & negative to earth voltage, Also separate annunciation for same shall be provided and indicated to ECS.

6.) Online battery bank monitoring system shall be provided for DC control supply battery banks. Provision for individual cell temperature, cell voltage & cell impedance shall be monitored and common alarm shall be provided for each category. Battery monitoring system shall have connectivity with ECS system and remote alarm facilities.

7.) For switchgear protection and control, in case of common substation for different process units, separate DC system shall be provided for different units where separate HV switchboards are provided for different units.

8.) For critical lighting, common DC system for each substation building, irrespective of the various units fed from that substation, shall be provided.

5.6.15 VARIABLE FREQUENCY DRIVE

S.No.	Description	Selected Option	Available Options
1	By pass feature required	Yes(Note-1)	
2	VFD rated output voltage		Incase where bypass is not provided.
2.1	MV Inverter	i) 415V for motor kW rating less than 315kW ii) 690V for motor kW rating more than 315kW & up to 700kW	
2.2	HV Inverter	6.6kV for motor rating more than 700kW	

Notes:

1.) Bypass for VFD shall be provided as a standard practice unless not recommended from Process or driven equipment operation point of view.

2.) For single large/critical drives with VFD, redundant VFDs (Hot Standby) along with redundant PLC for change over without any common point of failure shall be provided. Drives for motor driven ID/FD Fan, RGC, MAB, WGC & MUG compressor with only single drive shall be considered as critical drive. In case of PPU in PNC Reactor Agitator drive, pelletizer cutter motor drive shall be provided with hot standby drive.

3.) All drives for critical applications as listed above shall be provided with HMI for trending & diagnostics features.

5.6.16 CABLE SIZES

The power and control cables shall have the following minimum cross sectional areas

S.No.	Description	Selected Option	Available Options
1	Medium voltage power cable	Upto 16 sqmm (Copper) Above 16 sqmm (Aluminium) XLPE Insulated	
2	Control cables	2.5 sqmm (Copper) (Note-4)	
3	Lighting	2.5 sqmm (Copper)	
4	Communication system	0.9 mm dia. (Copper)	
5	Telephone System	0.63 mm dia.(Copper)	
6	Fire alarm system	1.5 sqmm (Copper)	

Notes:

- 1.) For lighting inside the building, minimum 1.5 sqmm copper conductor, PVC Insulated wire shall be used in conduit system (for circuit and point wiring), with proper colour coding.
- 2.) Cable sizes are indicative only and these shall be finalised as per the recommendations of the equipment manufacturer.
- 3.) Special cable type and size shall be decided on specific requirement.
- 4.) Control cable shall be of multistranded conductor, twisted pair overall shielded, XLPE insulated type.
- 5.) Communication cables used in PA / Telephone system shall be with solid conductors and XLPE insulated type.
- 6.) Cables used in FA system shall be of multistranded conductor, twisted pair, XLPE insulated type.
- 7.) All cables shall be with FRLS outer sheath.
- 8.) For all control cables minimum 1Pair shall be provided as spare.
- 9.) For MOVs, where control cable length is more than 500m, for DCS command 2 parallel conductors shall be used for each command.
- 10.) All cables for DC system for both control and lighting from Battery charger & DCDB onwards shall be with copper conductors only.
- 11.) All cables for UPS system from UPS & ACDB onwards shall be with copper conductors only.

5.7 CABLING SYSTEM

5.7.1 CABLE DETAILS

S.No.	Design Criteria	EHV	HV	415 volts
1	Loads located beyond 1 km	1-core cable	3-core cable	1-core cable / 3 1/2-core
2	Loads located 200-1000 m	1-core cable	3-core cable	1-core cable / 3 1/2-core
3	Loads located upto 200 m	1-core cable	3-core cable	1-core cable / 3 1/2-core
4	Loads beyond 1250A rating and located near the transformer.	Gas Insulated Busduct / 1 core cable	Bus duct	Bus duct / 1-core cable / 3 1/2-core
5	Recommended limiting size of multi-core cable (sqmm)	1000	300	300
6	Short-circuit withstand time (seconds)	1.Incomer from transformer:1 2.Incomer from other switchboard:1 3.Plant feeder:1 4.Transformer feeder:1	1.Incomer from transformer:1 2.Incomer from other switchboard:0.6 3.Plant feeder:0.6 4.Transformer feeder:0.4 5.Motor feeder:0.2	Not Applicable
7	Insulation voltage grade	Earthed	33kV Earthed 6.6kV Unearthed	Earthed
8	Type of cable insulation	XLPE	XLPE-FRLS	XLPE-FRLS
9	Fire survival (Resistant) cable for Fire proof MOV	-	-	Yes (Both Power & Control)

S.No.	Design Criteria	EHV	HV	415 volts
10	Power Cable for Motors/MOV	-	3 core	3 core
11	Cable Conductor	Copper	Copper/Aluminium (Refer Note-7)	Refer Cl. 5.6.16
12	Power & Earthing cable	Armoured	Armoured	Armoured

Notes :-

- 1.) Water swallowable tape shall be provided in the 66kV & 33kV cables only.
- 2.) All EHV/HV cables shall be with graphite coating.
- 3.) HV Busduct shall be Phase Segregated Air Insulated type.
- 4.) MV Busduct shall be Phase insulated Sandwich type.
- 5.) EHV GIBD shall be phase separated SF6 Insulated type.
- 6.) In case different material are provided for busbar of switchboards/transformers and busducts, bimetallic washer/plates shall be provided.
- 7) Power cables at 33kV level shall be with copper conductor

5.7.2 CABLE LAYING PHILOSOPHY

S.No.	Description	Selected Option	Available Options
1	Process area	RCC trench, sand filled without racks	
2	Offsite paved area	Above Ground cable tray on sleeper	
3	Offsite unpaved area	Above Ground cable tray/Directly buried	
4	Type of cable trays	Hot Dip Galvanized prefabricated	
5	Road Crossings for underground cables	Cable culvert	
6	Road Crossings for Above ground cables	Overhead cable bridge	

Notes :

- 1.) Plant communication, fire alarm and telephone cables shall be laid in instrumentation overhead cable duct / instrumentation trenches as far possible. In case these are not available, cable shall be laid in electrical routes along berm of the roads.
- 2.) Walkways shall be provided on either side of cable tray (with ladders at regular intervals) to facilitate movement of people while pulling cable.
- 3.) Cable entry of electrical cables to CR/SRR shall be through underground / covered sleeves.
- 4.) EHV cables shall be laid in RCC trench, sand filled without racks.
- 5.) Cables, before and after upto a length of 2m from the GI kick pipe entry in process area & pump houses shall be provided with fire proof coating as per IEC-60331.
- 6.) All power cables inside battery room from battery charger onwards shall be provided with fire proof coating as per IEC-60331.
- 7.) Cable trays, racks and trenches shall be sized to allow for 20 % space for future cables.

5.8 EARTHING SYSTEM

S.No.	Description	Selected Option	Available Options
1	Earth electrode	Cu bonded high tensile low carbon steel core electrode	

S.No.	Description	Selected Option	Available Options
2	Main earth loop material	GI strip	
3	Substation earth loop	GI strip	
4	EHV switchyard earth grid	GI Strip	

Note:-

- 1.) All earth pits (both earthing & lightning protection) shall be maintenance free chemical earth pits with Cu bonded high tensile low carbon steel core electrode
- 2.) Common clean earth shall be provided for relays, VFD PLC, Thyristor & SAS panels, separate from substation earthing system.

5.9 LIGHTING SYSTEM

5.9.1 SUPPLY SYSTEM

S.No.	Description	Selected Option	Available Options
1	Centralised with Lighting distribution board-LDB	No	
2	LDB at each substation	Yes	
3	Lighting transformer required	Yes	
4	100% Standby transformer for normal lighting system	Yes	
5	100% Standby transformer for emergency lighting system	Yes	
6	Lighting transformer voltage ratio	415V/415V	

5.9.2 CONTROL PHILOSOPHY

S.No.	Description	Selected Option	Available Options
1	Outdoor yard	Auto/Manual/Local (Respective S/S)	
2	Street lighting	Auto/Manual/Local (Respective S/S)	
3	Outdoor process area	Auto/ Manual/ Local (Respective S/S)	
4	Process building	Auto/ Manual/ Local (Respective S/S)	
5	Auto control	Synchronous timer/ECS	
6	Lamp type for outdoor general lighting	LED	
7	Lamp wattage for outdoor lighting (Normal)	Shall be finalised during detailed engineering	
8	Lamp type for emergency AC lighting	LED	
9	ELCB at Incomer of Lighting / Power Panels	Yes(ELCB shall be provided in Outgoing of LDB/ASB) (Refer Note-6)	
10	Switch ON/OFF push button at substation entry	Yes	

Notes:-

- 1.) Intelligent type synchronous timer shall be provided for control of outdoor lighting.
- 2.) Normal Lighting in substation building shall be contactor controlled with switch at entrance, whereas emergency lighting shall be based on Timer with bypass switch on the switchboard feeder.
- 3.) LED Lamps shall be provided for substation, control room/ SRR and for street lighting.
- 4.) 25% of outdoor general lighting in process area and offsite hazardous area shall be supplied from emergency source.
- 5.) Proximity sensors for normal lighting control shall be provided in Offices and CR/SRR Rack rooms.
- 6.) Combined ELCB + MCB for each lighting outgoing circuit at local lighting distribution panel shall be provided and ELCB shall be rated for 30mA in field and 300mA in indoors.

5.9.3 AC EMERGENCY LIGHTING

S.No.	Description	Selected Option	Available Options
1	Name of process plants	All process areas (as per operation requirement)	
2	Name of buildings	Substation, Control room/ SRR	
3	Power supply source	Respective EPCC/ELDB fed from DG	

5.9.4 DC CRITICAL LIGHTING FOR ESCAPE

S.No.	Description	Selected Option	Available Options
1	Name of process units	As per specific project requirement	
2	Name of building	Substation, control room, SRR, Administration building/office, FWPH, Fire Station, Compressor House.	
3	Power supply	220V DC	
4	DC lighting for remote buildings	Lighting fixture with built in battery	

5.9.5 WIRING TYPE

S.No.	Description	Selected Option	Available Options
1	Process plant / Building / Shed	Armoured cable	
2	Large service building	Black Enamelled Surface conduit	
3	Buildings with false ceiling	Black Enamelled Surface conduit above false ceiling / PVC concealed conduit below false ceiling	
4	Substation (Switchgear Room)	Black Enamelled Surface conduit or METSEC above false ceiling / PVC concealed conduit below false ceiling	
5	Substation (Cable Cellar)	Surface Conduit	

S.No.	Description	Selected Option	Available Options
6	Other buildings in safe area	Black Enamelled surface conduit/ PVC concealed conduit	

Notes:-

- 1.) For lighting in battery rooms, Armoured cables shall be used.

5.9.6 SPECIFIC LIGHTING REQUIREMENTS

S.No.	Description	Selected Option	Available Options
1	Aviation lighting	Yes (LED type, flashing)	
2	Security lighting for peripheral road boundary wall	As Required	
3	Type of control gear for HPMV/HPSV lamps	NA	
4	Control gear box location	NA	
5	Type of high mast flood light	30 meters Telescopic tubular with LED lamps	

Note:-

- 1.) Level gauge / vessel lamp illumination shall be fed from normal lighting supply.

5.10 ELECTRIC HEAT TRACING SYSTEM

S.No.	Description	Selected Option	Available Options
1	System Design Basis approach	Product Classification	

Note:-

- 1.) The incoming cable for heat tracing power distribution panel shall be with four cores, the neutral conductor being of same size as the phase conductors.
- 2.) Common alarm from each PDB shall be connected to DCS as a minimum.

5.11 ELECTRICAL EQUIPMENT FOR HAZARDOUS AREAS

The electrical equipment for hazardous areas shall be selected as per IS-16724 / IEC 60079-14 and petroleum rules & Gas group shall be selected based on the hazardous area classification. The minimum requirement is summarised below:

S.No.	Equipment	Zone-1	Zone-2
1	MV Motors	Ex-de*	Ex-n#/Ex-nA# (Note-2.9)
2	HV Motors	Ex-de* / Ex-p (Refer note-2.8)	Ex-n#/Ex-nA#/Ex-de*/Ex-p (Note-2.9, 2.10)
3	Push Button Station	Ex-d	Ex-d
4	Motor Starters	Ex-d	Ex-d
5	Plug & Socket	Ex-d	Ex-d
6	Welding Receptacle	Ex-d	Ex-d
7	Lighting fitting	Ex-d	Ex-nR
8	Junction Boxes	Ex-d	Ex-d
9	Transformer Unit	Ex-d	Ex-d

S.No.	Equipment	Zone-1	Zone-2
10	Break Glass Unit (Fire Alarm System)	Ex-d	Ex-d
11	Lighting Panel / Power Panel	Ex-d	Ex-d
12	Transformers	Hermetically sealed with surface temperature not exceeding 200 DEG C	Hermetically sealed with surface temperature not exceeding 200 DEG C
13	Auxiliary terminal boxes for sealed canned pumps	Ex-d	Ex-d

* For all Ex-de equipment, main enclosure of the equipment shall be Ex-d certified and terminal box shall be Ex-e certified.

Ex-ec motors as per IS/IEC 60079-7 (2015) shall be acceptable subject to availability of statutory approvals.

For additional Hazardous Area requirements, refer notes under clause 5.11.1 below -

5.11.1 NOTES

S.No.	Notes
1	The electrical equipment for hazardous areas shall generally be suitable for gas group IIB and temp classification T3 as applicable to the selected type of explosion protection. In case of hydrogen or hydrocarbon mixtures having more than 30% hydrogen, the gas group to be considered shall be IIC.
2	As additional safety features, the following requirements for electrical equipment shall be followed.
2.1	All electric motors for agitators/mixers and metering pumps handling flammable material shall be flameproof type irrespective of the area being classified as zone 2 or zone 1.
2.2	All electric motors for vertical sump pumps handling flammable material shall be flameproof type.
2.3	Irrespective of the area classification (whether zone 1 or zone 2), all lighting fixtures within the storage areas shall be flameproof type.
2.4	Irrespective of the area classification (whether zone 1 or zone 2), all motors and lighting fittings within the pump house/pump station/compressor house/other facilities associated with offsite tank farm and within the loading/unloading gantries shall be of flameproof type.
2.5	All emergency/critical lighting fixtures and associated junction boxes in hazardous areas (whether zone-1 and zone-2) shall be flameproof type.
2.6	Even though fired heaters in process units are not considered for area classification, all electrical equipments associated with fired heaters in process units shall as a minimum be suitable for installation in Zone-2 area.
2.7	Building such as Compressor sheds inside the process area shall be designed to allow adequate ventilation to allow area classification as Zone-2. Lighting equipment, EOT crane etc. in the shed shall be flameproof type. All other electrical equipment shall be suitable for Zone-1 or Zone-2 area depending on extent of hazard.
2.8	All motors for hazardous area Zone-1 shall preferably be flameproof type. Pressurised motors may be provided in exceptional cases, when flameproof motors are not available.
2.9	Ex-n motors shall be used unless any other type is specified by process licensor, except for following cases: (i) HV motors in Zone-2 area for centrifugal compressors shall be flameproof type. (ii) Flameproof motors shall be used in zone-2 areas having frequent start-stop requirements such as EOT cranes, elevators, MOV actuators, etc.

S.No.	Notes
2.10	Ex-p motors shall be used for higher rated motors where Ex-n motors are not available.
2.11	Cooling Tower fan motors and light fittings shall be flameproof type.
2.12	Irrespective of area classification, all canned motors shall be of flameproof type only.
2.13	For areas with hazardous dust (Zone-21 & 22), motors with enclosure "tD" or "pD" shall be provided.
3	Statutory Approval 1. Statutory Authority for Electrical Installation: State Electrical Inspectorate/CEA 2. Statutory authority for hazardous area: PESO

5.12 ELECTRICAL CONTROL SYSTEM-ECS

S.No.	Description	Selected Option	Available Options
1	Extent of coverage		
1.1	No of substations	All	
1.2	Monitoring		
1.2.1	EHV/HV switchboard	Yes	
1.2.2	415V switchboard (I/C, B/C & outgoing breaker feeders)	Yes (Upto PCC level)	
1.2.3	Emergency DG set	YES (Common Alarm Contact)	
1.3	Control		
1.3.1	EHV/HV switchboard	Yes	
1.3.2	415V switchboard (I/C, B/C & outgoing breaker feeders)	Yes (Upto PCC level)	
1.3.3	Emergency DG set	No	
2	Base ECS functionalities		
2.1	Breaker control in CPP & Switchyard	ON/OFF control for motor feeders, ON/OFF for all other breakers	
2.2	Breaker control in other substations	ON/OFF control for all feeders	
2.3	Area lighting	ON/OFF control	
2.4	Electrical plant data acquisition and display	Yes	
2.5	Routine log report generation and energy balance report	Yes	
2.6	Detection and reporting of alarms	Yes	
2.7	Sequence of event recording	Yes	
3	Advanced ECS functionalities		
3.1	Load shedding including maximum demand limit control	Yes	
3.2	Synchronization	Yes	
3.3	Capacitor feeder control for power factor improvement	Local APFC in each substation	
3.4	Active & Reactive power control	NA	

S.No.	Description	Selected Option	Available Options
3.5	Frequency & load control of all generators except DG	NA	
3.6	Excitation control of synchronous motors	NA	
3.7	Grid transformer OLTC control	YES (through discreet DI/DOs)	
4	Communication with other systems	Refer communication requirements in SAS	

Notes :

@- details to be finalised during detail engineering.

- 1.) All the UPS and Battery Charger status & trouble alarms shall be configured in ECS.
- 2.) All the critical and large capacity VFD alarms/trips should be monitored in ECS over serial link.
- 3.) Temperature & humidity monitoring for each substation and connected battery charger room/VFD room shall be provided with display and 4-20mA transmitter for interface with ECS.
- 4.) Refer note-2 of clause 5.4.1 for closing operation of Incomer & Bus coupler breaker through ECS

6.0 SPARE PARTS

6.1 MANDATORY SPARES

Mandatory spares shall be procured along with the main equipment. Such spares for each equipment shall be as per the below table. These spares include only those spares, which are critical for equipment.

S.No.	Part Description	Description
1	Generator	NA (Below Clauses Not Applicable)
1.1	Generator relay	1 set of each type & make
1.2	DVR - all control card	1 no. of each type
1.3	Control fuses / MCB	10 Nos. of each rating & type
1.4	Exciter Diodes and fuses	1 set
1.5	Control and Selector switches	1 No. of each type and make
1.6	Aux. contactors	20% of each type and make OR 1 No.(min) of each type and make, whichever is more
2	EHV & HV Gas Insulated Switchboard (GIS)	
2.1	Portable gas filling equipment/SF6 gas cart	1 No.
2.2	Handle for disconnect switch drive	4 Nos.
2.3	Handle for earthing switch drive	4 Nos.
2.4	Pre selection key for three position switch	1 No.
2.5	Power cable termination kit	2 sets
2.6	Tripping coil	1 No.
2.7	Closing coil	1 No.
2.8	Capacitive type voltage detectors	1 Set
2.9	Control fuses / MCB	10 Nos. of each rating & type
2.10	Density monitoring device	2 Nos of each type
2.11	Pressure Gauge	2 Nos of each type
2.12	Indicating lamps covers	5 nos. of each colour

S.No.	Part Description	Description
2.13	Indicating lamps	20% or 3 nos. (min.), whichever is more
3	Power Transformer	one set of spare for each transformer
3.1	Complete set of gaskets	1 set
3.2	Sealing / Gauge glass of Conservator	2 Nos of each rating & type.
3.3	Control fuses / MCB for MB cubicles	20% for each rating OR 1 No. (min.) of each rating, whichever is more
3.4	HV bushings	One set of each type and rating
4	Distribution Transformer	one set of spare for each transformer
4.1	Complete set of gaskets	1 set
4.2	Sealing / Gauge glass of Conservator	2 Nos. of each rating & type.
4.3	Control fuses / MCB for MB cubicles	20% for each rating OR 1 No. (min.) of each rating, whichever is more
4.4	HV & LV bushings	One set of each type and rating
5	HV Air Insulated Switchboard (AIS)	one set of spare for each switchboard (Refer Note-7)
5.1	Closing coil	1 No. of each rating & type
5.2	Shunt trip coil	1 No. of each rating & type
5.3	Control fuses / MCB	10 Nos. of each rating & type
5.4	Indicating lamps covers	5 Nos. of each colour
5.5	Indicating lamps	20% or 3 Nos. (min.), whichever is more
6	415V PCC/PMCC/EPCC or MV Switchboard	one set of spare for each switchboard
6.1	Closing coil	1 No. of each rating & type
6.2	Shunt trip coil	1 No. of each rating & type
6.3	Control fuses / MCB	10 Nos. each rating & type
6.4	Indicating lamps covers	5 Nos. of each colour
6.5	Indicating lamps	20% or 3 Nos. (min.), whichever is more
7	Variable Frequency Drive	one set of spare for each VFD
7.1	Transistors / IGBT / IGCT	1 No of each rating & type
7.2	Control cards	1 No of each type
7.3	Power supply cards	1 No of each rating & type
7.4	Power fuses	20% for each rating OR 1 no. (min.) of each rating, whichever is more
7.5	Control fuses / MCB	10 Nos. of each rating & type
7.6	Contactors	10% of each type OR 1 no. (min) of each type, whichever is more
7.7	Indicating lamps	20% OR 1 nos. (min.), whichever is more
7.8	Indicating lamps covers	2 nos of each colour
7.9	Blocker Diode	2 nos. of each rating & type
8	Substation Automation System (SAS) / HMI / Data Concentrator	one set of spare for each SAS / HMI / Data Concentrator
8.1	All cards such as input & output cards, power supply cards, processor cards etc.	1 No. of each type
8.2	Ethernet switches	1 No. of each type
8.3	Control fuses / MCB	10 Nos. of each rating & type
9	Relays for Switchboard / Relay control Panel	one set of spare for each Switchboard (Refer Note-8)/ Relay control Panel
9.1	Protection Relays	1 No. of each type
9.2	Auxiliary Relays	1 No. of each type
10	UPS System	one set of spare for each UPS system

S.No.	Part Description	Description
10.1	Power Thyristors / Transistors / IGBT / IGCT	1 No. of each rating & type
10.2	Control cards	1 No. of each type
10.3	Power supply cards	1 No. of each rating and type
10.4	Power fuses	20% for each rating OR 1 no. (min.)of each rating, whichever is more
10.5	Control fuses / MCB	10 Nos. of each rating & type
10.6	Indicating lamps	10% OR 3 nos. (min.), whichever is more
10.7	Indicating lamps covers	2 Nos. of each colour
10.8	Blocker Diode	2 Nos. of each rating & type
11	DC System	one set of spare for each DC System
11.1	Power Thyristors / Transistors / IGBT / IGCT	1 No. of each rating & type
11.2	Control cards	1 No. of each type
11.3	Power supply cards	1 No. of each rating and type
11.4	Power fuses	20% for each rating OR 1 no. (min.)of each rating, whichever is more
11.5	Control fuses / MCB	10 Nos. of each rating & type
11.6	Indicating lamps	10% OR 3 nos. (min.), whichever is more
11.7	Indicating lamps covers	2 Nos. of each colour
11.8	Blocker Diode	2 Nos. of each rating & type
12	Synchronous motors	one set of spare for each rating & type
12.1	Power fuses	20% for each rating OR 1 no. (min.)of each rating, whichever is more
12.2	Control fuses / MCB	10 Nos. of each rating & type
12.3	Bearing (DE & NDE) (as applicable)	1 set
12.4	Control cards	1 No. of each type
13	HV induction motors	one set of spare for each rating & type
13.1	Bearing (DE & NDE)	1 set
13.2	Terminal studs/bushing assembly	1 set each
14	MV induction motors 37 kW & above	one set of spare for each rating & type
14.1	Bearing (DE & NDE)	1 set
14.2	Terminal studs/bushing assembly	1 set each
15	Fire alarm system	
15.1	All cards	1 No. of each type
15.2	Power fuses	20% for each rating OR 1 no. (min.)of each rating, whichever is more
15.3	Control fuses / MCB	10 Nos. of each rating & type
15.4	Terminal blocks	20 Nos
15.5	Fire Detectors	1% of total installed capacity of each type OR 1 no.(min.) of each type, whichever is more
15.6	Glass for Break Glass Boxes/ Manual call point	5 % of each type OR 1 No. (min.) of each type, whichever is more
16	Paging system / Plant Communication System	
16.1	All cards	1 No of each type
16.2	Power fuses	20% for each rating OR 1 no. (min.)of each rating, whichever is more
16.3	Control fuses / MCB	10 Nos. each rating & type
17	Thyristor control panel for heaters	

S.No.	Part Description	Description
17.1	Rectifier control module (Control card fully assembled)	1 No. of each type
17.2	Power supply card	1 No. of each type
17.3	Control cards	1 No of each type
17.4	Power fuses	2 Nos. min. of each rating and type
17.5	Control fuses / MCB	10 Nos. each rating & type
17.6	Contactors	10% of each type OR one no (min) of each type, whichever is more
17.7	Indicating lamps	20% OR 1 nos. (min.), whichever is more
17.8	Indicating lamps covers	2 nos. of each colour
17.9	Blocker Diode	2 nos. of each rating & type
18	Electrical Control System (ECS)	
18.1	Interposing relays (As applicable)	5 Nos. of each type
18.2	Power supply & control cards	1 No. of each type
18.3	Transducers	20% of estimated quantity of each type and make OR 1 no (min) of each type and make, whichever is more
18.4	Function generator cum counter	1 No.
18.5	4-20mA signal injection set	1 No.
18.6	Isolation transformer	1 No.
19	Motor Operated Valves (MOVs)	
19.1	Position transmitter	10% (1 no. min. if the same is provided in MOVs)
19.2	Power supply unit	10% (1 no. min.)
19.3	Logic Board	10% (1 no. min.)
19.4	Local control board assembly	10% (1 no. min.)
19.5	Switchgear assembly	10% (1 no. min.)
19.6	Complete motor assembly	1 no of each rating

NOTES:

- The word 'TYPE' means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable.
- Wherever % age is identified, Contractor shall supply next rounded figure.
- The terminology used under 'Part Description' is the commonly used name of the part and may vary from manufacturer to manufacturer.
- Mandatory spares as indicated above do not cover commissioning spares.
- Mandatory spares as indicated above do not cover two year O&M spares.
- Mandatory spares shall be applicable for electrical items of motors / sub-packages as per mandatory spares philosophy specified elsewhere in the bid document.
- For Isolation breaker panel (GIS or AIS) one set of "Tripping Coil (1 No.), Closing coil (1 No.) and Control fuse/MCB (10 Nos. of each rating and type)" shall be considered as mandatory spares for each Isolation breaker panel (GIS or AIS).
- For Isolation breaker panel (GIS or AIS) one set of "Auxiliary relays (1 no. of each type)" shall be considered as mandatory spares for Relays for Isolation breaker panel (GIS or AIS).

6.2 COMMISSIONING SPARES

Commissioning Spare Parts shall be procured along with the main equipment as per equipment manufacturer's recommendations. The list of such recommended spares shall be obtained along with the offer.

6.3 RECOMMENDED SPARE FOR NORMAL OPERATION & MAINTAINENCE

Quotation for two-years spares for normal operation and maintenance (over and above mandatory spares) along with unit price shall be obtained with the proposal for Client to order the same separately.

6.4 SPECIAL TOOLS AND TACKLES

Required Special Tools and Tackles shall be procured along with the main equipment as per equipment manufacturer's recommendations. The list of such recommended special tools/tackles shall be obtained along with the offer.

7.0 VENDOR DATA REQUIREMENT

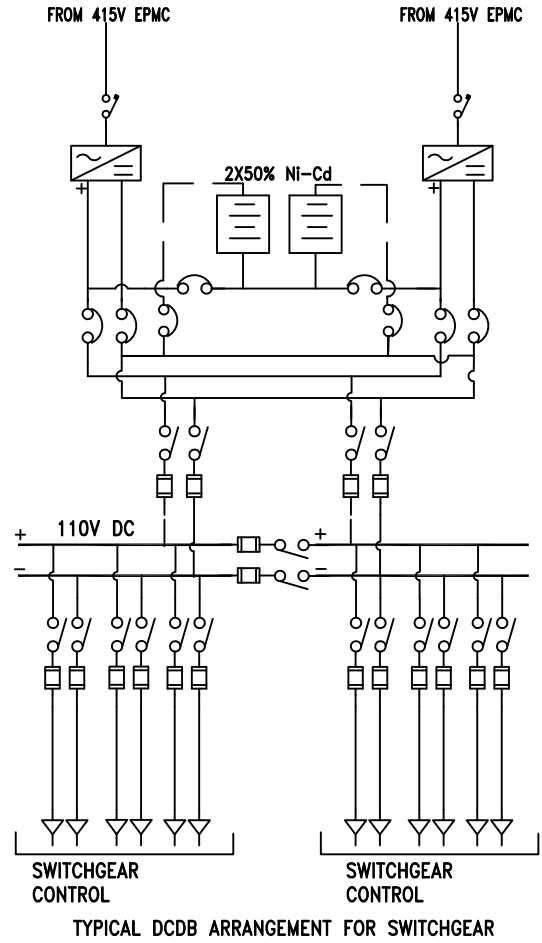
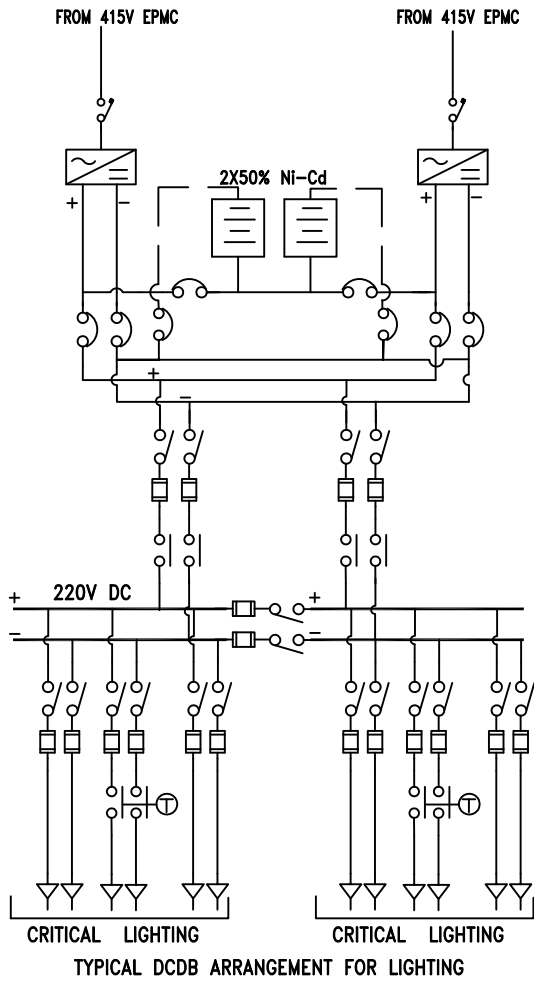
Vendor Data Requirement as indicated in the respective equipment Material Requisitions shall be followed.

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PROJECT: P25 PROJECT

CLIENT: M/s IOCL

REV	DATE	PURPOSE	BY	CHKD	APPD



1. DCDB FOR DC SYSTEM SHALL HAVE TWO NO. INCOMER AND ONE NO. BUS COUPLER.
2. DCDB FOR DC SYSTEM FOR DC CRITICAL LIGHTING SHALL HAVE CONTACTOR IN THE INCOMER FOR OPERATING UNDER AC MAINS SUPPLY FAILURE CONDITION AND CONTACTOR IN OUTDOOR TYPE CRITICAL LIGHTING FEEDER FOR OPERATING AS PER THE TIMER SETTING.
3. BATTERY CHARGER AND BATTERY FOR DC SYSTEM SHALL BE AS PER SPECIFICATION ATTACHE WITH MR.
4. '*' REFER MR FOR VOLTAGE LEVEL OF DCDB

Annexure-1



ENGINEERS INDIA LIMITED
NEW DELHI

**TYPICAL BUS BAR
ARRANGEMENT FOR DCDB
(FOR DC SYSTEM)**

SKETCH

REV

B269-999-16-50-SK-XXXX
SHT 1 OF 1

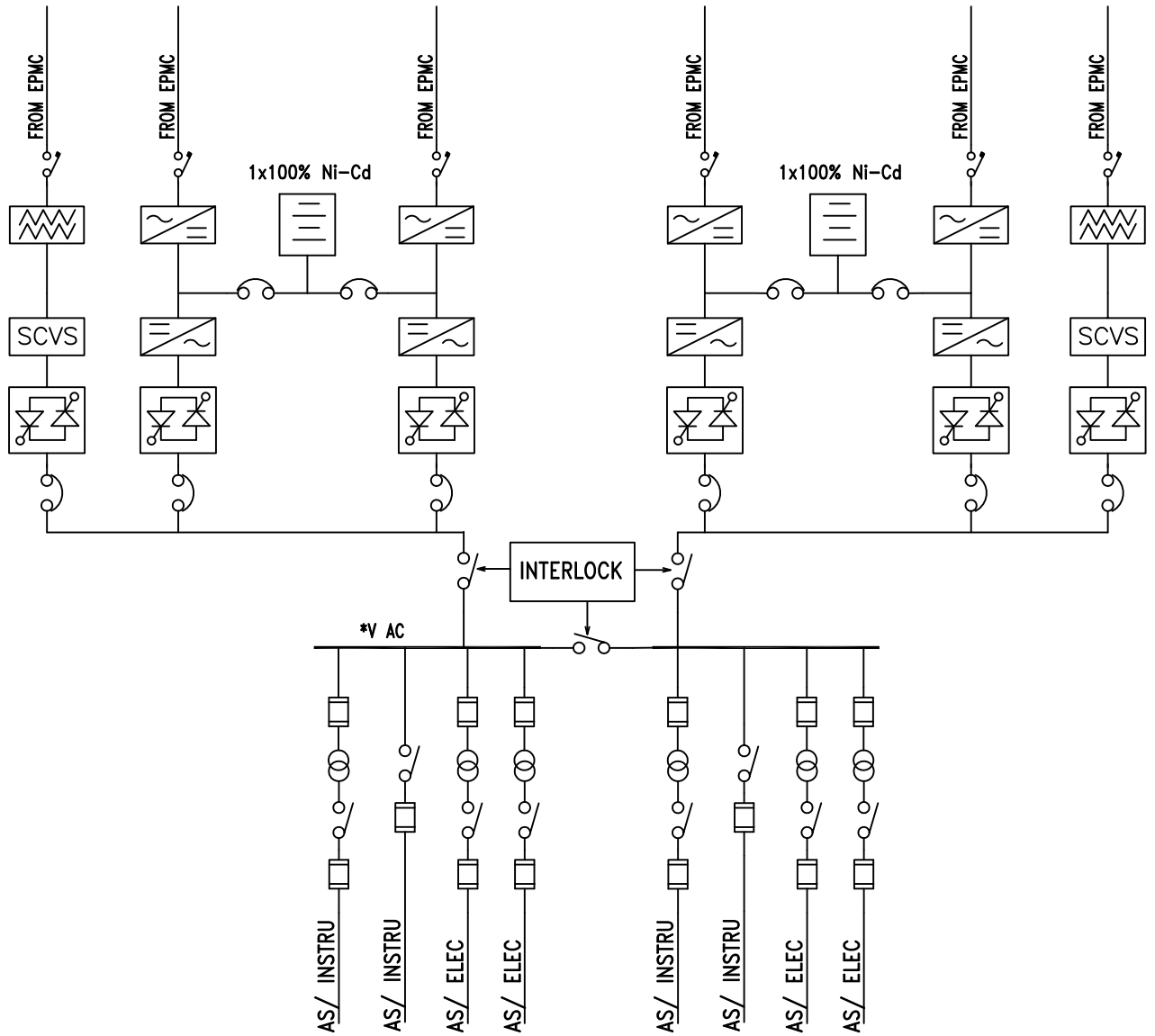
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PROJECT: P25 PROJECT

CLIENT: M/s IOCL

REV	DATE	PURPOSE	BY	CHKD	APPD



**TYPICAL ACDB ARRANGEMENT
UPS SYSTEM**

1. ACDB SHALL HAVE TWO NO. INCOMER AND ONE NO. BUS COUPLER.
2. BATTERY CHARGER AND BATTERY FOR UPS SHALL BE AS PER JOB SPECIFICATION.
3. FOR VOLTAGE AND CURRENT RATING OF ACDB AND OUTGOING COMPONENTS REFER RESPECTIVE FEEDER DETAILS DATASHEET.
4. EACH UPS MODULE (RECTIFIER/INVERTER SET) SHALL BE RATED FOR 100% RATING OF THE UPS.

Annexure-2



ENGINEERS INDIA LIMITED
NEW DELHI

**TYPICAL UPS & ACDB
ARRANGEMENT**

SKETCH

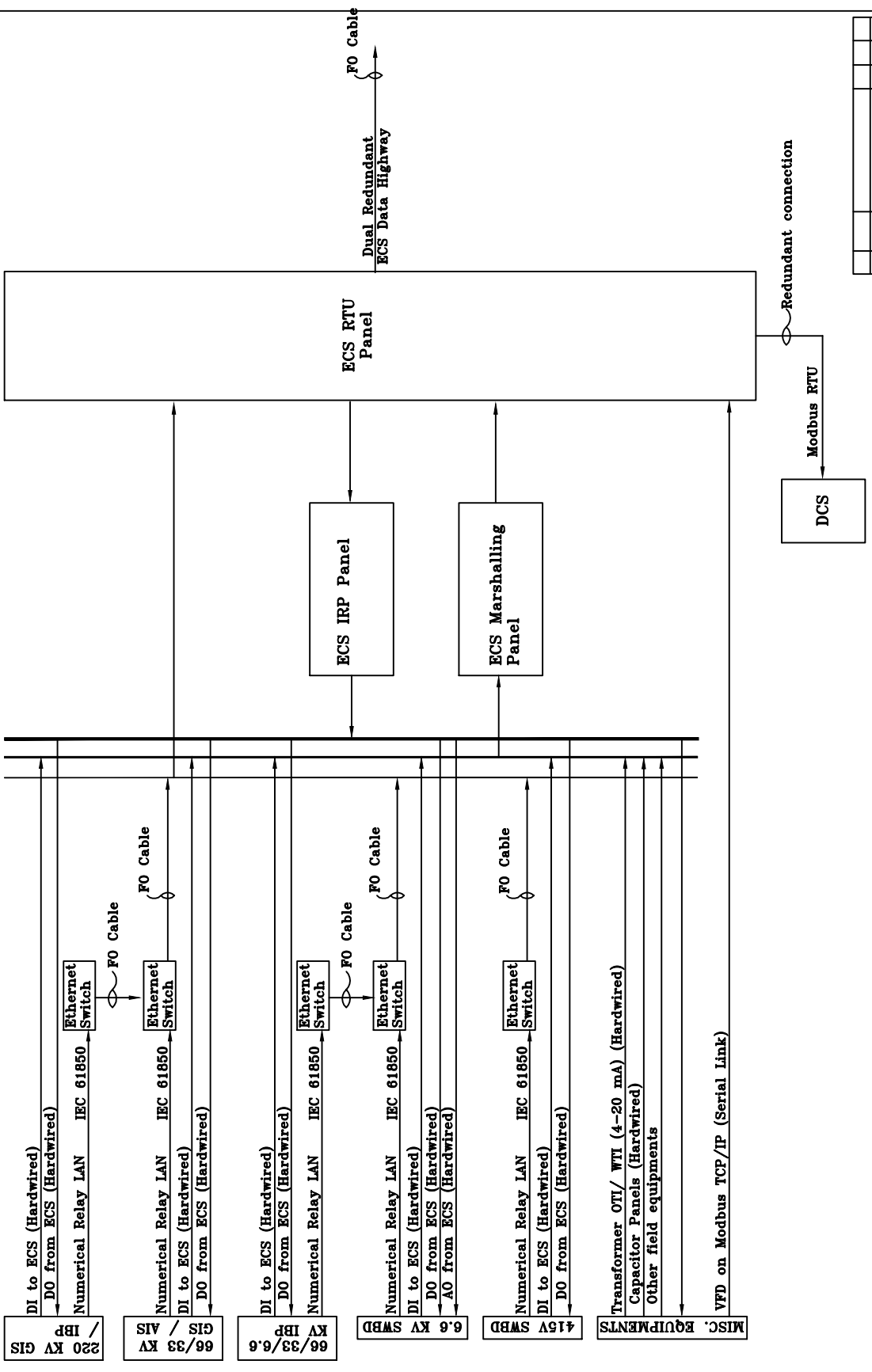
REV

B269-999-16-50-DS-XXXX
SHT 1 OF 1

X

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A4-210X297



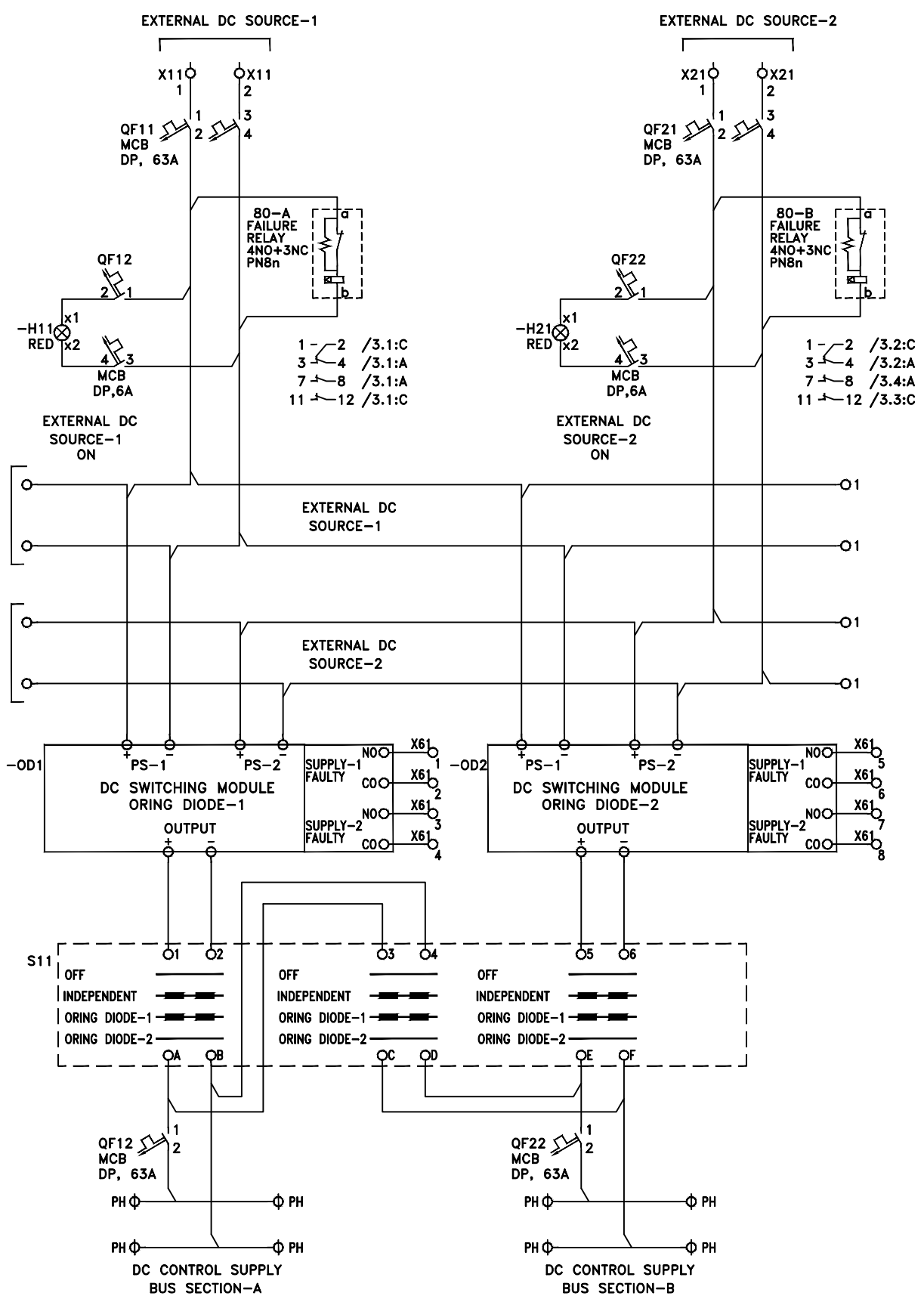
No	DATE	REVISION	BY	CHK	APP

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PROJECT: P25 PROJECT

CLIENT: M/s IOCL

REV	DATE	PURPOSE	BY	CHKD	APPD



Annexure-4



ENGINEERS INDIA LIMITED
 NEW DELHI

DC SUPPLY
 AUTO CHANGEOVER
 FOR SWBD

SKETCH

REV

B269-999-16-50-SK-XXXX
 SHT 1 OF 1

X

SECTION-2, Annexure_2

INSPECTION AND TEST PLAN FOR EHV GIS SWITCHBOARDS


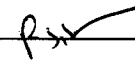
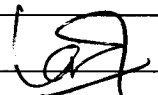
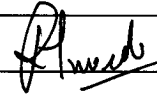
STANDARD SPECIFICATION NO.

6-81-1066 Rev. 0

Page 1 of 10

अति उच्च वोल्टेज गैस इंसुलटेड स्विचबोर्डों के लिये
निरीक्षण और परीक्षण योजना

INSPECTION AND TEST PLAN FOR EHV GAS INSULATED SWITCHBOARDS (GIS)

Rev. No.	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
0	12.09.2018	Issued for implementation	 MM	 RS	 RKS	 RKT
			Approved by			

Abbreviations:

BIS	:	Bureau of Indian Standard	IP	:	Ingress Protection
CT	:	Current Transformer	IR	:	Insulation resistance
CRP	:	Control Relay Panel	JEC	:	Japanese Electro technical Committee
EHV	:	Extra High Voltage	KV	:	Kilo Volt
EIL	:	Engineers India Limited	LCC	:	Local Control Panel
EMC	:	Electromagnetic Compatibility	MTC	:	Material Test Certificate
ERTL	:	Electronics Regional Test Laboratory	NEMA	:	National Electrical Manufacturers Association
FAT	:	Factory Acceptance Test	PO	:	Purchase Order
FR	:	Fire Retardant	PR	:	Purchase Requisition
FRLS	:	Fire Retardant Low smoke	PVC	:	Poly Vinyl Chloride
GIS	:	Gas Insulated Switchgear	QC	:	Quality Control
HT	:	High Tension	TC	:	Test Certificate
HV	:	High Voltage	TPI or TPIA	:	Third Party Inspection Agency
HMI	:	Human Machine Interface	VDR	:	Vendor Data Requirement
ITP	:	Inspection and Test Plan	VT	:	Voltage Transformer
IEC	:	International Electro technical Commission	XLPE	:	Cross Linked Poly Ethylene

Inspection Standards Committee**Convenor :** Mr. R K Singh

Members: Mr. Rajeev Kumar
 Mr. Neeraj Mathur
 Mr. Mahendra Mittal
 Mr. Deepak Gupta (Projects)

Mr. Himangshu Pal
 Mr. R Muthu Ramalingam
 Mr. T Kamalakannan

1.0 SCOPE

This Inspection and Test Plan covers the minimum testing requirements of Extra High Voltage Gas insulated Switch boards (EHV GIS) from 66 KV and up to 400 KV.

2.0 REFERENCE DOCUMENTS

PO/PR/ Standards referred therein/ Job specifications/ Approved documents/ Relevant IEC.

3.0 INSPECTION AND TEST REQUIREMENTS

SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
1.0	Procedures	--	--	--	--	--	--
2.0	Material Inspection						
2.1	Incoming Material like Basic HT kit with Circuit Breaker/ Disconnecter and Earthing Switches, SF6 Gas Properties, Checks On Tank, Plating of Joints, Bus Bars, Fabricated Items, Static Filters, Safety Diaphragm, Pressure Relief Devices, Valves, Expansion Bellows, Pipe Fittings, Bus Bar Sleeves, Cable Wire (FRLS), Instrument Transformers , Relays, Indicating Instruments, Switches,	Visual, Dimensional, Operational/performance checks, Review of Manufacturer's Certificates etc. as applicable	100%	TC's/ Inspection & Test Records / Lab Test Records	H	H/R	R

**INSPECTION AND TEST PLAN
FOR
EHV GIS SWITCHBOARDS**

STANDARD SPECIFICATION NO.

6-81-1066 Rev. 0

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
	Breakers, Surge Arrestor , Hooters, Push Button etc. as applicable						
3.0	In process Inspection						
3.1	Breaker Truck Assembly	<ul style="list-style-type: none"> Mechanical Operation including spring charging mechanism (current and time) / electro hydraulic mechanism (As applicable), Breaker opening / closing at normal and worst voltage conditions, Stroke, Opening / closing time and speed, bouncing time, simultaneous closing of all poles, Contact resistance measurement, Gas leakage check (for SF6 breakers), Insulation resistance test, High voltage/ Power Frequency, partial discharge test Breaker Duty cycle test 	<p>100% by Supplier and random by EIL/TPIA</p> <p>On each type/ model</p>	<p>Test Records / Inspection Witness Record</p> <p>Type Test Report</p>		H	H
						H	R

**INSPECTION AND TEST PLAN
FOR
EHV GIS SWITCHBOARDS**

STANDARD SPECIFICATION NO.

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
3.2	Disconnecter and earthing switches	<ul style="list-style-type: none"> Visual checks. Mechanical and electrical operation including mechanical and electrical interlocks Contact resistance measurement. Insulation resistance test. High voltage/Power frequency test. 	100% by Supplier and random by EIL/TPIA	Test Records / Inspection Witness Record		H	H
3.3	Wiring checks	Size, type, make termination, ferruling, continuity, color coding	100%	Suppliers Test Records	--	H	R
4.0	Final Inspection						
		ACCEPTANCE TESTS: <ul style="list-style-type: none"> Visual check including layout, Tag plates, Paint shade, Bus marking and sleeving, Joint shrouding, Earthing arrangement, safety features, accessibility of arcing contact, Identification and location of components etc Dimension check including operational height, Bus bar size, Clearances, Head room from gland 					

**INSPECTION AND TEST PLAN
FOR
EHV GIS SWITCHBOARDS**

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
4.1	Switchgear Assembly	plate to terminal link, mounting arrangement for CTs, VTs Compartmentalization, cable gland size, Paint thickness etc.	100%	Test Records / Inspection Witness Record	-	H	H
		<ul style="list-style-type: none"> • Verification of Bus bar support arrangement with respect to type tested panel drawings and provision for external cable termination. • Bill of material check. • Density/pressure switches indication /operation checks. • Operation check of circuit breaker operation counters. • Mechanical/Electrical interlock checks of Circuit breaker/Isolator/earthing switches * • Operation check for auxiliary equipment circuits and auxiliary contacts • Operation checks for all control functions and interlocks as per schematic diagrams in Service position including mechanical interlock check. 	100%	Test Records / Inspection Witness Record	-	H	H

**INSPECTION AND TEST PLAN
FOR
EHV GIS SWITCHBOARDS**

STANDARD SPECIFICATION NO.

6-81-1066 Rev. 0

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
	Switchgear Assembly (Contd.)	<ul style="list-style-type: none"> • Functional/operation checks on LCC panel including alarm, indication, annunciation, mimic diagram display etc. • Functional/ operation checks on CRP panel including alarm, indication, annunciation, mimic diagram display, relays, auxiliary contact etc. • HV and IR checks on LCC & CRP panel. • Relay operation check through secondary injection.* • Primary current injection test for all current and voltage transformers.* • Measurement of resistance of main circuit. • Communication check between relays and Data concentrator / HMI (if applicable)* • HMI operation and functional checks as per separate agreed ITP/FAT (if applicable) • Insulation resistance of main, auxiliary and control circuits 					

**INSPECTION AND TEST PLAN
FOR
EHV GIS SWITCHBOARDS**

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
		before and after High Voltage Test. <ul style="list-style-type: none"> • Power Frequency voltage withstand test on main, auxiliary and control circuits. • Partial discharge test • Enclosure pressure test and Leak Tightness checks. • Acceptance test on SF6 Gas * 					
4.2	Switchgear Assembly	TYPE TESTS <ul style="list-style-type: none"> • Short time current withstand test on main and earthing circuit. • Temperature Rise test. • Internal Arc test. • Lighting Impulse, Switching impulse, Power Frequency withstand Test and partial discharge test(Di electric test) • Making and breaking capacity test of circuit breaker • Short circuit test duties for Circuit breaker. • Tightness test and pressure withstand test for gas filled compartment. 	On Each type/Model	Test Agency Reports	-	R/W**	R/W**

**INSPECTION AND TEST PLAN
FOR
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STANDARD SPECIFICATION NO.

6-81-1066 Rev. 0

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
		<ul style="list-style-type: none"> • Operation and mechanical endurance test • Degree of protection for panels. • Electromagnetic compatibility (EMC) test on circuit breaker 					
	Disconnecter and Earthing switches	<p style="text-align: center;">TYPE TEST</p> <ul style="list-style-type: none"> • Operation and mechanical endurance test • Short time and peak withstand capacity test. • Measurement of contact resistance • Temperature rise test • Impulse and power frequency withstand test • Electromagnetic compatibility test • Degree of protection test. 	On Each type/Model	Test Agency Reports	-	R/W**	R/W**
	Surge arrestor, CT,PT	<ul style="list-style-type: none"> • Type test as per relevant IEC 	On Each type/Model	Test Agency Reports	-	R/W**	R/W**
5.0	Painting						
5.1	Painting of panels (prior to assembly)	<ul style="list-style-type: none"> • Pre treatment, primer and final paint, shade, thickness 	100%	Supplier test records	H	W	R

**INSPECTION AND TEST PLAN
FOR
EHV GIS SWITCHBOARDS**

STANDARD SPECIFICATION NO.

6-81-1066 Rev. 0

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
6.0	Documentation and IC						
6.1	Documentation and IC	<ul style="list-style-type: none"> Review of Internal Test Reports Certification from supplier for complete relay parameterization of numerical relays at works IC issuance. 	100%	Supplier's Test Records / Inspection Certificate	-	-	H
6.2	Final Document submission	Compilation of Inspection reports, drawings, etc. as per VDR / PR	100%	Final data folder/ Completeness certificate	-	H	H

* Quantum of check is 100% by Supplier & random basis by EIL/TPIA.

** Witness if called for in job specifications. In such cases specified Type test will be considered as part of Acceptance Test.

Legends: H- Hold (Do not proceed without approval, R-Review, RW-Random witness (As specified or 10 % - Samples must include min 1 No of each type), W- Witness (Give due notice, work may proceed after scheduled date).

NOTES :-

- This document describes the generic test requirements. Any additional test or inspection scope if specified in contract documents shall also be applicable. (Unless otherwise agreed upon).
- Acceptance Norms for all the activities shall be as per PO/PR/ Standards referred therein/ Job specifications /Approved documents.

SITE SPECIFIC SEISMIC SPECTRA

PROJECT : P-25 PANIPAT REFINERY EXPANSION PROJECT

OWNER : M/s IOCL

JOB NO. : B269

Rev. No	Date	Purpose	Prepared by	Reviewed by	Approved by
0	03/12/2020	ISSUED FOR IMPLEMENTATION	MBA	GGSA	SVRS

SITE SPECIFIC SEISMIC SPECTRA

Site specific seismic spectrum is generated separately for Design Basis Earthquake (DBE) & Maximum Considered Earthquake (MCE) for different damping values in accordance with Clause no. 3.5 and Clause no 3.18 of IS 1893 (Part 4) : 2015 respectively. The spectral accelerations presented here shall be used along with Clause no. 7.3.1 of IS 1893 (Part 4): 2015.

1.1 Spectral Acceleration Coefficients (S_a/g) for Design Basis Earthquake (DBE):

Spectral Acceleration Coefficients (S_a/g) for 5% damping for Design Basis Earthquake (DBE) in the horizontal direction shall be based on the following equation. The spectral acceleration values for different damping ratio are presented in Figure 1 and Table 1.

$$S_a/g \text{ (damping: 5\%)} = 0.16+2.4T \quad \text{for } 0.00 < T < 0.10 \text{ sec}$$

$$= 0.4 \quad \text{for } 0.10 < T < 0.55 \text{ sec}$$

$$= \frac{0.217}{T} \quad \text{for } 0.55 < T < 7.00 \text{ sec}$$

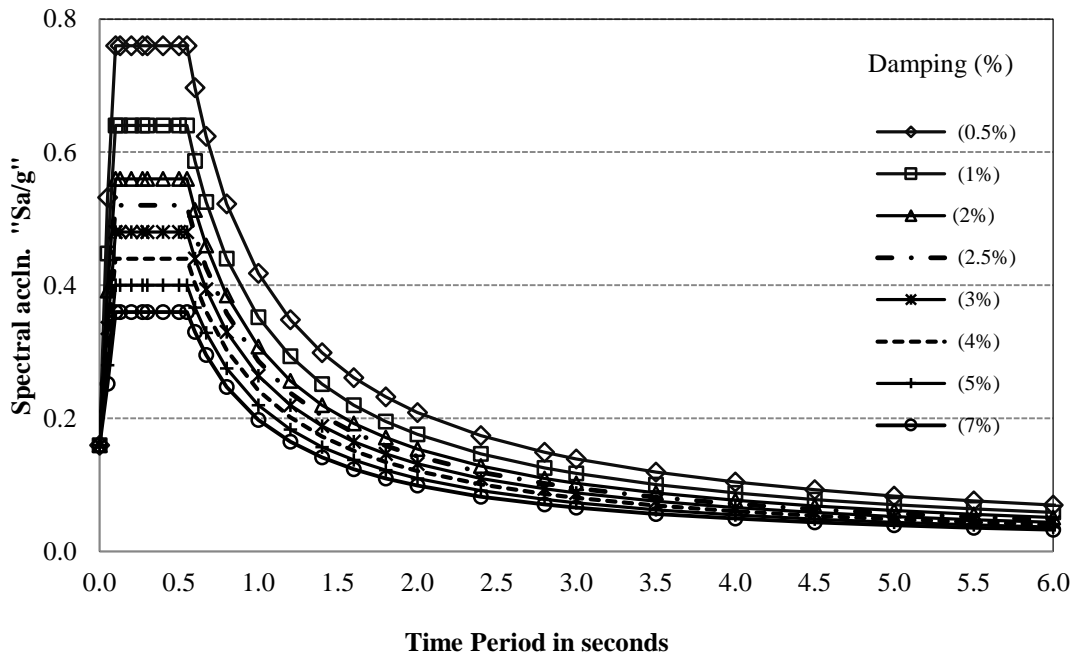


Figure 1: Site specific seismic spectra for DBE

Table 1: Spectral Acceleration Coefficients (S_a/g) for Design Basis Earthquake (DBE)

Time Period (sec)	Percentage of critical damping							
	0.5	1.0	2.0	2.5	3.0	4.0	5.0	7.0
0.000	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160
0.050	0.532	0.448	0.392	0.364	0.336	0.308	0.280	0.252
0.100	0.760	0.640	0.560	0.520	0.480	0.440	0.400	0.360
0.130	0.760	0.640	0.560	0.520	0.480	0.440	0.400	0.360
0.200	0.760	0.640	0.560	0.520	0.480	0.440	0.400	0.360
0.270	0.760	0.640	0.560	0.520	0.480	0.440	0.400	0.360
0.300	0.760	0.640	0.560	0.520	0.480	0.440	0.400	0.360
0.400	0.760	0.640	0.560	0.520	0.480	0.440	0.400	0.360
0.500	0.760	0.640	0.560	0.520	0.480	0.440	0.400	0.360
0.550	0.760	0.640	0.560	0.520	0.480	0.440	0.400	0.360
0.600	0.697	0.587	0.513	0.477	0.440	0.403	0.367	0.330
0.670	0.624	0.525	0.460	0.427	0.394	0.361	0.328	0.296
0.800	0.523	0.440	0.385	0.358	0.330	0.303	0.275	0.248
1.000	0.418	0.352	0.308	0.286	0.264	0.242	0.220	0.198
1.200	0.348	0.293	0.257	0.238	0.220	0.202	0.183	0.165
1.400	0.299	0.251	0.220	0.204	0.189	0.173	0.157	0.141
1.600	0.261	0.220	0.193	0.179	0.165	0.151	0.138	0.124
1.800	0.232	0.196	0.171	0.159	0.147	0.134	0.122	0.110
2.000	0.209	0.176	0.154	0.143	0.132	0.121	0.110	0.099
2.400	0.174	0.147	0.128	0.119	0.110	0.101	0.092	0.083
2.800	0.149	0.126	0.110	0.102	0.094	0.086	0.079	0.071
3.000	0.139	0.117	0.103	0.095	0.088	0.081	0.073	0.066
3.500	0.119	0.101	0.088	0.082	0.075	0.069	0.063	0.057
4.000	0.105	0.088	0.077	0.072	0.066	0.061	0.055	0.050
4.500	0.093	0.078	0.068	0.064	0.059	0.054	0.049	0.044
5.000	0.084	0.070	0.062	0.057	0.053	0.048	0.044	0.040
5.500	0.076	0.064	0.056	0.052	0.048	0.044	0.040	0.036
6.000	0.070	0.059	0.051	0.048	0.044	0.040	0.037	0.033
6.500	0.064	0.054	0.047	0.044	0.041	0.037	0.034	0.030
7.000	0.060	0.050	0.044	0.041	0.038	0.035	0.031	0.028

1.2 Spectral Acceleration Coefficients (Sa/g) for Maximum Considered Earthquake (MCE):

Spectral Acceleration Coefficients (Sa/g) for 5% damping for Maximum Considered Earthquake (MCE) shall be based on the following equation. The spectral acceleration values for different damping ratio are presented in the Figure 2 and Table 2.

$$\begin{aligned}
 S_a/g \text{ (damping: 5\%)} &= 0.24+3.6T && \text{for } 0.00 < T < 0.10 \text{ sec} \\
 &= 0.6 && \text{for } 0.10 < T < 0.67 \text{ sec} \\
 &= \frac{0.326}{T} && \text{for } 0.67 < T < 7.0 \text{ sec}
 \end{aligned}$$

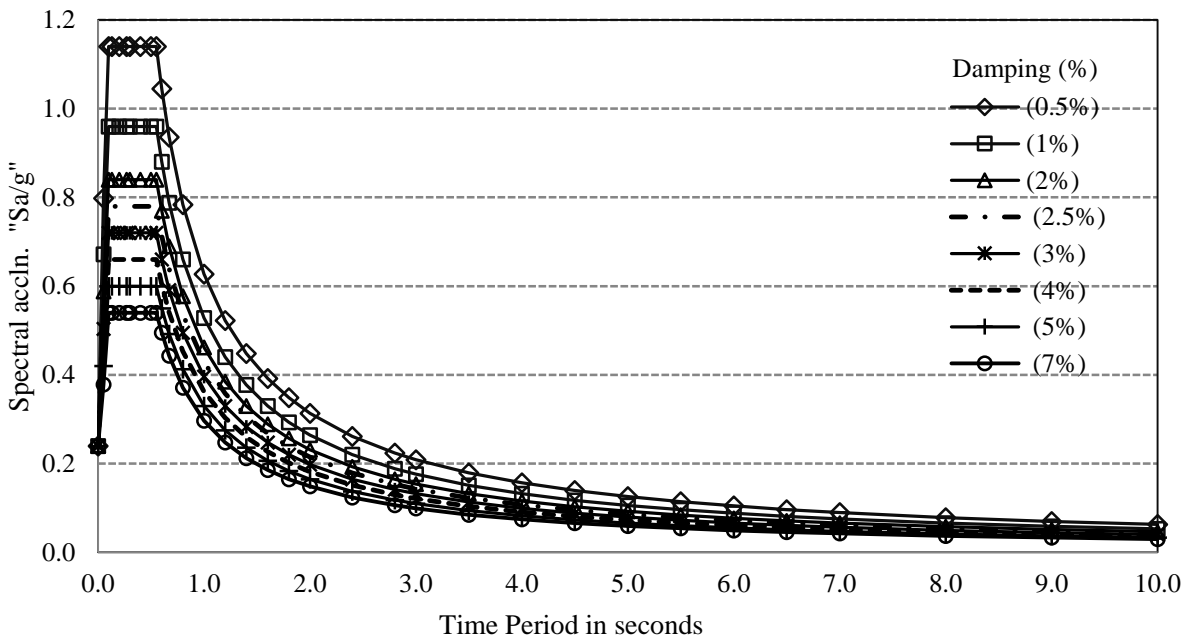


Figure 2: Site specific seismic spectra for MCE

Table 2: Spectral Acceleration Coefficients (S_a/g) for Maximum Considered Earthquake (MCE)

Time Period (sec)	Percentage of critical damping							
	0.5	1.0	2.0	2.5	3.0	4.0	5.0	7.0
0.000	0.240	0.240	0.240	0.240	0.240	0.240	0.240	0.240
0.050	0.798	0.672	0.588	0.546	0.504	0.462	0.420	0.378
0.100	1.140	0.960	0.840	0.780	0.720	0.660	0.600	0.540
0.130	1.140	0.960	0.840	0.780	0.720	0.660	0.600	0.540
0.200	1.140	0.960	0.840	0.780	0.720	0.660	0.600	0.540
0.270	1.140	0.960	0.840	0.780	0.720	0.660	0.600	0.540
0.300	1.140	0.960	0.840	0.780	0.720	0.660	0.600	0.540
0.400	1.140	0.960	0.840	0.780	0.720	0.660	0.600	0.540
0.500	1.140	0.960	0.840	0.780	0.720	0.660	0.600	0.540
0.550	1.140	0.960	0.840	0.780	0.720	0.660	0.600	0.540
0.600	1.045	0.880	0.770	0.715	0.660	0.605	0.550	0.495
0.670	0.936	0.788	0.690	0.640	0.591	0.542	0.493	0.443
0.800	0.784	0.660	0.578	0.536	0.495	0.454	0.413	0.371
1.000	0.627	0.528	0.462	0.429	0.396	0.363	0.330	0.297
1.200	0.523	0.440	0.385	0.358	0.330	0.303	0.275	0.248
1.400	0.448	0.377	0.330	0.306	0.283	0.259	0.236	0.212
1.600	0.392	0.330	0.289	0.268	0.248	0.227	0.206	0.186
1.800	0.348	0.293	0.257	0.238	0.220	0.202	0.183	0.165
2.000	0.314	0.264	0.231	0.215	0.198	0.182	0.165	0.149
2.400	0.261	0.220	0.193	0.179	0.165	0.151	0.138	0.124
2.800	0.224	0.189	0.165	0.153	0.141	0.130	0.118	0.106
3.000	0.209	0.176	0.154	0.143	0.132	0.121	0.110	0.099
3.500	0.179	0.151	0.132	0.123	0.113	0.104	0.094	0.085
4.000	0.157	0.132	0.116	0.107	0.099	0.091	0.083	0.074
4.500	0.139	0.117	0.103	0.095	0.088	0.081	0.073	0.066
5.000	0.125	0.106	0.092	0.086	0.079	0.073	0.066	0.059
5.500	0.114	0.096	0.084	0.078	0.072	0.066	0.060	0.054
6.000	0.105	0.088	0.077	0.072	0.066	0.061	0.055	0.050
6.500	0.096	0.081	0.071	0.066	0.061	0.056	0.051	0.046
7.000	0.090	0.075	0.066	0.061	0.057	0.052	0.047	0.042

NOTES:

1. For methodology of calculation of seismic forces and other seismic design criteria, refer latest revisions of the following codes:
IS 1893 (Part 1):2016 : General provisions and buildings
IS 1893 (Part 4):2015 : Industrial structures including stack-like structures
2. All parameters shall be in accordance with the above mentioned codes.
3. Structures/equipment categorized as Category 1 shall also be checked for MCE.
4. For design purpose, spectra shall be considered as per the section 1.1 and 1.2. For any other purpose such as ductile detailing requirement, the site location shall be considered as Zone IV.
5. When cylindrical storage tanks are designed as per API 650/620 using site-specific design methods, the percentage of critical damping and response reduction shall be taken in accordance with the respective design codes.

SECTION-3

GENERAL TECHNICAL REQUIRMENTS (Part- B)

1.0 GENERAL

- 1.1 This section stipulates the general technical requirements under the contract and will form integral part of the technical specification.
- 1.2 The provisions under this specification are intended to supplement requirement for the materials, equipments 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.

2.0 INSTRUCTION TO BIDDERS

- 2.1 The bidders shall submit the technical requirements, data and information as per the technical specifications provided in the bid documents.
- 2.2 The bidders shall furnish catalogues, engineering data, technical information, design document, drawings etc fully in conformity with the technical specification.
- 2.3 It is recognised that the contractor 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.
- 2.4 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.
- 2.5 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.
- 2.6 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.

3.0 STANDARDS

- 3.1 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.
- 3.2 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.
- 3.3 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.
- 3.4 The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intend to compliment each other.
- 3.5 The Contractor 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.
- 3.6 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.
- 3.7 Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards referred shall also be accepted.
- 3.8 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.

4.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

- 4.1 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 with out showing undue strain, re-strike etc. under such over voltage conditions and in system where line lengths would extend up to 200 km.
- 4.2 All equipments shall also perform satisfactorily under various Electro-mechanical and meteorological conditions of the site of installation.
- 4.3 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.
- 4.4 The bidder shall design the various forces for terminal connectors of the equipment are required to withstand.
- 4.5 The equipment shall also comply to the following:
 - All outdoor EHV equipments 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.

5.0 ENGINEERING DATA

- 5.1 The furnishing of engineering data by the Contractor shall be in accordance with the schedule for each set of equipment as specified in the technical specifications.
- 5.2 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 through 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 Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviation from the requirements, specified under these specifications and documents.
- 5.3 All engineering data submitted by the Contractor 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.
- 5.4 LIST OF DOCUMENTS
 - 5.4.1 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.
 - 5.4.2 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.
 - 5.4.3 All engineering data submitted by the Contractor 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.
- 5.5 DRAWINGS
 - 5.5.1 All drawing submitted by the Contractor 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 equipments and materials, clearances and spaces required for installation and interconnection between various portions of equipments and any other information specifically requested in the specifications.
 - 5.5.2 Each drawing submitted by the Contractor 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.
 - 5.5.3 Further work by the Contractor shall be in strict accordance with these drawing and no deviation shall be permitted without the written approval of the Owner if so required.

5.5.4 All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Contractor's risk. The Contractor 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 Contractor's drawing or work by the Owner shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

5.5.5 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, resubmission and approval by recommended agency (As listed in Section/Chapter-1)	Within 4 weeks of receipt
2	Approval/comments/by Owner on initial submission	Within 4 weeks of receipt.
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
5	Furnishing of distribution copies	weeks from the date of last approval.

NOTE:

The contractor 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, catalogs 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, handling, 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 Contractor to the Owner.

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

6.0 COLOUR SCHEME AND CODES

- 6.1 The contractor shall propose parts a color scheme for the those equipments /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 cubicals.
- Finishing colour of various auxiliary system equipment including piping.
- Finishing colour of various building items.

- 6.2 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.

7.0 MATERIAL/ WORKMANSHIP

7.1 GENERAL REQUIREMENTS

- 7.1.1 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.
- 7.1.2 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.

- 7.1.3 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 similarity. 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.
- 7.1.4 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.
- 7.1.5 Whenever possible, all similar parts 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.
- 7.1.6 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 equipments as recommended by Engineer in-charge.
- 7.1.7 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, leveling, 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.
- 7.1.8 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.
- 7.1.9 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 a 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.

7.1.10 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.

7.2 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 favorable to the growth of fungi and mildew. The indoor equipments located in non- air conditioned areas shall also be same type.

7.2.1 SPACE HEATERS

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

7.2.1.2 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.

7.2.1.3 The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centered 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 glaze. 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.

7.2.2 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.

7.2.3 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 of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

7.2.4 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.

8.0 RATING PLATES, NAME PLATES AND LABELS

8.1 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.

8.2 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.

9.0 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 Contractor unless specification excluded under the exclusions in these specifications and documents

10.0 DESIGN IMPROVEMENTS

10.1 The bidder may note that the equipments 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.

10.2 If any such agreed upon change is such that it 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 contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

11.0 QUALITY ASSURANCE PROGRAMME

11.1 To ensure that the equipment and services under the scope of this contract whether manufactured or performed within the contractor's Work or at his Subcontractor's premises or at the Owner's site or at any other place of work are in accordance with the specification, the Contractor shall adopt suitable quality assurance programme to control such activities at all points necessary.

Such programme shall be outlined by the contractor and shall be finally accepted by the Owner after discussions before award of contract. A quality assurance programme of the contractor shall generally cover 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 subcontractor'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 Contractor/his vendor's quality management and control activities.

11.2 QUALITY ASSURANCE DOCUMENTS

The contractor 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.

12.0 INSPECTION, TESTING & INSPECTION CERTIFICATE

- 12.1 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 Contractor'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 contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the work were manufactured or assembled on the Contractor 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.
- 12.2 All equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with relevant standards.
- 12.3 The Contractor 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 Contractor'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 contractor must ensure TPI for all inspections in line with tender documents.
- 12.4 The Owner or Inspector shall, within fifteen (15) days from the date of inspection as defined here in give notice in writing to the contractor, of any objection to any drawings and all any equipment and workmanship which in his opinion is not in accordance with the contract. The Contractor 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.

- 12.5 When the, factory tests have been completed at the Contractor's or Subcontractor'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.
- 12.6 In all cases where the Contract provides for tests whether at the premises or at the works of the contractor or of any Sub-Contractor. The Contractor 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 contractor and shall give facilities to the Owner/ Inspector or to his authorised representative to accomplish testing.
- 12.7 The inspection by Owner and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the contractors.
- 12.8 The Owner will have the right of having at his own expenses any other test(s) of Reasonable nature carried out at Contractor premises or at site of in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.
- 12.9 The Owner reserves the right for getting any field tests conducted on the completely assembled equipment at site.

13.0 TESTS

13.1 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 Contractor 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 Contractor's quality assurance programme.

13.2 COMMISSIONING TESTS

- 13.2.1 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.
- 13.2.2 Any special equipment, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.
- 13.2.3 The specified tests to be conducted on equipment have been brought out in the respective chapters of the technical specification.

13.2.4 The Contractor 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.

14.0 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 Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Owner takes no responsibility of the wagons.

15.0 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.

16.0 PAINTING AND FINISHING OF METAL SURFACES

16.1 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.

16.2 HOT DIP GALVANIZING

16.2.1 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.

16.2.2 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.

16.2.3 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.

- 16.2.4 The galvanized steel shall be subjected to six one minute dips in copper sulphate solution as per IS-2633.
- 16.2.5 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
- 16.2.6 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.

16.3 PAINTING

- 16.3.1 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 before hand 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.
- 16.3.2 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.
- 16.3.3 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.
- 16.3.4 The exterior color 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 equipments.
- 16.3.5 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.

17.0 HANDLING, STORING AND INSTALLTION

- 17.1 In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Owner or his representative, the contractor 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 energisation at rated voltage.

- 17.2 Contractor may engage manufacturer's engineer to supervise the unloading, transportation to site, storing and erection. The contractor shall engage the manufacturer's Engineer's for testing and commissioning of the various equipment being procured by them separately. Contractor 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.
- 17.3 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. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawing/instructions correctly.
- 17.4 Where assemblies are supplied in more than one section, Contractor shall make all necessary mechanical and electrical connections between section including the connection between buses. Contractor 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 Contractor at his own expense.
- 17.5 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.
- 17.6 The Contractor shall be fully responsible for the equipment material unit the same is handed over to the Owner in an operating condition after commissioning. Contractor 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.
- 17.7 Where material/equipment is unloaded by Owner before the Contractor arrives at site or even when he is at site. Owner by right can hand over the same to Contractor and there upon it will be the responsibility of Contractor to store the material in an orderly and proper manner.
- 17.8 The Supplier shall be responsible for making suitable indoor storage facilities, to store all equipment which require indoor storage.
- 17.9 The words 'erection' and 'installation' used in the specification are synonymous.
- 17.10 Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.
- 17.11 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:

	220 kV	132 kV	33 kV
Phase to earth (mm)	2100	1300	320
Phase to Phase (mm)	2100	1600	350

Section clearance (mm)	5000	4000	2800
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The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life.

18.0 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.

19.0 DESIGN CO-ORDINATION

- 19.1 The Contractor shall be responsible for the selection and design of appropriate equipments 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.
- 19.2 The Contractor has to coordinate designs and termination with the agencies (If any) who are LSTK vendors/ Contractor for the Owner if applicable. The names of agencies shall be intimated to the successful bidders.

20.0 DESIGN CO-ORDINATION MEETING

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

21.0 TOOLS AND TACKELS

The Contractor 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.

22.0 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.

23.0 SUPPORT STRUCTURE

- 23.1 The support structures should be hot dip galvanised with minimum 610 gram/m² net of Zinc.
- 23.2 In case of any deviation in this regard the bid is liable to be rejected.
- 23.3 Support structure shall meet the following mandatory requirements.

- 23.4 The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or supporting insulators to the bottom of the equipment base, where it rests on the foundation pad shall be 2.55 meters or as per applicable standard.
- 23.5 The design calculations taking into account the environmental conditions of the substations shall be furnished for sizing of the structures.

24.0 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

24.1 All power clamps and connectors shall conform to IS:5561 & NEMA CC1 and shall be made of materials listed below:

a)	For connecting ACSR Conductors	Aluminium alloy casting conforming to designation A6 of IS:617 and shall be tested for all test as per IS:617
b)	For connecting equipment terminals made of copper with ACSR conductors	Bimetallic connectors made from aluminium alloy casting, conforming to designation A6 of IS 617 with 2mm thick bimetallic liner and shall tested as per IS:617
c)	For connecting GI shield wire	Galvanised mild steel
d)	i) Bolts, nuts & plain washer galvanised ii) Spring washers for items 'a' to 'c'	i) Electro galvanisation for sizes Plain, washers below M12, for others hot dip galvanised. ii) Electro-galvanised mild steel suitable for at least service condition-3 as per IS:1573

- 24.2 Each equipment shall be supplied with the necessary terminals and connectors, as required by the ultimate design for the particular installation. The conductor termination of equipment shall be suitable for Moose ACSR Conductor. The requirement regarding external RIV as specified for any equipment shall include its terminal fittings and the equipment shall be factory tested with the connectors in position.
- 24.3 Where copper to aluminium connections are required, bi-metallic clamps shall be used, which shall be properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to parts which are not current carrying or subjected to stress. The design details of the joint shall be furnished to the Owner by the supplier.
- 24.4 Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified in each particular case, are also included in the scope of work.
- 24.5 No current carrying part of any of any clamp shall be less than 12 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner of minimum 2 mm thickness shall be cast integral with aluminum body for Bi-metallic clamps.
- 24.6 Lateral load deflection test shall be carried out as an acceptance test. The test procedure and accepted norms shall be mutually discussed and agreed to.

- 24.7 All casting shall be free blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.
- 24.8 Clamp shall be designed to carry the same current as the conductor and the temperature rise shall be equal or less than that of the conductor at the specified with respect to the specified reference ambient temperature, shall also be indelibly marked on each component of the clamp/connector, except on the hardware.
- 24.9 All current carrying parts shall be designed and manufactured to have minimum contact resistance.
- 24.10 Clamps and connectors shall be designed to be corona controlled. RIV level for 220 kV system shall not be more than 1000/ micro volts respectively at the specified test voltage as per IS/NEMA.

24.11 TESTS

Clamps and connectors shall conform to type tests and shall be subjected to routine tests as per IS:5561.

25.0 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

- 25.1 All type of boxes, cabinets etc. shall generally conform to & be tested in accordance with IS-5039/IS-8623, IEC-439, as applicable, and the clauses given below.
- 25.2 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 aluminum enclosed box the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet of specified thickness.
- 25.3 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 kV r.m.s 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 contractor shall carry out the IP-55 test alongwith these tests, at his cost.
- 25.4 Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.
- 25.5 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.

- 25.6 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 atleast 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.
- 25.7 A 240V, single phase, 50Hz, 15 amp 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.
- 25.8 For illumination of control cabinet a 7 Watt LED shall be provided.
- 25.9 All control switches shall be of rotary switch type and Toggle/piano switches shall not be provided.

25.10 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.

25.11 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.

26.0 AUXILIARY SWITCHES

The auxiliary switch shall confirm to the following type tests:

Electrical endurance test -A minimum of 2000 operation for 2A DC with a time constant examination of mV drop/visual defects/temperature rise test.

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.

27.0 TERMINAL BLOCKS AND WIRING

- 27.1 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.

- 27.2 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.
- 27.3 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.
- 27.4 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.
- 27.5 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.
- 27.6 The terminal blocks shall be of extensible design.
- 27.7 The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.
- 27.8 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.
- 27.9 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.

- 27.10
 - 27.11 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.
 - 27.12 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.
 - 27.13 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.
- 27.14 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.

28.0 LAMPS AND SOCKETS

28.1 LAMPS

All indication lamps shall also be LED based. Socket base shall be as per IS-1258, except in the case of signal lamps.

28.2 SOCKETS

28.3 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.

28.4 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.

28.5 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.

28.6 SWITCHES AND FUSES

28.6.1 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.

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

28.6.3 Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All 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.

29.0 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS:

29.1 The bidder shall offer composite silicon rubber polymer insulator for all insulation purpose as per project requirement, conforming to IEC-61109. In case if non-compliance of composite insulators with respect to State/National electricity authorities guidelines/requirements, the anti-fog type porcelain insulators may be used wherever mandatory. The required deviations with respect to above requirements shall be clearly mentioned in the deviation sheet along with the supporting documents. In absence of such deviations statements, the compliance of this point is mandatory and binding on the vendor.

29.2 Bushing shall be manufactured and tested in accordance with IS:2099 & IEC: 137 while hollow column insulators shall manufactured and tested in accordance with IEC 233/18 5621. The support insulators shall be manufactured and tested as per IS 2544/IEC 168 and IEC 273. The Insulators shall also conform to IEC 815 as applicable.

29.3 Following requirements to be fulfilled if anti-fog porcelain insulators are provided as instructed in point 29.1 of this chapter.

- 29.3.1 Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from lamination, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.
- 29.3.2 Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.
- 29.3.3 Support insulators/bushings/hollow column insulators shall be designed to have ample insulation, mechanical and rigidity for the conditions under which they will be used.
- 29.3.4 When operating at rated voltage there shall be no electric discharge between the conductors and busing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the normal rated voltage.
- 29.3.5 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and support other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.
- 29.3.6 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be true up porcelain parts by grinding and metal parts by machining. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.

29.4 TESTS

Bushing hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests in accordance with IS:2099 & IS: 2544.

29.4.1 Technical parameters of bushing/Hollow column insulators/support insulators:

		220 kV System	132 kV System	66 kV System	33 kV System
a)	Rated Voltage (kV)	245	145	72.5	36
b)	Impulse withstand voltage (dry and wet) (kVp)	1050	650	325	170
c)	Power frequency withstand voltage (dry and wet) (kV) (rms)	460	275	140	75
d)	Total creepage distance (mm)	25mm/kv			
e)	Pollution	Class – III heavy (as per IEC 71) and as specified in section 2 for all class of equipment.			
f)	Insulator shall also meet requirement of and IEC-815 as applicable having alternate long and short sheds.				

30.0 MOTORS

Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and conform to type tests and shall be subjected to routine tests as per applicable standards. The motors shall be of approved make.

30.1 ENCLOSURES

- a) Motor to be installed shall have enclosure equivalent to IP 55 as per IS:4691.
- b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
- c) Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing.
- d) Motor weighing more than 25 kg shall be provided with eyebolts, lugs or other means to facilitate lifting.

31.0 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 IEG 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.

32.0 RADIO INTERFERENCE VOLTAGE (RIV) TEST

32.1 GENERAL

Unless otherwise stipulated, all equipment together with its associated connectors, where applicable, shall be tested for measurement of radio interference voltage (RIV).

32.2 TEST LEVELS


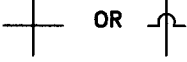
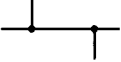
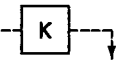
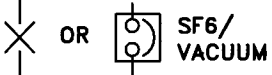






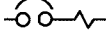

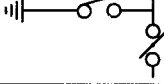


The test voltage levels for measurement of external RIV are listed under the relevant clauses of the specification.

32.3 TEST METHOD FOR RIV

32.3.1 RIV tests shall levels for according to measuring as per International Special- Committee on radio Interference (CISPR) Publication 16-1 (1993) Part-1. The measuring circuit shall preferably be tuned to frequency with 10 % of 0.5 MHz but other frequency being recorded. The results shall be in microvolts.


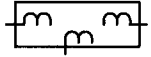



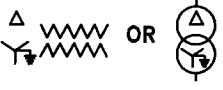










32.3.2 Alternatively, RIV tests shall be in accordance with NEMA standard Publication No.107-1964, except otherwise noted herein.

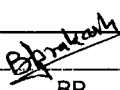
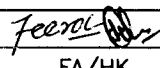
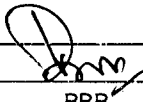

- 32.3.3 In measurement, RIV, temporary additional external shielding may be provided. In measurements of RIV only standard fitting of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.
- 32.3.4 Ambient noise shall be measured before and after each series of tests to ensure that there is no ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing voltages 85%, 100%, 115% and
- 32.3.5 130% of the specified RIV test voltage for all equipment unless otherwise specified.
- 32.3.6 The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.
- 32.3.7 The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.


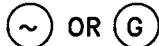














	BUS
	CROSSING OF CONDUCTORS—NOT CONNECTED
	CONNECTIONS OF CONDUCTORS
	KEY INTERLOCK, K—KEY, ARROW TERMINATES AT DEVICE
	SF6 / VACUUM CIRCUIT BREAKER
	AIR CIRCUIT BREAKER
	DRAWOUT FEATURE
	CABLE GLAND
	AIR BREAK ISOLATOR/DISCONNECT SWITCH
	OIL IMMERSD ISOLATOR/DISCONNECT SWITCH
	FUSE
	AIR CIRCUIT BREAKER WITH INHERENT RELEASES
	DOUBLE BREAK ISOLATOR
	ISOLATOR WITH EARTH SWITCH
	LIGHTNING ARRESTOR
	CONTACTOR


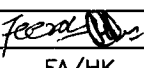


5	08.11.16	UPDATED & ISSUED AS STANDARD	<i>B. Prakash</i> BP	<i>Jeeva</i> FA/HK	<i>Dom</i> BRB	<i>Am</i> RN
4	27.06.11	REAFFIRMED & ISSUED	BP	RKS/RSC	UAP	DM
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
Approved by						

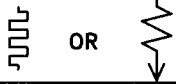














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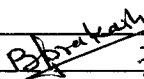
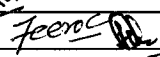
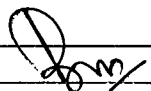

	CURRENT TRANSFORMER
	SUMMATION CT
	INTERPOSING CT
	CORE BALANCE CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	POWER/DISTRIBUTION TRANSFORMER—DESCRIPTION AS NOTED (PRIMARY DELTA CONNECTED, SECONDARY STAR CONNECTED. STAR POINT SOLIDLY EARTHED)
	TRANSFORMER WITH OLTC
	INSTRUMENT, A- AMMETER, V- VOLTMETER, W- WATTMETER, KWH- KILOWATT HOUR METER, F- FREQUENCY METER, pf- POWER FACTOR METER, HM- HOUR RUN COUNTER MF - MULTI FUNCTION METER
	AS- AMMETER SELECTOR SWITCH, VS- VOLTMETER SELECTOR SWITCH
	FREQUENCY RECORDER
	VOLTAGE RECORDER
	TRI VECTOR METER
	INDICATING LIGHT R- RED, W- WHITE, B- BLUE, Y- YELLOW G- GREEN AND A- AMBER
	415V, 3 PHASE POWER/WELDING RECEPTACLE
	BUS DUCT
	BATTERY

5	08.11.16	UPDATED & ISSUED AS STANDARD				
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
4	27.06.11	REAFFIRMED & ISSUED	BP	RKS/RSC	UAP	DM
Approved by						

	PERMANENT MAGNET GENERATOR
	GENERATOR—DESCRIPTION AS INDICATED
	INDUCTION MOTOR
	SYNCHRONOUS MOTOR
	MINIATURE CIRCUIT BREAKER (MCB)
	MINIATURE CIRCUIT BREAKER WITH EARTH LEAKAGE CIRCUIT BREAKER (MCB + ELCB)
	MOULDED CASE CIRCUIT BREAKER (MCCB)
	RECTIFIER
	INVERTER
	DC - DC CONVERTER
	STATIC VOLTAGE REGULATOR
	AUTOMATIC VOLTAGE REGULATOR
	PUSH BUTTON STATION / LOCAL CONTROL STATION
	PUSH BUTTON STATION WITH AMMETER
	PUSH BUTTON STATION WITH INDICATING LAMP
	CAPACITOR, VARIABLE CAPACITOR

5	08.11.16	UPDATED & ISSUED AS STANDARD				
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	NEUTRAL GROUNDING RESISTOR
	NEUTRAL GROUNDING TRANSFORMER
	TWO WAY SELECTOR SWITCH
	THREE WAY SELECTOR SWITCH
	TIME DELAY RELAY
	DISTANCE PROTECTION RELAY
	CHECK SYNCHRONISING RELAY
	27 - UNDER VOLTAGE RELAY 27R - RESIDUAL VOLTAGE CHECK RELAY 27M - UNDER VOLTAGE RELAY (MOTOR PROTECTION) 27C - VOLTAGE HEALTHY CHECK RELAY
	REVERSE POWER RELAY
	LOW FORWARD POWER RELAY
	LOSS OF EXCITATION RELAY
	NEGATIVE PHASE SEQUENCE RELAY
	THERMAL OVERLOAD RELAY
	INSTANTANEOUS OVER CURRENT RELAY
	INSTANTANEOUS EARTH FAULT RELAY

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51	IDMTL OVER CURRENT RELAY
51G	STANDBY EARTH FAULT RELAY
51N	IDMTL EARTH FAULT RELAY
51V	VOLTAGE RESTRAINED IDMTL OVER CURRENT RELAY
59	OVER VOLTAGE RELAY
60	NEUTRAL DISPLACEMENT RELAY
63TX	AUX. RELAY FOR TRANSFORMER TROUBLE/TRIP
64F	ROTOR EARTH FAULT RELAY
64G _{1,2}	STATOR EARTH FAULT MAIN AND BACKUP RELAY
64R	RESTRICTED EARTH FAULT RELAY
67	DIRECTIONAL OVER CURRENT RELAY
67N	DIRECTIONAL EARTH FAULT RELAY
78	OUT OF STEP RELAY
80	CONTROL SUPPLY SUPERVISION RELAY
81	UNDER FREQUENCY / df/dt RELAY
86	LOCKOUT RELAY

5	08.11.16	UPDATED & ISSUED AS STANDARD	BP	FA/HK	BRB	RN
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Rev. No.	Date	Purpose	Prepared by	Checked by	Std. Committee Convener	Std. Bureau Chairman
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
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SYMBOL	DESCRIPTION	CODE/AGENCY
	A.C. MOTOR	IEC
	A.C. GENERATOR	IEC
	SYNCHRONOUS GENERATOR (GS)	IEC
	SYNCHRONOUS MOTOR (MS)	IEC
	MOTOR STARTER-GENERAL	IEC
	STARTER-NON REVERSING MOTOR	IEC
	STARTER-REVERSING MOTOR	IEC
	STAR-DELTA STARTER	IEC
	STARTER REGULATOR WITH THYRISTOR	IEC
	DIRECT ON-LINE CONTACTOR STARTER -REVERSING MOTOR	IEC
	STARTER OPERATING IN STEPS	IEC
	THREE PHASE DELTA-STAR TRANSFORMER	IEC
	THREE PHASE DELTA-STAR TRANSFORMER WITH OLTC	IEC
	TRANSFORMER WITH TWO WINDINGS	IEC
	TRANSFORMER WITH THREE WINDINGS	IEC
	VOLTAGE TRANSFORMER	IEC


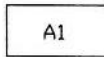











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SYMBOL	DESCRIPTION	CODE/AGENCY
	CURRENT TRANSFORMER	IEC
	CURRENT TRANSFORMER, CORE BALANCE	IEC
	AUTO TRANSFORMER	IEC
	EMERGENCY STOP LOCKING TYPE	EIL
	EMERGENCY STOP NON-LOCKING TYPE	EIL
	THREE PHASE WINDING, STAR	IEC
	THREE PHASE WINDING, DELTA	IEC
	THREE PHASE WINDING, STAR WITH NEUTRAL BROUGHT OUT	IEC
	CIRCUIT BREAKER, GENERAL	IEC
	CIRCUIT BREAKER, 1 POLE	IEC
	CIRCUIT BREAKER, 3 POLE * =DENOTES TYPE ACB = AIR CIRCUIT BREAKER VCB = VACUUM CIRCUIT BREAKER MCCB = MOULDED CASE CKT. BREAKER MCB = MINIATURE CIRCUIT BREAKER SF6 = SULPHUR HEXAFLUORIDE CIRCUIT BREAKER	IEC
	DISCONNECTOR (ISOLATOR) 3 POLE	EIL
	SWITCH DISCONNECTOR, 3 POLE (ON-LOAD ISOLATING SWITCH)	EIL
	SWITCH DISCONNECTOR, 3 POLE NEUTRAL (ON-LOAD ISOLATING SWITCH)	EIL
	SWITCH DISCONNECTOR, 3 POLE NEUTRAL(FIXED) ON-LOAD ISOLATING SWITCH	EIL

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SYMBOL	DESCRIPTION	CODE/AGENCY
	FUSE, GENERAL	IEC
	MULTIPLE FUSE	EIL
	FUSE SHOWING POWER FLOW DIRECTION	IEC
	FUSE SWITCH 3 POLE	EIL
	CONTACTOR	IEC
	ARROWHEAD	EIL
	CONNECTION POINT	IEC
	TERMINAL	IEC
	CABLE TERMINATION	IEC
	PLUG AND SOCKET	IEC
	KEY INTERLOCK	IEC
	MECHANICAL INTERLOCK	EIL
	ELECTRICAL INTERLOCK	EIL
	REMOVABLE LINK	IEC
	INTEGRATING METER A1 = DENOTES TYPE Wh = WATT HOUR METER h = HOURS RUN METER Ah = AMPERE-HOUR METER	IEC

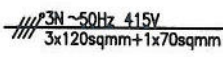





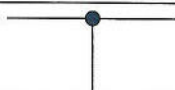


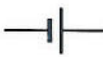




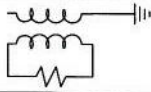
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SYMBOL	DESCRIPTION	CODE/AGENCY
	INDICATING INSTRUMENT A1 = DENOTES TYPE V = VOLTMETER A = AMMETER Hz = FREQUENCY METER $\cos \phi$ = POWER FACTOR METER Var = VAR METER Hz = FREQUENCY METER ϕ = PHASE METER n = TACHOMETER	IEC
	RECORDING INSTRUMENT A1 = DENOTES TYPE W = WATT METER	IEC
	SYNCHROSCOPE	IEC
	1 PHASE/NEUTRAL/EARTH	EIL
	3 PHASE	EIL
	3 PHASE/NEUTRAL/EARTH	EIL
	DRAWOUT FEATURE	EIL
	BUSDUCT	EIL
	CENTRE BREAK DISCONNECT	EIL
	INTEGRAL EARTHING SWITCHGEAR	EIL
	ROTATING DISCONNECT CLOCKWISE EARTHING SWITCH	EIL
	AMMETER SELECTOR SWITCH	EIL
	VOLTMETER SELECTOR SWITCH	EIL

















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SYMBOL	DESCRIPTION	CODE/AGENCY
	OVERCURRENT PROTECTION	EIL
	THERMAL OVERCURRENT PROTECTION	EIL
	MAGNETIC OVERCURRENT PROTECTION	EIL
	UNDER VOLTAGE PROTECTION	EIL
	EARTH LEAKAGE PROTECTION BY CURRENT	EIL
	EARTH LEAKAGE PROTECTION BY VOLTAGE	EIL
	LOCKING DEVICE PADLOCK FACILITY	EIL
	MECHANICAL INTERLOCK BETWEEN TWO DEVICES	EIL
	AUTOMATIC RETURN	EIL
	OPERATED BY KEY	IEC
	OPERATED BY ELECTRIC MOTOR	IEC
	MOTOR-OPERATED VALVE	EIL
	REMOTE CONTROL UNIT WITH AMMETER CONTROLLED BY ROTARY STACK SWITCH	EIL
	REMOTE CONTROL UNIT WITHOUT AMMETER CONTROLLED BY ROTARY STACK SWITCH	EIL
	REMOTE CONTROL UNIT WITH AMMETER CONTROLLED BY PUSH BUTTON	EIL
	REMOTE CONTROL UNIT WITHOUT AMMETER CONTROLLED BY PUSH BUTTON	EIL

















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SYMBOL	DESCRIPTION	CODE/AGENCY
	CABLE SINGLE LINE REPRESENTATION	EIL
	EQUIPOTENTIALITY	EIL
	BUSBAR	EIL
	PROTECTIVE EARTH	IEC
	CHANGE-OVER CONTACT WITH CENTRE-OFF POSITION	IEC
	STATIC SWITCH PASSING CURRENT IN ONE DIRECTION	EIL
	T CONNECTION	IEC
	LIGHTENING ARRESTOR	IEC
	REACTOR	IEC
	BATTERY (PRIMARY OR SECONDARY CELLS)	IEC
	RECTIFIER	IEC
	INVERTER	IEC
	DC/DC CONVERTOR	IEC
	NEUTRAL GROUNDING RESISTOR	EIL
	NEUTRAL GROUNDING TRANSFORMER	EIL

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SYMBOL	DESCRIPTION	CODE/AGENCY
	START PUSH-BUTTON AND AUTOMATIC RETURN	IEC
	STOP PUSH-BUTTON	EIL
	MAKE CONTACT DELAYED WHEN CLOSING	IEC
	MAKE CONTACT DELAYED WHEN OPENING	IEC
	BREAK CONTACT DELAYED WHEN OPENING	IEC
	BREAK CONTACT DELAYED WHEN CLOSING	IEC
	MAKE CONTACT	IEC
	BREAK CONTACT	IEC
	CHANGE-OVER CONTACT BREAK BEFORE MAKE	IEC
	CHANGE-OVER CONTACT MAKE BEFORE BREAK	IEC
	CONTACT WITH TWO MAKES	IEC
	CONTACT WITH TWO BREAKS	IEC
	INDICATING LAMP * = DENOTES COLOUR GN = GREEN YE = YELLOW RD = RED BU = BLUE WH = WHITE	IEC
	FUSE SWITCH	IEC
	CIRCUIT BREAKER WITH AUTOMATIC RELEASE	EIL
	RELAY CONTACT MAKE WITH SPRING RETURN	EIL

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SYMBOL	DESCRIPTION	CODE/AGENCY
	DISCONNECTOR (ISOLATOR)	IEC
	SWITCH-DISCONNECTOR (ON-LOAD ISOLATING SWITCH)	IEC
	FUSE DISCONNECTOR (FUSE ISOLATOR)	IEC
	FUSE SWITCH DISCONNECTOR (ONLOAD ISOLATING FUSE SWITCH)	IEC
	ANTI-CONDENSATION HEATER	IEC
	CONTACTOR COIL	EIL
	EARTH (GROUND), GENERAL SYMBOL	IEC
	CHASSIS OR FRAME EARTH	IEC
	CLEAN EARTH (NOISELESS)	IEC
	THERMAL O/L RELAY-OPERATING DEVICE	IEC
	DIODE	IEC
	THYRISTOR	IEC
	TERMINAL STRIP	IEC
	RESISTOR, GENERAL	IEC
	ADJUSTABLE RESISTOR	IEC
	RELAY COIL OF PERMANENT RELAY	IEC

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SYMBOL	DESCRIPTION	CODE/AGENCY
	RELAY COIL OF SLOW RELEASING RELAY	IEC
	RELAY COIL OF SLOW OPERATING RELAY	IEC
	RELAY COIL- SLOW OPERATING SLOW RELEASING RELAY	IEC
	RELAY COIL- HIGH SPEED RELAY (FAST OPERATING & RELEASING)	IEC
	RELAY COIL- POLARISED RELAY	IEC
	RELAY COIL OF ALTERNATING CURRENT RELAY	IEC
	CAPACITOR, GENERAL	IEC
	POLARISED CAPACITOR	IEC
	ADJUSTABLE CAPACITOR	IEC
	INDUCTOR, COIL, WINDING CHOKE	IEC
	PHOTOVOLTIC CELL	IEC
	PHOTO DIODE (PHOTO CONDUCTIVE WITH ASYMMETRICAL CONDUCTIVITY)	IEC
	LIGHT DEPENDENT RESISTOR (PHOTO CONDUCTIVE DEVICE WITH SYMMETRICAL CONDUCTIVITY)	IEC
	2 POSITION SWITCH	IEC
	3 POSITION SWITCH	IEC
	4 POSITION SWITCH	IEC

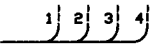
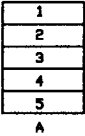
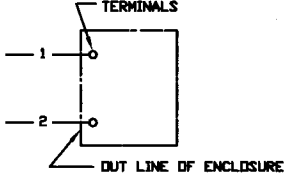











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SYMBOL	DESCRIPTION	CODE/AGENCY
R1	RELAY COIL GENERAL	IEEE/NEMA
AVR	AUTOMATIC VOLTAGE REGULATOR RELAY	EIL
U=0	NO VOLTAGE RELAY	IEC
2	TIME DELAY RELAY	IEEE/NEMA
12	OVERSPEED RELAY	IEEE/NEMA
21	DISTANCE PROTECTION RELAY	IEEE/NEMA
25	CHECK SYNCHRONISING RELAY	IEEE/NEMA
27	27 - UNDER VOLTAGE RELAY 27R - RESIDUAL VOLTAGE CHECK RELAY 27M - UNDER VOLTAGE RELAY (MOTOR PROTECTION) 27H - VOLTAGE HEALTHY CHECK RELAY	IEEE/NEMA
32	REVERSE POWER / DIRECTIONAL POWER RELAY	IEEE/NEMA
37	LOW FORWARD POWER / UNDER CURRENT RELAY	IEEE/NEMA
40	LOSS OF EXCITATION RELAY	IEEE/NEMA
46	NEGATIVE PHASE SEQUENCE RELAY	IEEE/NEMA
49	THERMAL OVERLOAD RELAY	IEEE/NEMA
50	INSTANTANEOUS OVER CURRENT RELAY	IEEE/NEMA
50N	INSTANTANEOUS EARTH FAULT RELAY	IEEE/NEMA

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SYMBOL	DESCRIPTION	CODE/AGENCY
51	IDMTL OVER CURRENT RELAY	IEEE/NEMA
51G	STANDBY EARTH FAULT RELAY	IEEE/NEMA
51N	IDMTL EARTH FAULT RELAY	IEEE/NEMA
51V	VOLTAGE RESTRAINED IDMTL OVER CURRENT RELAY	IEEE/NEMA
59	OVER VOLTAGE RELAY	IEEE/NEMA
60	NEUTRAL DISPLACEMENT RELAY	IEEE/NEMA
63TX	AUX. RELAY FOR TRANSFORMER TROUBLE/TRIP	IEEE/NEMA
64F	ROTOR EARTH FAULT RELAY	IEEE/NEMA
64G 1,2	STATOR EARTH FAULT MAIN AND BACKUP RELAY	IEEE/NEMA
64R	RESTRICTED EARTH FAULT RELAY	IEEE/NEMA
67	DIRECTIONAL OVER CURRENT RELAY	IEEE/NEMA
67N	DIRECTIONAL EARTH FAULT RELAY	IEEE/NEMA
78	OUT OF STEP RELAY	IEEE/NEMA
80	CONTROL SUPPLY SUPERVISION RELAY	IEEE/NEMA
81	UNDER FREQUENCY / df/dt RELAY	IEEE/NEMA
86	LOCKOUT RELAY	IEEE/NEMA

1	05.03.2019	REAFFIRMED & ISSUED AS STANDARD	VKS	HK	BRB	RKT
0	26.03.2014	ISSUED AS STANDARD	SL / AKH	HK / SA	BRB	SC
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
						Approved by

	GROUPING OF CONDUCTORS, LINE BEND INDICATES DIRECTION OF CONDUCTOR JOINING CABLE, NUMERAL INDICATES WIRE NUMBER	
	TERMINAL BLOCK 'A', NUMERAL INDICATES TERMINAL NUMBER	
	WIRES DESIGNATED 1 & 2 ARE CONNECTED TO TERMINALS OF AN APPARATUS	
	HOOTER H - HORN S - SIREN LSP - LOUDSPEAKER	
	RELAY COIL, 2 - INDICATES RELAY NUMBER	
	BREAK CONTACT DELAYED BREAK	
	MAKE CONTACT DELAYED MAKE	
	BREAK CONTACT DELAYED MAKE	
	MAKE CONTACT DELAYED BREAK	
	OPEN CONTACT - THE POSITION OF THE CONTACT IN A RELAY IS SHOWN WITH COIL DE-ENERGISED	
	CLOSED CONTACT - THE POSITION OF THE CONTACT IN A RELAY IS SHOWN WITH COIL DE-ENERGISED	
	MOTOR, 3 PHASE	
	NORMALLY OPEN	TEMPERATURE ACTUATED SWITCH
	NORMALLY CLOSED	

5	08.11.16	UPDATED & ISSUED AS STANDARD	BP	FA/HK	BRB	RN
4	27.06.11	REAFFIRMED & ISSUED	BP	RKS/RSC	UAP	DM
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
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	HELD CLOSE	LIMIT SWITCH
	HELD OPEN	
	NORMALLY OPEN (OPEN ON LOW PRESSURE)	VACUUM/ PRESSURE SWITCH
	NORMALLY CLOSE (CLOSED ON LOW PRESSURE)	
	PUSH BUTTON - CLOSING, SINGLE CIRCUIT, MOMENTARY OR SPRING RETURN	
	PUSH BUTTON - OPENING, SINGLE CIRCUIT, MOMENTARY OR SPRING RETURN	
	PUSH BUTTON, TWO CIRCUIT, MOMENTARY OR SPRING RETURN	
	PUSH BUTTON, TWO CIRCUIT, MAINTAINED OR NON-SPRING RETURN	
	SEMICONDUCTOR DIODE	
	SILICON CONTROL RECTIFIER	
	FULL WAVE RECTIFIER	
	FUSE	
	EMG. STOP	
	STAY PUT EMERGENCY STOP (MUSHROOM HEAD) PUSH BUTTON WITH RESETING FEATURE	
	EARTH CONNECTION	

5	08.11.16	UPDATED & ISSUED AS STANDARD	<i>BP</i>	<i>FA/HK</i>	<i>BRB</i>	<i>RN</i>
4	27.06.11	REAFFIRMED & ISSUED	BP	RKS/RSC	UAP	DM
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
						Approved by

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13OD		Description : CABLES:CONTROL (UNPAIRED)-PVC/XLPE		
Approved Suppliers				
1	3854	CHANDRESH CABLES LIMITED	INDIA	
2	3872	GUPTA POWER INFRASTRUCTURE LIMITED	INDIA	
3	K190A	KEC INTERNATIONAL LIMITED	INDIA	
4	3752	APAR INDUSTRIES LTD	INDIA	
5	T212	THERMO CABLES LTD (FORM. T-150)	INDIA	
6	S304	SUYOG ELECTRICALS LTD	INDIA	
7	3602	Special Cables Pvt. Ltd.	INDIA	
8	S025	SRIRAM CABLES PVT LTD	INDIA	
9	A034	ASSOCIATED CABLES PVT LTD	INDIA	
10	U003	UNIVERSAL CABLES LTD	INDIA	
11	3722	POLYCAB INDIA LIMITED	INDIA	
12	G156	GEMSCAB INDUSTRIES LTD	INDIA	
13	3724	CORDS CABLE INDUSTRIESLTD.	INDIA	
14	C145	CORDS CABLE INDUSTRIES LTD	INDIA	
15	K082	KEI INDUSTRIES LIMITED	INDIA	
16	E063	ELKAY TELELINKS LTD.-	INDIA	
17	3783	POLYCAB INDIA LIMITED	INDIA	
18	T124	TCL CABLES PRIVATE LIMITED	INDIA	
19	A132	ASSOCIATED FLEXIBLES & WIRES [P] LTD	INDIA	
20	3669	KEI INDUSTRIES LIMITED	INDIA	
21	3765	THERMO CABLES LTD.	INDIA	
22	3784	POLYCAB INDIA LIMITED	INDIA	
23	D012	DELTON CABLES LIMITED	INDIA	
24	H060	HAVELLS INDIA LTD	INDIA	
25	3814	RR KABEL LIMITED	INDIA	
On Holiday				
1	R203	RALLISON ELECTRICALS PVT. LTD.	INDIA	
2	N112	NORTH EASTERN CABLES PVT LTD	INDIA	
3	R203	RALLISON ELECTRICALS PVT. LTD.	INDIA	
4	S073	SCOT INNOVATION WIRES & CABLES PVT LTD	INDIA	
5	I211	ICON CABLE LTD.	INDIA	
6	F013	FINOLEX CABLES LTD.	INDIA	
7	C019	CMI LIMITED	INDIA	
8	R203	RALLISON ELECTRICALS PVT. LTD.	INDIA	
9	E169	ECKO CABLES PVT LTD	INDIA	

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 13OD		Description : CABLES:CONTROL (UNPAIRED)-PVC/XLPE		
10	R179	RAVIN CABLES LTD	INDIA	



066053057049

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14CD		Description : CONTACTORS		
Approved Suppliers				
1	A200	ABB INDIA LTD (BANGALORE)	INDIA	
2	S450A	SCHNEIDER ELECTRIC INDIA P LTD-HYDERABAD	INDIA	
3	G147	GE INDIA INDUSTRIAL PVT LTD	INDIA	
4	S003	SIEMENS LIMITED	INDIA	
5	B002	BCH ELECTRIC LTD	INDIA	
6	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	
On Holiday				
1	3791	C & S ELECTRIC LTD	INDIA	



066053057049

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



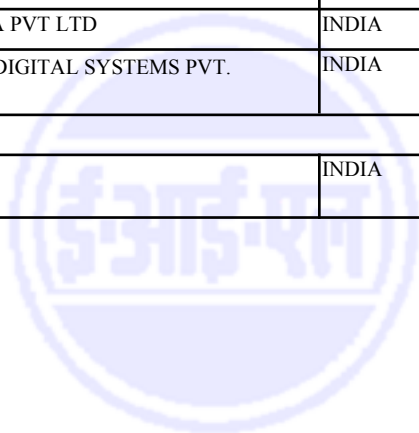
066053057049

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



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Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14MA		Description : MCB		
Approved Suppliers				
1	3824	HAVELLS INDIA LIMITED	INDIA	
2	S003	SIEMENS LIMITED	INDIA	
3	A372	ABB INDIA LTD	INDIA	
4	L071	LEGRAND (INDIA) PVT. LTD (FORM. M-006)	INDIA	
5	I168	INDIANA CURRENT CONTROL LTD	INDIA	
6	3888	POLYCAB INDIA LIMITED	INDIA	
7	S393	STANDARD ELECTRICALS LTD	INDIA	
8	S450	SCHNEIDER ELECTRIC INDIA PVT LTD	INDIA	
9	3726	NOVATEUR ELECTRICAL & DIGITAL SYSTEMS PVT. LTD.	INDIA	
On Holiday				
1	3793	C & S ELECTRIC LTD	INDIA	



066053057049

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



066053057049

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



066053057049

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14PB Description : PUSH BUTTON AND INDICATING LAMPS				
Approved Suppliers				
1	L001C	LARSEN & TOUBRO LTD-POWAI	INDIA	
2	S450A	SCHNEIDER ELECTRIC INDIA P LTD-HYDERABAD	INDIA	
3	B002	BCH ELECTRIC LTD	INDIA	
4	S365	SHRI TULSI SWITCHGEARS PVT LTD	INDIA	
5	H142	HOTLINE SWITCHGEAR & CONTROLS	INDIA	
6	S003	SIEMENS LIMITED	INDIA	
7	P291	PRECIFINE PRODUCTS PVT. LTD.	INDIA	
8	E173	ESSEN DEINKI	INDIA	
9	T166	TEKNIC ELECTRIC (I) PVT. LTD.	INDIA	
On Holiday				
1	3791	C & S ELECTRIC LTD	INDIA	



066053057049

Sr No	Supplier Code	Supplier Name	Country	Holiday Description
Item Code : 14SA		Description : FUSE SWITCH COMBINATION		
Approved Suppliers				
1	I013	NOVATEUR ELECTRICAL & DIGITAL SYSTEMS P	INDIA	
2	L103	SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED	INDIA	
3	S393	STANDARD ELECTRICALS LTD	INDIA	
4	S003	SIEMENS LIMITED	INDIA	
5	G147	GE INDIA INDUSTRIAL PVT LTD	INDIA	
6	3825	HAVELLS INDIA LIMITED	INDIA	
On Holiday				
1	3790	C & S ELECTRIC LTD	INDIA	



066053057049

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



066053057049

VENDOR DATA REQUIREMENTS

The following drawings/documents marked "✓" shall be furnished by the bidder.

GIS PACKAGES

S. N. O.	DESCRIPTION	WITH BID	POST ORDER			REMARKS
			FOR REVIEW	FOR RECORD	WITH DATA BOOK (FINAL)	
1.	Filled in Technical Compliance Checklist attached with tender	✓				
2.		✓	✓		✓	
3.			✓		✓	
4.	Electrical interface Document (Battery Limit Interface) with Owner		✓		✓	
5.	System Study Report: Electrical Load Data, Load Analysis, Load Flow, Short Circuit calculation		✓		✓	
6.						
7.						
8.						
9.	Study Reports: Insulation Co-ordination Study report, Relay Co-ordination Study Report		✓		✓	
10.	3 D Model Review Report			✓	✓	
11.	Miscellaneous Schedules: Equipment List/ Motor List/ Lighting Panel/ Power Panel/ LCS Schedule, etc.			✓	✓	
12.	Cable Schedule, Interconnection Document			✓	✓	
13.	ECS & DCS Interface Document and Interconnection Drawing			✓	✓	
14.						
15.	Test Records, Type Test Certificates for Miscellaneous Equipments			✓	✓	
16.	List of Mandatory Spares		✓		✓	
17.	List of Maintenance Spares, Commissioning Spares, Special Tools and Tackles				✓	
18.	Data Books/ Manuals : Installation Manual, Operating/ Maintenance Manual, Catalogues/ Brochures, Equipment storage procedure at site				✓	
19.						

S. N. O.	DESCRIPTION	WITH BID	POST ORDER			REMARKS
			FOR REVIEW	FOR RECORD	WITH DATA BOOK (FINAL)	
20.						

EHV- GIS

S. N. O.	DESCRIPTION	WITH BID	POST ORDER			REMARKS
			FOR REVIEW	FOR RECORD	WITH DATA BOOK (FINAL)	
1.	Data Sheets (Duly filled-in), GA Drawings (Elevation and Plan) of GIS, LCC including clearance requirements	✓	✓		✓	
2.	Installation Plan including foundation, cutout and mounting details of GIS, LCC, Cross Sectional View, Name Plate Drawing, Gas SLD, Gas filling arrangement details			✓	✓	
3.	Single Line Diagram, Arrangement of cable termination, CT/PT burdens, Vk, Im, RCT etc. for class PS CT's, surge arrester, List of Mandatory Spares		✓		✓	
4.	Control Schematics, Wiring Diagram and Terminal Details, Interpanel Wiring Diagram, Bill Of Material, Auxiliary Power Data (AC & DC), Interlock Details, ECS I/O List			✓	✓	
5.	Substation Automation System Drawings: GA Drawing of Panel, System Architecture		✓		✓	
6.	Substation Automation System Drawings: Power Requirement, Bill of Material			✓	✓	
7.	Drawing/ Details of SF6 Gas leakage detector, Gas filling and evacuation plant, SF6 Gas analyser, Portable Partial Discharge monitoring system, Online SF6 gas topping system			✓	✓	
8.	Inspection & Test Plan (ITP) -For review by Inspection Dept.		✓		✓	Refer Note-1**
9.	Type Test Certificate (For identical design of GIS)			✓	✓	
10.	Test Records			✓	✓	
11.	Calculation of critical field strength, Calculation in support of average intensity of electromagnetic field on surface of enclosure, Insulation Co-ordination studies, Calculation for touch and step potential, Equipotential earth mat drawings along with design calculation.		✓		✓	
12.	Study report of VFTO generated, Methodology for partial discharge detection, Design criteria regarding location of pressure relief devices, rupture diaphragms, Calculation to show no ferroresonance due to capacitance of GIS for voltage transformers, Design calculation for simulated parameters for seismic level, Measure to mitigate transient enclosure voltages by high frequency current.			✓	✓	

**VENDOR DATA REQUIREMENTS
 FOR
 220KV GIS PACKAGE**

S. N. O.	DESCRIPTION	WITH BID	POST ORDER			REMARKS
			FOR REVIEW	FOR RECORD	WITH DATA BOOK (FINAL)	
13.	List of Recommended Spares, Commissioning Spares, Special Tools & Tackles				✓	
14.	Data Books/ Manuals : Installation Manual, Operating/ Maintenance Manual, Catalogues/ Brochures, Equipment storage procedure at site				✓	

Notes :

1. "TICK" denotes applicability.
2. Post order, drawing / document review shall commence only after approval of Document Control Index (DCI).
3. All post order documents shall be submitted / approved through EIL eDMS portal.
4. Final documentation shall be submitted in hard copy (Seven prints) and soft (three CDs/DVDs) in addition to submission through emails.
5. All drawings & documents shall be submitted in A4 or A3 paper sizes. Documents in higher paper size shall be submitted in exceptional circumstances or as indicated in the MR/Tender.
6. Post order- The schedule of drawing / data submission shall be mutually agreed between BHEL / EIL & the bidder during finalization of Document Control Index (DCI).
7. Bill of Material shall form part of the respective drawing.
- 8.
- 9.
10. All inspection related documents (QA/QC/ITP) shall be submitted to Third Party Inspection Agency (TPIA).
11. '*' indicates the following
 - a. Equipments whose ITP is attached with Contract - ITP for respective equipment shall be followed. Therefore, no ITP is to be furnished for review for those equipments.

Project	Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery			Client	IOCL REFINERY DIVISION - HEAD OFFICE
Unit	COMMON	Location	Panipat	Job No.	B269
				Unit No.	999
i	Operating Mechanism			Motorised	
ii	Mechanical indicator for High speed earthswitch status			Required	
iii	Electrical interlock with associated circuit breaker			Required	
D	Miscellaneous				
1	Paint Shade			RAL-7032	
2	Interface with ECS			Required	
3	SF6 Gas monitoring system			Required	
4	SF6 Gas Handling /filling unit			Required	
5	Spare SF6 gas			Required	
6	Quality of spare gas			10% of total gas as per 6.9.4 of 6-51-0066	
7	Mimic on LV compartment			Required	
8	Voltage Detectors			Required	
MANUFACTURER'S DATA					
A	General				
1	Name of manufacture				
2	Place of manufacture				
3	Type designation				
4	LCC				
5	Degree of protection				
i	Gas compartment				
ii	LCC				
iii	CRP				
6	Enclosure				
7	Enclosure material				
i	Gas compartment				
ii	LCC				
iii	CRP				
9	Rated Voltage			kV	
10	1 min. power frequency withstand (rms)			kV	
11	Lighting impulse withstand voltage			kV	
12	Switching impulse withstand voltage				
13	Rated current				
i	Busbar			A	
ii	Incomers and outgoing feeders			A	
14	1 sec short ckt. withstand capacity			kA	
15	Peak dynamic withstand capacity			kA	
16	Bus bar material				
17	Main Busbar size				
18	Bus bar size for incomers and outgoing feeders			sqmm	
19	Insulating material (busbar support)				
20	Eath busbar material / size			sqmm	
B	SF6 Gas				
1	Average leakage rate of SF6 gas			% / year	
2	Gas monitoring devices (density quaques/pressure switch)				
3	Gas handling and filling arrangement /cart				
	- maximum power requirement			kW	
4	Whether GIS are dispatched filled with SF6 gas				
C	27-SEP-2021	REVISED AND REISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
B	05-JUL-2021	REVISED AND REISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
A	12-MAY-2020	ISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

Project Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery **Client** IOCL REFINERY DIVISION - HEAD OFFICE

Unit COMMON **Location** Panipat **Job No.** B269 **Unit No.** 999

5	SF6 gas pressure for each gas compartment	
i	Design Pressure	
ii	Operating Pressure	
iii	Alarm Pressure	
iv	Lockout Pressure	
6	Pressure of relief device	
7	Spare gas (no. of cylinders,volume/pressure of cylinder)	
C	Circuit Breaker	
1	Type of circuit breaker	SF6
2	Make	
3	Place of manufacture	
4	Type designation	
5	Encloser	
6	Number of poles per phase	
7	Number of interrupting chambers per pole	
8	Number of trip coils	
9	Rated continuous current for I/C and O/G fdrs	
10	Duty cycle	
11	CB Operating mechanism	
12	Short circuit withstand capacity	kA
13	Breaking capacity	kA
14	Peak making capacity	kA
15	% DC component	
16	First pole to clear factor	
17	Power required for opening	W
18	Power required for closing	W
19	Power required for spring charging motor	W
20	Closing time	sec
21	Opening time	sec
22	Provision of manual spring charging	
23	Manual trip device	
24	Mechanical ON/OFF indicator for breaker	
25	Mechanical indication for spring status	
26	Operation counter	
27	Number of auxiliary contacts and their rating	
28	Breaker is trip free	
D	Disconnecter / Earthing switch	
1	Make	
2	Place of manufacture	
3	Type designation	
4	Rated continuous current of disconnector/earth switch for I/C and O/G fdr	
5	Short circuit withstand capacity	
6	Short circuit making capacity of high speed earth switch	
7	Operating mechanism	
8	Type of motor drive	

Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By
C	27-SEP-2021	REVISED AND REISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
B	05-JUL-2021	REVISED AND REISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
A	12-MAY-2020	ISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR

Project Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery **Client** IOCL REFINERY DIVISION - HEAD OFFICE

Unit COMMON **Location** Panipat **Job No.** B269 **Unit No.** 999

9	Number of auxiliary contacts and their rating	
10	Mechanical ON/OFF indicator	
11	Manual operation handle	
12	Manual spring charging	
13	Power required for spring charging motor	
E	Instrument Transformers	
1	Current Transformer	
i	Make	
ii	Place of manufacture	
iii	Type designation	
iv	CT ratio, accuracy & VA burden	
v	Knee point voltage / secondary voltage, accuracy & VA burden	
2	Voltage Transformer	
i	Make	
ii	Place of manufacture	
iii	Type designation	
iv	Primary Voltage / Secondary Voltage ,accuracy & VA burden	
F	Surge Arrestors	
1	Make	
2	Type designation	
3	Place of manufacture	
4	Rated Voltage	kV
5	MCOV(Max. Continuous voltage, accuracy & VA burden)	kV
6	Line discharge class	kA
7	Nominal discharge current	kA
8	High current withstand capacity	kA
9	Temporary overvoltage for 1 sec	
10	Temporary overvoltage for 10 sec	
G	Mechanical	
1	Feeder / Bay	
	Max. overall weight	
	overall Dimensions(Width X Depth X Height)	
2	LCC	
	overall Dimensions(Width X Depth X Height)	
3	CRP	
	overall Dimensions(Width X Depth X Height)	
4.	Largest shipping section	
	Max overall weight	
	overall Dimensions(Width X Depth X Height)	
5	Gas handling & filling plant / service cart	
	Overall dimensions(Width X Depth X Height)	
6	Recommended clearances	
	GIS (Front / rear / above)	mm
	LCC (Front / rear / above)	mm
	CRP (Front / rear / above)	mm

Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By
C	27-SEP-2021	REVISED AND REISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
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Project Overall Project Management and EPCM Services for Capacity Expansion of Panipat Refinery **Client** IOCL REFINERY DIVISION - HEAD OFFICE

Unit COMMON **Location** Panipat **Job No.** B269 **Unit No.** 999

7	Shock loading on foundation	
8	Requirement of EOT crane for GIS	
9	Capacity of EOT crane required	
10	Clear height recommended for EOT crane	
11	Dispatch for each feeder / bay	
H	Copies of following test certificates encl	
	For each type of offered feeder/bay with circuit breaker, disconnector and earthswitch	
1	Short circuit tests(peak and 1 sec withstand)	
2	Making and breaking tests	
3	Temperature rise test	
4	Internal arc test	
5.	Dielectric tests	
6	Operation and mechanical endurance tests	

Notes

- 1 Disconnector class shall be M2.
- 2 Rated line charging interrupting current of breaker shall be as per IEC on light loaded line and 4KM of cable.
- 3 Following equipments shall be supplied along with GIS:
 - a) SF6 Gas Leakage Detector
 - b) Gas Filling and Evacuation Cart
 - c) SF6 Gas Analyser
 - d) Online Partial Discharge (PD) Monitoring System along with all software and hardware as required
 - e) Online SF6 Gas filling system
- 4 Although the equipment shall be installed in Air Conditioned GIS/ Switchgear hall, but same shall be suitable for installation and satisfactory operation in a non air conditioned, tropical, humid and corrosive environment.

C	27-SEP-2021	REVISED AND REISSUED WITH TENDER	ANIL KUMAR GARHWAL	HARISH KUMAR	HARISH KUMAR
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Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

(TECHNICAL)

FORM-I

FORMAT FOR BIDDERS' QUERIES

Date :24/03/2022

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

BIDDING DOCUMENT: SG/B269-999-EB-T-0020/22

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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233	PART-2 Scope of Supply & Work (Civil & UG, Structural, Arch.) Part B: Structural	878 of 3674	1.01)	Concrete block masonry with solid/hollow concrete blocks in substructure and superstructure for all depths and heights.	Kindly clarify the type of masonry whether it will be brick masonry or concrete block masonry.	Bidder to follow tender requirement
234	66 kV HV - HV-100111 GIS			Busbar Protection at 66kV GIS	Low Impedance Bus Bar protection is asked for 66 kV in specs. The number of bays in each section is very high. Centralized Low Impedance Bus Bar protection can be complex in this case as all CT wires will be connected to the Central Unit and this may result in maintenance issues. Distributed Low Impedance Bus bar protection is better solution from maintenance point of view. Please confirm if Distributed Load Impedance Bus Bar protection can be made applicable for all bidders.	Bidder to follow the tender document.
235	B269-999-80-43-SOW-0020 Rev 2	Scope of Work & Supply		Special tools and tackles	Kindly clarify the list of tools which to be considered.	Special tools & tackles as required, shall be supplied by bidder. Bidder to follow tender document.
236	B269-999-16-50-SP-0020 Rev C	Scope of Work & Job Specification (Electrical)	5.7.15.4	On Line Partial Discharge Monitoring system	a) 220kV GIS Bay extension B) Out Door 220kV Isolator Breaker Panel We understand that only sensors to be provided and that shall be integrated with existing PD Monitoring by existing supplier only. Please confirm.	Refer Technical amendment -01.
237	B269-999-16-50-SP-0020 Rev C	Scope of Work & Job Specification (Electrical)	5.7.15.5 & 5.7.15.2	SF6 topping system Gas filling and evacuating plant	We understand that SF6 Gas Topping system can be done through Gas Filling and evacuation plant only and there is no separate equipment is required against Gas Topping system. Kindly accept and confirm.	Bidder to follow the tender document.
238	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C & B269-999-16-50-DS-0035		66kV Trafo feeder connection	As per SLD & 66 kV GIS FEEDER DETAIL DATASHEET, we understand that the Transformer connection from GIS through GIBD only. However, in the same data sheet (SI.No. 18 & 19), Cable size details are mentioned. Please confirm the requirement of termination type(GIBD/Cable)	As per SLD & feeder detail data sheet (-DS-0035) attached with tender, GIBD has been envisaged at secondary side of 220/66kV transformer.
239	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C & B269-999-16-50-DS-0035		66kV Trafo feeder connection	Kindly confirm the battery limit of GIBD against spare Trafo feeders and also confirm the location of spare feeder in Layout.	Refer Technical amendment -01.
240	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C		Requirement of PT/VT	SLD does not show any VT. But in 66kV GIS Feeder data sheet(Refer Note 5 & 7), requirement of Line PT & Bus PT are given. Kindly clarify the feeder wise requirement of VT/PT	Key SLD is indicative only. Requirement of line PT & bus PT shall be considered as per feeder details data sheet & hardware data sheet attached with tender document.
241	B269-999-16-50-DS-0035	66 kV GIS FEEDER DETAIL DATASHEET	Notes-5 of DATA SHEET (Page2 of 2)	Gas Insulated surge arrestor shall be provided in incomers and all outgoing feeders. SLD does not show any S.A.	Please confirm the requirement of Surge Arrestor	Key SLD is indicative only. Bidder to refer feeder details data sheet & hardware data sheet attached with tender document.
242	6-51-0068 Rev. 0	Specification for EHV Power Transformers		Short circuit test report	We understand SCT Report to be provided of "similar" Transformer as per IS 2026 / IEC 60076.	Refer Technical amendment -01.
243	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C & B269-999-16-50-DS-0035		Wave Trap	We understand that wave Trap shall be Hanging Type. No separate foundations are required.	Vertical pedestal mounted wave trap is preferable. However, same shall be decided during detailed engineering based on footprint on (95x95) mtr. available area.
244	6-51-0068 Rev. 0	Specification for EHV Power Transformers		Short circuit test on cable box	We understand from TS that all 220 kV cable box will be oil filled cable box. Thereby SCT test to be conducted on only any one cable box Irrespective of MVA rating .	Bidder to follow tender document.
245	KEY SINGLE LINE DIAGRAM 220KV GIS PACKAGE (SS-100)	DWG no. - 00200 Rev.C & B269-999-16-50-DS-0035		No of Bays	While going through the SLD and DATA SHEET- The Total No. of Breaker Bays are counted as 63. And Non-Breaker BM+BE Bays are 2. Kindly confirm the no of bays to be consider and accordingly control & Protection Panels.	Refer Technical amendment -01.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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