ENGINEERING DESIGN BASIS
ELECTRICAL

JOB NO: **B857**

PROJECT: **EPCM Services for Site Enabling for Bina Petrochemical and Refinery Expansion Project**

CLIENT: **BPCL - BINA REFINERY**

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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 Rev no. 7.
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
ACSR	Aluminium Conductor Steel Reinforced
AN	Air Natural
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
ELR	Earth Leakage Relay
EMPR	Electronic Motor Protection Relay
EPCC	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 Switchgear
GTG	Gas Turbine Generator
HMI	Human Machine Interface
HV	High Voltage
IEC	International Electro-Technical Commission
IS	Indian Standard
LDB	Lighting Distribution Board
LV	Low Voltage
MCC	Motor Control Centre
MCCB	Moulded Case Circuit Breaker
MI	Mineral Insulated
MOV	Motor Operated Valve
MPCB	Motor Protection Circuit Breaker
MPR	Motor Protection Relay

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Code	Description
MV	Medium Voltage
NA	Not Applicable
NGR	Neutral Grounding Resistor
NGT	Neutral Grounding Transformer
NIFPS	Nitrogen Injection Fire Protection System
OFAF	Oil Forced Air Forced
OLTC	On Load Tap Changer
ONAF	Oil Natural Air Forced
ONAN	Oil Natural Air Natural
PCC	Power Control Centre
PESO	Petroleum & Explosive Safety Organisation
PL	Power Limiting
PLC	Programmable Logic Control
PMCC	Power Cum Motor Control Centre
PRP	Parallel Redundancy Protocol
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 Photovoltaic
SR	Self Regulating
STG	Steam Turbine Generator
TP	Three Phase
TPN	Three Phase & Neutral
UPS	Uninterrupted Power Supply
VCB	Vacuum Circuit Breaker
VFD	Variable Frequency Drive
VT	Voltage Transformer
XLPE	Cross Link Poly Ethylene
TCP	***Thyristor Control panel***
SVR	***Static Voltage Regulator***

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	IEEE recommended practice and requirements for harmonic control in electric power systems	IEEE-519	
2	Code of Practice for Electrical Wiring Installations	IS 732	
3	Outdoor type oil immersed distribution transformers up to and including 2 500 KVA,33kV - specification part 1 mineral oil immersed	IS-1180	
4	Code of practice for the fire safety of buildings - Electrical Installations.	IS-1646	

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S.No.	Description	Standards / Codes	Edition
5	Code of practice for selection: installation and maintenance of automatic fire detection and alarm system.	IS-2189	
6	Code of practice for fire safety of industrial buildings - Electrical generating and distributing stations.	IS-3034	
7	Code of practice for Earthing.	IS-3043	
8	Code of practice for Interior Illumination: Part 1 General requirements and recommendations for welding interiors	IS-3646	
9	Application guide for Insulation Coordination.	IS-3716	
11	Guide for safety procedures and practices in electrical work	IS-5216	
12	Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installations.	IS-5572	
13	Code of practice for Industrial Lighting.	IS-6665	
14	Guide for Control of undesirable static electricity.	IS-7689	
15	Guide for improvement of power factor - consumer's installations.	IS-7752	
16	Application guide for on load tap changers.	IS-8478	
17	Reference ambient temperature for electrical equipment	IS-9676	
18	Code of practice for selection, installation and maintenance of transformer.	IS-10028	
19	Code of practice for selection, installation and maintenance for switchgear and control gear.	IS-10118	
20	Voltage bands for electrical installations including preferred voltages and frequencies.	IS-12360	
21	Energy efficient induction motors-three phase squirrel cage	IS-12615	
22	Guide for short circuit calculations in three phase AC systems.	IS-13234	
23	Electrical apparatus for explosive gas atmospheres - General requirements.	IS/IEC 60079-0	
24	Equipment protection flameproof enclosures "d"	IS/IEC 60079-1	
25	Explosive atmospheres - Part 2: Equipment protection by pressurized enclosure "p"	IS/IEC 60079 : PART 2	

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S.No.	Description	Standards / Codes	Edition
26	Electrical Apparatus for explosive gas atmospheres - Powder filling 'q'	IS/IEC 60079 : PART 5	
27	Electrical apparatus for explosive gas atmospheres - Oil immersion "o"	IS/IEC 60079 : PART 6	
28	Electrical apparatus for explosive gas atmospheres Increased safety type "e"	IS/IEC 60079 : PART 7	
29	Explosive Atmospheres Part 10 Classification of Areas Section 2 Combustible dust atmospheres	IS/IEC 60079 : PART10-2	
30	Explosive atmospheres: Part 11 equipment protection by intrinsic safety "i"	IS/IEC 60079 : PART 11	
31	Explosive Atmospheres: Electrical Installations Design, Selection and Erection	IS-16724/ IEC 60079 : PART 14	
32	Electrical apparatus for explosive gas atmosphere -Part-15 Construction, test and marking of type of protection "n" electrical apparatus	IS/IEC 60079 : PART 15	
33	Explosive atmospheres: Part 18 equipment protection by encapsulation "m"	IS/IEC 60079 : PART 18	
36	Explosive atmospheres: Part 31 equipment dust ignition protection by enclosure "t"	IS/IEC 60079 : PART 31	
37	Code of practice for the protection of buildings and allied structures against lightning.	IS/IEC- 62305	
38	Recommended practices on static electricity	OISD-RP-110	
39	Classification of Area for electrical installation at Hydrocarbon Processing and handling facilities	OISD STD-113	
40	Inspection and safe practices during electrical installation	OISD-RP-147	
41	Design aspects for safety in electrical systems	OISD-RP-149	
42	Fire Protection System for Electrical Installations	OISD STD 173	
43	Lightning Protection	OISD-GDN-180	
44	National Electrical Code (NEC) - BIS Publication.	SP-30	
45	Rotating Electrical Machines - Efficiency classes of line operated AC motors	IS/IEC 60034-30-1	
46	Electrical apparatus for use in the presence of combustible dust: Selection and installation	IS/IEC 61241-14	
47	Electrical apparatus for use in the presence of combustible dust: Type of protection "pD".	IS/IEC 61241-4	

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S.No.	Description	Standards / Codes	Edition
48	Recommended Practice for Lightning Protection of Aboveground Storage Tanks for Flammable or Combustible Liquids	API-RP-545	

3.0 GENERAL / DESIGN CONSIDERATIONS

S.No.	Project Philosophy
1	LV - Low Voltage. The voltage which does not normally exceed 250 V.
2	MV - Medium Voltage. The voltage which normally exceeds 250 V and does not exceed 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	FRP Canopy shall be provided for all outdoor equipment except transformers and Capacitor Banks.
6	Circuit breaker provided for PCC/ EPCC/ MCC/ ASB/ LDB/ ELDB incomer shall be 4 Pole type.

4.0 SPECIFIC DESIGN REQUIREMENTS

S.No.	Project Philosophy
1.0	***Equipment numbering philosophy for electrical equipment in this petchem project shall be as listed below (@@@- denotes substation number):*** ***220/69kV Power Trafo.: @@@-TR-011*** ***66/6.9kV Power Trafo.: @@@-TR-021*** ***33/6.9kV Power Trafo.: @@@-TR-031*** ***6.6/0.433kV Dist. Trafo.: @@@-TR-041*** ***415/415V Normal/Emergency Ltg. Trafo.: @@@-TR-061*** ***220kV GIS switchboard: @@@-EHV-101*** ***66kV GIS Isolator: @@@-HV-111*** ***66kV GIS: @@@-HV-102*** ***33kV GIS Isolator: @@@-HV-121*** ***6.6kV Isolator: @@@-HV-211*** ***6.6kV Switchboard: @@@-HV-201*** ***415V Normal/Emg. Power PCC: @@@-PCC-301*** ***415V Normal/Emg. Power MCC: @@@-MCC-311*** ***415V Normal/Emg. Lighting: @@@-LB-331*** ***415V Aux. Power: @@@-ASB-351*** ***Normal lighting panels: @@@-LP-501*** ***Emg. Lighting panels: @@@-ELP-531*** ***Power panels: @@@-PP-601*** ***Space heater panels: @@@-SHP-631*** ***Power panels for Instrumentation: @@@-PPI-661*** ***110V DCDB: @@@-DCDB-701*** ***110V UPS-ACDB: @@@-ACDB-711*** ***ECS panels: @@@-IFP/IRP/RTU-901*** ***Marshalling panels: @@@-DCSMB/ECSMB-911*** ***Tag number indicated above is for the first equipment in the series of that type.***

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S.No.	Project Philosophy
2	***5 years comprehensive AMC charges for UPS, DC chargers, SAS, ECS (including EMS), VFDs/Soft starters (except air fin coolers), TCP and Nitrogen Injection Fire protection systems (NIFPS) shall be taken into account while evaluating the offer. Placement of this comprehensive AMC will be done after expiry of the guarantee period.***
3	Miscellaneous Requirements
3.1	All push button stations shall be provided with 2 nos. earthing lugs/studs.
3.2	***Sufficient no. of 240 volts flame proof plug points along with 240/24 volts flame proof transformer units shall be provided in the plant for shutdown purpose. In the column near each man way minimum TWO no. 240 volts flame proof plug point along with one no. 240/24 volts flame proof transformer unit to be provided. Transformer unit shall be suitable for connecting two nos. flame proof hand lamps. Also sufficient no. of 3 phase 4 wire FLP welding receptacles shall be provided at suitable location near each columns and heaters, at least ONE 3 Phase Welding receptacles near each column & heater.***
3.3	Paint Shade for Electrical equipment"s shall be as below: a) RAL-7032 (for Indoor Equipment) b) 632 as per IS-5/RAL-7031 (for Outdoor Equipment) c) Paint shade of the motor shall be grass green shade No. 218.
3.4	All the MCCs shall be intelligent type with intelligent motor protection relays for all the motors having rating less than 55 KW. All the PLC and DCS signals shall be through relay logic. The iMCCs shall be fully integrated with DCS through Modbus, Ethernet communication.
3.5	***Motor having 1.2 MW or above capacity shall have differential protection. In case the motor is having provision for both VFD and direct on line, necessary provision shall be considered so that differential CT circuit gets by-passed whenever the motor is running in VFD mode.***
3.6	***VFD (critical), failure of which, causes tripping of plant shall have 100% hot standby facility with redundant PLC (with individual signals from field/control room to respective PLC)***
3.7	Shroud shall be provided on the stop push button of LCP/LCS
3.8	Cable trays used shall be GI coated of 100 micron thickness. All the hardware used for joining the cable trays shall be of SS-316 material. However for cooling tower area and CWPH, FRP trays shall be used.
3.9	All cables shall be supplied in metallic drums as specified in the data sheet. Each drum shall have the BPCL PO no., BPCL Project Electrical & BPCL Project Name mentioned on both sides of the drum. The cable shall have BPCL Project Name-Electrical printed on the cable outer sheath at regular intervals.
3.10	Cable tray earthing shall be done by laying GI strip or earthing cable along the cable tray and earthing the tray at every 25m interval.
3.11	Wherever welding has been done on the cable tray, an anti-rust zinc coating shall be provided for preventing rusting of cable tray.
3.12	LIGHTNING PROTECTION: Risk assessment against Lightning strike on plant structure, buildings (including Control room, SRR, Substation), Pump house sheds and tanks etc. shall be carried out as per OISD-GDN-180, IS/IEC 62305 and API-RP-545. Based on risk level assessment mitigation arrangement required to lower the risk less than tolerable limit shall be carried out. In buildings where solar panels have been provided, lightning protection shall be taken care accordingly.
3.13	For temporary electrical installation, requirement of Cl. no. 7 of OISD-147 shall be followed.
3.14	***For maintenance 3 phase (415V 3P + N + E), 125A Power sockets shall be provided so as to ensure complete coverage of the plant through 50 meter radius.***

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S.No.	Project Philosophy
3.15	Convenience outlets (240V) 15/5 A shall be provided so as to ensure complete coverage of the plant through 20 meter radius. Near the manholes of the vessels 24V transformer unit shall be fixed type and shall be provided with single hand lamp at each man hole. Design of the sockets shall be such that 240V and 24V plugs are not interchangeable.
3.16	***The following minimum standard equipment shall be supplied in each substation:*** ***Fire extinguishers (type Co2 and Dry chemical powder), 1 pcs framed key diagram of electrical system(SLD), Discharge earthing rod-2 sets, first aid kit & Breaker trolley (1 no. suitable for each type)***
3.17	Solar power fencing system shall be provided for new boundary wall.
3.18	Independent LCS with ammeters shall be provided for all the auxiliary motors of HVAC system i.e. cooling water pump motors, condensate pump motors, chiller pump motors etc. These LCS shall have LOTO facility.
3.19	***LOTO system facility (Box, lock & Key, HASP,Wire etc.) shall be provided in each substation.***
3.20	***In every manned generating station, sub-station or switching station of voltage exceeding 650 V, an artificial respirator shall be provided and kept in good*** ***working condition.***
4.0	Following clause-wise modifications / additions to Design Philosophy (6-51-0099 Rev.7) shall be applicable:
4.1	Clause 4.1 System Design Philosophy First line to be modified as Safety to personnel and equipment both during Installation, testing, commissioning, operation and maintenance.
4.2	Clause 4.6.2 Note-c) Voltage Drops The subject note shall be read as "For MV motors, the voltage available at the motor terminals must not be less than 80% of rated voltage during start up and reacceleration. However, motor shall be able to start up at 75% of the rated voltage available at the motor terminals."
4.3	Clause 4.10.3 Protection and metering schemes The subject clause gets modified as "Metering shall be provided to keep a record of power and cumulative energy consumption and supervision of all concerned parameters....."
4.4	Clause 4.17.6 Electrical Surface Heating System Add a new clause as "For Electrical Heat Tracing system, temperature sensing device shall be RTD. Controllers with all requisite status and control signals shall be provided accordingly. These signals shall be also wired upto control room including supply of cables by vendor."
4.5	***Clause 4.12 Emergency Power supply system for UPS and DC system shall be as below:*** ***a) For UPS system – UPS-1 incomer shall be fed from EPMC/EPCC, whereas UPS-2 & SVR (bypass) shall be fed from PMCC/PCC.*** ***b) For DC system (switchgear control & critical lighting) – charger-1 shall be fed from EPMC and charger-2 shall be fed from PMCC/PCC.***
4.6	Clause 4.15.2 Plant Communication System The subject clause gets modified as "Each exchange shall be designed to have at least 20% spare capacity"
4.7	Clause 4.15.4 Plant Communication System Add a new clause as "Call station shall have min 4 keys. One for master, one for slave to slave and two spare."
4.8	Clause 4.16.4 Fire Detection and Alarm System The subject gets modified as "Each panel and each loop / zone shall have at least 20% spare capacity.
4.9	Clause 4.16.7 Fire Detection and Alarm System Add a new clause as "Manual fire call point as per OISD requirement."
4.10	***DELETED***
4.11	***DELETED***

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S.No.	Project Philosophy
4.12	Clause 5.3.7 Switchgear In the subject clauses Future load growth of 20% shall be considered instead of 10%.
4.13	Clause 5.3.9 Switchgear The subject clause gets modified as "Circuit breaker / contactors controlling motor feeders shall have a rating of at least 150% of the maximum continuous rating instead of 125% of the connected load."
4.14	Clause 5.3.12 Switchgear Add at the end of the clause "Breaker rating shall be in-panel rating"
4.15	Clause 5.3.14 Switchgear Add at the end of the clause "Motors 55KW and above shall be provided with air circuit breaker having DC control supply for closing and tripping purpose."
4.16	***Clause 5.3.15 Switchgear Add at the end of the clause "1 no. PCC at each substation shall be provided with one 800A feeder on each side to feed construction power supply. The construction power supply module shall be equipped with numerical relay having all necessary protections, energy meter and CBCT with sensitive earth fault protection along with other protection. However, these feeders shall not be considered in transformer sizing."***
4.17	Clause 5.3.16 Switchgear The subject clause gets modified as "For ALL motors, CT in Y phase shall be provided in switchboard for remote metering."
4.18	Clause 5.3.17 Switchgear Add at the end of the clause " ACBs/MCCBs/Switches of I/Cs & B/C of MCC, ASB, LDB & ELDB shall have 4 poles".
4.19	Clause 5.3.19 Switchgear Add a new clause "In HV switchgear, horizontal bus bar size in the complete board shall be of same size. Similarly size of the bus bar from horizontal bus to breaker and breaker to outgoing shall be designed based on breaker rating and not on CT/feeder rating."
4.20	Clause 5.3.20 Switchgear Add a new clause "Bus bar material for PCC & MCC shall be Electrolytic grade Aluminium / Copper and Neutral bus bar size shall be same as phase bus bar size."
4.21	Clause 5.4 Bus Duct Add at the end of the clause "Bus bar material shall be Electrolytic grade Aluminium / Copper and Neutral bus bar size shall be same as phase bus bar size."
4.22	Clause 5.7.1 DC Power Supply System The subject gets modified as " ------- DC distribution board. Charger shall be dual redundant type with separate battery set (2 sets with 100% capacity for switchgear protection and control & 1 set with 100% capacity for DC Emergency Lighting) for each charger."
4.23	Clause 5.7.3 DC Power Supply System In the subject clause 20% spare capacity for future load growth shall be considered instead of 10%.
4.24	Clause 5.7.5 DC Power Supply System In the subject clause 20% Spare feeders for future use shall be considered instead of 10%
4.25	Clause 5.8.4 Uninterrupted Power Supply System In the subject clause 20% Spare feeders for future feeders shall be considered instead of 10%.
4.26	Clause 5.8.3 Uninterrupted Power Supply System In the subject clause 20% Spare capacity for future load growth shall be considered instead of 10%
4.27	Clause 5.8.6 Uninterrupted Power Supply System Add a new clause "ACDB shall have current and voltage transducer to give signal to DCS for total current & voltage. Same to be connected to DCS also apart from other UPS alarm."
4.28	Clause 5.11.7 Emergency Generator Add a new clause "The Emergency generator shall have brushless excitation system with PMG & Pilot excitor or rotating diodes."
4.29	Clause 5.11.8 Emergency Generator Add a new clause "In house breaker shall be provided near Emergency generator set for positive isolation.
4.30	Clause 5.11.9 Emergency Generator Add a new clause "Emergency Generator shall have auto/ manual synchronizing facility for trial/ going on load/ offload."
4.31	Clause 5.13.3 and 5.13.4 Cables and Wires In the subject clause XLPE insulated cables shall be considered instead of PVC insulated cables.

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S.No.	Project Philosophy
4.32	Clause 5.13.8 Cables and Wires In the subject clause considering 20% future load growth, all incoming cables to switchgear/UPS/DC system/ DB's and other equipment shall be sized instead of 10%. Cable for capacitor banks shall be sized for 135 % of the rated capacitor current.
4.33	Clause 5.13.9 Cables and Wires The subject clause gets modified as "The incoming cable for heat tracing power distribution panel and lighting distribution board shall be with four cores....."
4.34	Clause 5.13.12 Cables and Wires Add a new clause "Outer sheath shall be FRLS for all the cables and wires."
4.35	***Clause 5.13.13 Cables and Wires Add a new clause "For LAN and electronic data transfer, only fiber optic cables shall be used."***
4.36	Clause 5.15.3 Convenience Receptacles The last line of the subject clause gets modified as "..... In hazardous areas as well as in safe areas flameproof hand lamps shall only be rated for 24V & shall be LED based"
4.37	***Clause 5.16.3 Actuators for Motor Operated Valve Add new clause "MOVs shall be installed away from the heat source (radiated heat) so as to avoid failure of electronic cards due to the heat or MOV control shall be away from the heat source. If this is not possible, feasibility of having control unit located at suitable location shall be explored during detailed engineering".***
4.38	***Clause 5.20 Add a new clause "Conformal coating shall be done for all PCB, electronic equipment as per min. Class 3C2 (Harsh environment) of IEC 60721-3-3. Alternatively, it shall comply with ANSI/ ISA S71.04 class G3 or IEC 60068-2-60 for mixed flow gas test or ASTM B845. Supporting documents shall be provided for the same"***
4.39	Clause 6.5 Substation / MCC Room Design Philosophy In the subject clause instead of rolling shutter door MS door in two parts shall be provided.
4.40	Clause 6.8 Substation / MCC Room Design Philosophy The subject clause gets modified as "------ Light fittings in this room shall be flameproof LED type. -------The battery room shall be provided with minimum two nos. flameproof exhaust fans..... No switches shall be provided inside the battery room."
4.41	Clause 6.9 Substation / MCC Room Design Philosophy Add at the end of the clause "Excitation panel, Digital voltage regulator panels & PLC based thyristor control panel shall also be located in air conditioned room."
4.42	Clause 6.11 Substation / MCC Room Design Philosophy The last line of clause gets modified as "Fire protection for transformers and switchgear room shall be provided to comply with the requirements of OISD-STD-116,117, 173 and as per latest CEA rules."
4.43	Clause 7.1 Installation Design Philosophy The 2nd line of the subject clause gets modified as ".... Shall generally conform to EIL/BPCL standard specifications and installation standards".
4.44	***Clause 7.2.1 Cabling System at the end of the clause following shall be added "Preferably, total cable route connected to fire water pump/motors starting from receiving substation to Fire water pump house shall be through a built-in RCC cable trench"***
4.45	Clause 7.2.2 Cabling System In the 2nd line of the subject clause instead of sand, trenches in hazardous areas shall be filled up with stone dust.
4.46	***Clause 7.2.5 Cabling System In the 1st line of the subject clause instead of 10%, 20% space for future cables shall be considered on cable trays, racks and trenches.***
4.47	***Clause 7.3.6 Earthing System Add new bullet point, All values shall comply to latest revision of OISD Std. – 137.***

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S.No.	Project Philosophy
4.48	Clause 7.3.12 Earthing System Add a new clause "If required/ suggested by the original equipment manufacturer of electronic equipment"s like UPS, Excitation voltage regulator, Numerical Relays, LCP etc. dedicated clean earth shall be provided by having dedicated earth pits."
4.49	Clause 7.4.5 Lighting System The 3rd last line of the subject clause gets modified as "Adequate number of self contained flameproof portable hand lamps and battery operated....."
4.50	***Clause 7.4.8 Lighting System The subject clause gets modified as ".....Tall structure shall have aviation obstruction LED based lighting as per statutory requirements."***
4.51	***Clause 5.16.4 Actuators for Motor Operated Valve Add new clause "All MOV actuators shall be non-intrusive type."***
4.52	***Clause 5.16.5 Actuators for Motor Operated Valve Add new clause " Fire safe Electric Actuators shall be provided with Intumescent paint for fire proofing and same shall be suitable for 30 minutes. Fire Proofing shall be ensured as per UL-1709 for hydrocarbon fire."***
4.53	Clause 5.3.8 Switchgear : The subject clause gets modified as "Spare outgoing feeders shall be provided in all switchgear. For HV switchboards, the number of spares shall be as indicated in SLD. For other switchboards (and where not specifically indicated in SLD), at least one number of each type of outgoing feeder or 20% of each type of outgoing feeder, whichever is more, shall be provided as spare in the switchboard."
4.54	Clause 5.13.4 Cables and Wires : The subject clause gets modified as "The control cables shall be twisted pair, copper conductor, XLPE insulated, armoured, extruded FRLS PVC outer sheathed and individual & overall shielded. Control cables with twisted pair and shielding shall also be provided for specialized applications i.e. for CT secondary current, differential protection, restricted earth fault protection, etc."
4.55	***Clause 5.13.10 Cables and Wires : The subject clause gets modified as "All control cables shall have minimum 10% spare pairs, except that control cables having up to seven pair shall have one pair as spare."***
4.56	Clause 4.16.1 Fire Detection and Alarm System Add at the end of the clause "The system shall be connected to nearest control room and fire station control room through redundant fibre optic network. FA panel shall have Modbus connectivity features for interfacing with DCS system in lieu of repeater panel".
4.57	Clause 5.3.17 Switchgear In the subject clauses maximum rating of bus-bars 800A for ASB/LDB/ELDB shall be considered instead of 1250A.
4.58	Clause 5.14.4 Control station Add a new clause as "Stop Push button shall have provision of putting LOTO locks and padlocks."
4.59	Clause 5.10.1 HV Capacitor Banks Add at the end of the clause "Dry type series reactor shall be used for capacitor banks. Dry type series reactor shall not be integrated with capacitor cubicle and shall be separate standalone panel."
4.60	***Clause 5.14.1 Control station Add at the end of the clause "For air cooler motors, Emergency stop push button station shall have ammeter and stop push button at grade level."***
4.61	Clause 5.16.6 Actuators for Motor Operated Valve Add new clause "MOVs shall be explosion proof and suitably fire rated of 1100 deg. C for 30 min duration."
4.62	Clause 6.15.j The subject gets modified as "Battery rack to wall clearance for Single row, single/double tier & Double row, single tier as 750mm instead of 100mm.

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S.No.	Project Philosophy
4.63	***Clause 4.1 System Design Philosophy, Add at the end of the clause " "All motors efficiency class shall be IE3 (for Hazardous area) / IE4 (safe area). Distribution transformer upto 2500 kVA shall be minimum energy efficiency level 2 / Table-3 of GOI notification dtd 08 Dec 2023, BEE star rating 2 (including latest GOI notifications). All lighting fixtures shall be LED type. Intelligent MCC (i-MCC) shall be considered for MV switchboards (draw-out type).***
4.64	***Clause 4.4.1 Capacity of Electrical system, Add at the end of the clause "Electrical system shall be designed to suit single feeder operation. However in case of three incomers any two incomers shall be able to take full load of the system."***
4.65	Clause 4.10.1 Protection and Metering Schemes, Add sr. no. "d) Type 2 coordination for LV system shall be ensured"
4.66	Clause 4.11.1 DC Power Supply, Add at the end of the clause "Critical Lube oil pumps of generators/ critical equipment or as specified by OEM/Process Licensor."
4.67	cl. no. 4.19: Add the following: For Existing refinery revamp - New ECS & EMS system shall be considered of same make as existing system. OEM basis. For Petchem - Separate new ECS & EMS system shall be considered. The same need not be on OEM basis.
4.68	Clause 4.6.1 (Note-2) shall be replaced with the following "In case of difficulty in achieving specified voltage drops in cables up to lighting panel, total 5% drop from Auxiliary switchboard/ LDB up to lighting points may be permitted".
4.69	New cl. no. 5.3.19: Add "LOTO facility shall be provided in switchgear."
4.70	cl. no. 4.15: Add the following: For Existing refinery revamp - New Plant communication system shall be considered of same make as existing system. OEM basis. For Petchem - Separate new Plant communication system shall be considered. The same need not be on OEM basis.
4.71	cl. no. 4.16: Add the following: For Existing refinery revamp - New Fire alarm system shall be considered of same make as existing system. OEM basis. For Petchem - Separate new Fire alarm system shall be considered. The same need not be on OEM basis.
4.72	cl. no. 5.7.1: Add the following "DC system for switchgear control: refer attached sketch (option-II), however the battery bank shall be 2x100%. DC system for Lighting: Refer attached sketch (option-II), with 1x100% battery bank."
4.73	cl. no. 5.8.1: Add the following "UPS system shall be as per attached sketch (option-III), however the battery bank shall be 2x100%"
4.74	cl. no. 5.11.5: replace the following "The Emergency generator set shall have at least 20% spare capacity for meeting future requirements"
4.75	cl. no. 6.15: Add sl. no. o as "Spacing between the two LT panels where the breakers are mounted shall be minimum 2 meters."
4.76	New cl. no. 6.22: Add "SLD of HT board shall be painted behind the HT board indicating the bus bar arrangement."
4.77	New cl. no. 6.23: Add "All the modules shall have stickers (Yellow background with black letters) or letter painting indicating KW, cable size, FLC at front and back for HT and front for LT. A bigger size sticker having list of motor tag nos. and module no. shall be pasted on both side of the panel end covers"

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S.No.	Project Philosophy
4.78	New cl. no. 6.24: Add "All spare cut outs in sub-station floor shall be properly marked and flushed with floor level"
4.79	New cl. no. 6.25: Add "Spare entries in panels, gland plates shall be blocked to avoid dust and vermin ingress."
4.80	New cl. no. 6.26: Add "Insulation paint (epoxy coating) shall be applied in substations as per the highest system voltage in respective substations subject to market availability."
4.81	New cl. no. 6.27: Add "All HT tools, First aid Box etc. shall be provided and located at an earmarked place in sub-station and labelled."
4.82	New cl. no. 6.28: Add "Two nos. (min.)gas masks shall be provided conspicuously and installed and maintained at accessible places for use in the event of fire or smoke."
4.83	New cl. no. 6.29: Add "Fire buckets filled with clean dry sand and ready for immediate use for extinguishing fires in addition to fire extinguishers suitable for dealing with fires, shall be conspicuously marked and kept in all generating stations, enclosed sub- stations and switching-stations in convenient location."
4.84	New cl. no. 6.30: Add "In every manned generating station, sub-station or switching station of voltage exceeding 650 V, an artificial respirator shall be provided and kept in good working condition"
4.85	New cl. no. 6.31: Add "Instructions, in English or Hindi and the local language of the District and where Hindi is the local language, in English and Hindi for the resuscitation of persons suffering from electric shock, shall be affixed; in a conspicuous place in every generating station, enclosed sub-station, enclosed switching station"
4.86	***New cl. no. 6.32: Add "415V, 400A DB (FLP) total 4 nos. shall be provided at suitable locations in each process unit of petchem in consultation with BPCL. It is proposed to take the supply source for this DB from the ASB/EPCC of same substation having DG backup."***
4.87	New cl. no. 6.33: Add "10/20 Pairs telephone cable shall be laid from nearest existing telephone JB to the plant end (for Hazardous area - analogue telephones)"
4.88	New cl. no. 6.34: Add "All new substations shall be connected to MRS through fibre optic cable network. FO cable laying can be planned along with Power cable from MRS. All interfacing shall be through OFC cables such as differential protection, inter-tripping & ECS connectivity etc."
4.89	New cl. no. 6.35: Add "Fire proofing of all substation entries for cable / bus duct shall be done."
4.90	cl. no. 7.2.3: In the statement "30 m" shall be read as "15 m"
4.91	cl. no. 7.2.14: Add the following after the statement "GI cover shall be considered for top most cable tray and bottom of the lowest cable trays shall also be covered with GI sheet. GI type sheet shall be selected based on the type of cable trays. Tray cover shall be provided for the outermost trays of vertical droppers."
4.92	cl. no. 7.4.12: The statement shall be read as "Lighting system design shall be based on minimum illumination levels as specified in latest PNGRB guidelines"

5.0 OWNER / CLIENT SPECIFIC REQUIREMENTS

5.1 SITE CONDITIONS

S.No.	Description	Selected Option	Available Options
1	Equipment design temperature	45 DEG C	a)40 DEG C b)45 DEG C c)50 DEG C d)Any other
2	Relative humidity	86%	

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S.No.	Description	Selected Option	Available Options
3	Soil Resistivity	As per soil investigation report	
4	Minimum temperature. for battery sizing	10 DEG C	a)10 DEG C b)20 DEG C c)Any other
5	Minimum temperature For Electric heat tracing	1.1 DEG C	
6	Altitude above mean sea level	Less than 1000m above MSL	a)Less than 1000m above MSL b)Any Other
7	Maximum temp	48 DEG C	
8	Minimum temp	1.1 DEG C	
9	Pollution level for outdoor equipment	Heavy	a)Light b)Medium c)Heavy d)Very heavy

5.2 POWER SOURCE DETAILS

S.No.	Description	Selected Option	Available Options
1	Power System	220kV system (Independent system) For Petchem. 33kV System for BINA Refinery.	a)Grid Supply b)In house CPP c)Grid supply with CPP d)Existing electrical system
2	Grid Supply	220kV from MPSEB for PETCHEM.	a)Yes b)No (Below Clause is not applicable)
2.1	Name of sub station	***400kV MPPTCL substation Bina***	
2.2	Number of feeders	***2 circuits (DCDS)***	
2.3	Length of feeder	***21 KM***	
2.4	Type /size of conductor/ cable size	* __ sqmm	
2.5	Voltage	220 kV ± 10%	
2.6	Frequency	***50 Hz ± 5%***	
2.7	Maximum fault level		*
2.7.1	3 Phase fault	***12615.04 MVA***	
2.7.2	1 Phase fault	***10739.69 MVA***	
2.7.3	X/R Ratio	*	
2.8	Minimum fault level	* kA, sec.	
2.9	Design fault level	50 kA for 3 sec.	
2.10	Basic Insulation Level	460 kV / 1050 kV	
2.11	System neutral Earthing	Solid Grounded	
2.12	Parallel operation of incomers	Yes*	a)YES b)NO
2.14	PLCC requirement	Yes	a)YES b)NO
3	CPP and its configuration		
3.1	Type of Generator	STG	a)STG b)GTG
3.1.1	Number of Generators	REFER CPP DESIGN BASIS	

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S.No.	Description	Selected Option	Available Options
3.1.2	Rating of Generator/Voltage/P.f	REFER CPP DESIGN BASIS	
3.1.3	Requirement of Generator Circuit Breaker	No	a)YES b)NO
3.2	Parallel operation with grid	Yes*	a)YES b)NO
3.3	Black Start DG Envisaged	As per CPP Design Basis	a)YES b)NO
3.4	Electricity duty metering	*	a)YES b)NO
4	Existing System	220kV Grid with Internal Generation	
4.1	Name of Substation	Existing Substation	
4.2	Voltage rating	33 kV	
4.3	Maximum fault level	*	
4.4	Design fault level	40 kA for 1 sec.	
4.5	System neutral earthing	Solid earthed	
4.6	NGR rating (if applicable)	Not Applicable	
5	Emergency generator	Centralised (REFER NOTE-1)	a)Centralised b)Distributed
5.1	Generator Voltage	6.6kV	a)6.6KV b)415V c)Any Other
5.2	Parallel operation with other sources	Momentary Paralleling However during load trial, continuously paralleling with grid is also envisaged.	a)Momentary Paralleling b)Continuously Paralleling
5.3	Auto Starting	Yes	a)YES b)NO
5.4	Type of Emergency Generator	*	a)Diesel b)Gas
6	Solar Power System		
6.1	Solar PV System	Provided	a)Provided b)Not provided
6.2	Buildings on which solar power system to be mounted	Non Plant Building, Admin Building. Further Sub-station, Control Room & Warehouse not associated with Process Units	
6.3	Technology	Silicon Crystalline (Mono/Poly)	a)Silicon Crystalline Mono b)Silicon Crystalline Poly c)Silicon Crystalline (Mono/Poly)
6.4	Battery	Not Provided	a)Provided b)Not Provided
6.5	Connectivity	Local Switchboard	
6.6	Monitoring System	Data logger based connection to SAS	a)Data logger based connection to SAS b)Internet web based with HMI

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**** - New Power System selection option shall be finalised after detailed study by MPPPTCL.***

Note:-

1. The rating and Qty. of emergency Generator sets shall be finalized during detailed engineering.The emergency Generator set for the plant shall cater to emergency loads of various units,utility and offsite areas.

2. Based on Process Licensor/ Flare Loading, the emergency generator option (distributed / centralized) shall be selected during detail engineering. However, preferred option shall be centralized Emergency generator with black start facility.

3. For Bina refinery power distribution is 33KV & 6.6 KV level from Existing substation. For new refinery unit loads, Power distribution will be 33KV & 6.6 KV.

4. Power factor correction with APFC control shall be at 6.6kV bus. Exact value of Power factor at load centre & grid connection shall be ascertained during detail engineering.

5. Location of solar inverter: Installed in switchgear hall either floor or wall mounted as per site condition as suggested by PMC/EPCM.

6. Power distribution for the new petchem complex shall be as below:
a) Normal power - through 220kV Grid
b) Emergency power - through Diesel generator (DG)
c) Critical/Most Essential power - Being fed from existing CPP having existing grid backup.

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	For Bina Refinery 33kV/6.6kV/415V ± 10% For Petchem 220kV/66kV/6.6kV/415V ± 10%	a) 11kV/6.6kV/415V ± 10% b) 33kV/6.6kV/415V ± 10% c) 66kV/6.6kV/415V ± 10% d) 66kV/11kV/415V ± 10% e) Other
1.2	Frequency	***50 Hz ± 5%***	a)50 Hz ± 3% b)60 Hz ± 3%
2	DC System		
2.1	Electrical protection and Control system	110V ± 10%	a)220V ± 10% b)110V ± 10%

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S.No.	Description	Selected Option	Available Options
2.2	DC critical Lighting system	110V ± 10%	a)220V ± 10% b)110V ± 10%
2.3	Instrumentation Power Supplies	Refer Instrumentation Design Basis	

Note:
1.0 Refer section 5.6.10 of this document for design voltage/frequency variation for motors.

2.0 110 V DC control supply shall be considered for 220 KV GIS substation at Petchem and for all other substations.

5.3.2 UTILISATION VOLTAGE

S.No.	Description	Selected Option	Available Options
1	Primary EHV/HV distribution voltage	33kV (For Bina Refinery) 66kV (For Petchem)	a)33kV b)66kV c)11kV d)Any other
2	Secondary HV distribution voltage	6.6kV	a)11kV b)6.6kV c)3.3kV d)Any Other
3	Primary EHV/HV distribution system neutral Earthing	Solidly Earthed	a)Solidly Earthed b)NGR c)Unearthed
4	Secondary HV distribution system Neutral Earthing	NGR	
5	HV motor voltage for DOL	6.6kV (For motors rating > 132kW)	
6	MV motor voltage	415 V AC (DOL)(For motors rating 0.18<=kW<=132)	
7	AC Motors	240V AC (except MOVs) (For motors rating < 0.18kW)	
8	DC Motor	110V DC (if required)	
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 (incoming power supply)	
13	Auxiliary Boards incoming power supply	415V AC,TPN	
14	Welding Receptacles	415V AC,TPN	
15	Electrical heaters	415V AC, TP	
16	Normal Lighting/Emergency Lighting	240V AC,SPN	
17	LAN UPS Output Voltage	***230V AC,SPN***	

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1. Utilisation Voltage for Convenience outlets shall be 240 VAC, SPN.

2. For higher rated motors such as MAB, WGC etc.(in ECU) & Extruder (in PPU/LLDPE) etc, input supply shall be provided at 66kV level respectively which will be step-down to suitable voltage level for feeding respective motors.

3. Contactor shall close satisfactorily at any value between 85 % and 110 % of their rated control supply voltage. The limits between which contactors shall drop out and open fully shall be between 75 % to 20 % for a.c. The drop off voltage shall be governed by following criteria and same shall be finalized during detailed engineering:-Process critical motors/Electrical system stability.

4) The above S. no. 5 & 6 are related to DOL motors. For VFD fed motors refer Cl. no. 5.6.15.

5) following new subclauses for utilisation voltage shall be added as:
a) Rim seal UPS : 230V AC, SPN
b) Weigh bridge: 230V AC, SPN

5.3.3 UTILISATION VOLTAGE FOR CRITICAL SUPPLIES

S.No.	Description	Selected Option	Available Options
1	Switchgear protection control power supply	110V DC (Note-1)	a)220V DC b)110V DC
2	Critical lighting power supply	110V DC	a)220V DC b)110V DC
3	Input power supply for Plant communication system	240V AC SPN (With Dedicated battery back up)	a)240V AC SPN (With Dedicated battery back up) b)110V AC UPS
4	Input power supply Fire alarm system	240V AC SPN (With Dedicated battery back up)	a)240V AC SPN (With Dedicated battery back up) b)110V AC UPS
5	Power supply for electrical annunciation panel	Not Applicable	a)220V DC b)110V DC
6	Control supply for VFD/ Soft-Starter/ Thyristor Panel	230V AC UPS	a)110V DC b)220V DC c)110V AC UPS d)230V AC UPS
7	Normal Instrumentation power supply	Refer Instrumentation design basis	
8	Critical instrumentation power supply	Refer Instrumentation design basis	
9	Instrumentation Shut-down system power supply	Refer Instrumentation design basis	
10	DC system for lighting and switchgear control	Separate	a)Separate b)Common

Notes: 1.
110 V DC control supply shall be considered for 220 KV GIS substation at Petchem and for all other substations.

5.3.4 SYSTEM NEUTRAL EARTHING

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S.No.	Description	Selected Option	Available Options
1	EHV System	Solid earthed	a)Solid earthed b)Resistance earthed
2	HV System	6.6kV (Resistance earthed) 33kV (Solid earthed)	a)Solid earthed b)Resistance earthed c)Unearthed
3	415V System	Solid earthed	a)Solid earthed b)Resistance earthed
4	GT/ST Generator with generator transformer	NGT	a)NGT b)NGR c)Solid earthed d)Unearthed
5	GT/ST Generator without generator transformer	Not Applicable	a)NGT b)NGR c)Solid earthed
6	Emergency Generator-HV System	NGR	a)NGT b)NGR c)Solid earthed
7	Emergency Generator-415V System	Solid earthed	a)Solid earthed b)Resistance earthed
8	NGR rating- HV System	___A	
9	NGR rating- 415V System	___A	

5.3.5 OPERATING PHILOSOPHY

S.No.	Description	Selected Option	Remarks
1	Auto/Manual transfer at primary distribution voltage bus with momentary paralleling	YES (continuous parallel operation)	a)NA b)YES c)NO
2	Auto/Manual transfer at secondary distribution voltage bus with momentary paralleling	Yes (Continuous parallel operation)	a)YES b)NO
2.1	Bus transfer scheme	Normal	a)Fast b)Normal c)NA
3	Auto /Manual transfer at MV with momentary paralleling		
3.1	At PCC/EPC/EPMCC Level	Yes (Note-1)	a)YES b)NO c)OTHER
3.2	At MCC Level (In case ACB incomers and Bus couplers)	Not Applicable (Note-2)	a)YES b)NO c)OTHER
3.3	At ASB/ LDB Level	No (including MCC level)	a)YES b)NO c)OTHER
4	Continuous Parallel operation of Incomers		
4.1	Primary EHV/HV voltage	Yes for 220kV & 66 kV GIS switchboards at Petchem & 33kV GIS switchboards at Bina Refinery.	a)YES b)NO

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S.No.	Description	Selected Option	Remarks
4.2	Secondary HV voltage	Yes	a)YES b)NO
4.3	PCC/PMCC	No	a)YES b)NO
5	Power Factor Correction	Required	
5.1	Power factor improvement capacitors- location	6.6kV bus with APFC	a)6.6kV bus b)415V c)Both 6.6kV & 415V d)Any other
5.2	Minimum P.F. to be maintained at Power Transformer Primary at respective sub-station	***Refer Note-4 below***	a)0.95 b)0.90
5.3	Monitoring at Power Transformer Primary at respective sub-station	Yes	a)YES b)NO
6	Load shedding	Yes (Note-3)	a)YES b)NO
6.1	Voltage level for Load Shedding	For Bina refinery 33kV, 6.6kV For Petchem 66kV, 6.6kV	a) 66kV b) 33kV c) 11kV d) 6.6kV e) 0.415kV - PCC/PMCC incomer f) Any Other

Notes:-
1. Auto changeover logic/ABT is not envisaged in normal (GRID power) EHV, HV, MV, LV switchboards. However, for Emergency DG switchboard (EPCC/EPMCC etc.) shall have the facility of auto changeover/ABT.

2. Manual Transfer shall be considered for MCC switchboards.

3. Voltage level for Load Shedding shall be 66KV,33 KV,415V). Load shedding at 415V-PCC/EPCC level shall be 415V switchboard (I/C-ACB, B/C-ACB and outgoing ACB feeders).

4. Power factor 0.99 (min.) - at Grid transformer primary
Power factor 0.995 (min.) - at 6.6kV switchboard

5.4 CONTROL-PROTECTION - METERING

5.4.1 CONTROL PHILOSOPHY

S.No.	Description	Selected Option	Available Options
1	Location of Relays for Generator	Separate Relay and Control Panel	
2	Location of Relays for Outdoor Switchyard	Not Applicable	
3	Location of Protection relays for EHV/HV switchgear		

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S.No.	Description	Selected Option	Available Options
3.1	Primary voltage EHV/HV switch gear	***On switchgear (33kV at Bina refinery switchboards)*** ***Bay controller and separate Relay & control panel for 220kV GIS & 66kV GIS in Petchem***	a)On switchgear b)Separate relay and control panel
3.2	Secondary Voltage HV switchgear	On 6.6kV switchgear	a)On switchgear b)Separate relay and control panel
4	EHV/HV Switchgear control		
4.1	Generator	Control Relay Panel	a)Control Relay Panel b)SCAP c)ECS
4.2	Outdoor Switchyard	Not Applicable	a)Control Relay Panel b)SCAP c)ECS (for breaker)
4.3	Primary voltage EHV/HV switch gear	***On switchgear (for 33kV at Bina Refinery switchboards)*** ***Separate Relay & control panel (for 220kV GIS & 66kV GIS in Petchem Project)***	a)On switchgear b)SCAP (for breaker) c)Separate relay and control panel
4.4	Secondary Voltage HV switchgear	On 6.6kV switchgear	a)On switchgear b)Separate relay and control panel c)ECS
5	Numerical Protection/Monitoring system for		
5.1	Generators	Yes	a)YES b)NO
5.2	EHV system	Yes	a)YES b)NO
5.3	HV Switchboard	Yes	a)YES b)NO
5.4	PMCC/PCC	Yes	a)YES b)NO
5.5	MCC (for incomer and bus coupler having ACB)	Yes & IMPR relay for motor feeders upto 45kW.	a)YES b)NO
6	Control and logic through numerical relays	Yes (Note-3)	a)YES b)NO
7	Hardwired synchronization control panel-SCAP	Yes	a)YES b)NO
7.1	Synchronizing trolley required	Yes	a)YES b)NO
7.2	Type of Panel	*	a)Mosaic b)Simplex
7.3	Extent of Coverage on SCAP	*	
8	Type of annunciation panel	Not Applicable	a)HMI b)Part of SCAP

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S.No.	Description	Selected Option	Available Options
9	Load shedding panel	Yes (Part of ECS with RTU)(Note-5)	a)Part of ECS b)Separate PLC c)Hardwired
10	Method of motor starting		
10.1	HV Motors	DOL (above 132kW). VFD controlled soft starter shall be considered. if required depending upon motor rating (Note-1)	a)Direct on line (Note-1) b)Auto transformer c)Voltage Controlled Soft starter d)V/F Soft starter e)Dedicated transformer 2 MW and above
10.2	MV Motors	DOL upto 132 kW motor rating (Note-1)	a)Direct on line b)V/F Soft starter c)Voltage Controlled Soft starter
11	Starting MVA limitation conditions for Motors		
11.1	HV Motors	***Starting current 500% (inclusive of positive tolerance) of full load current (Note-2)***	
11.2	MV Motors	As per IS-12615-2018/IEC 60034-30	

**** To be decided during detail engineering.***

Notes:

1. 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 power system study.

2. Lower starting current shall be specified if required based on motor start-up study.

3. STOP signals shall be directly hardwired. However, start and DCS permissive signals shall be routed through numerical relay for time stamping & monitoring. this will also reduce wiring within the switchboards. All status signals to DCS shall be through ECS on Modbus TCP IP protocol except critical process signals used in interlocking which shall be hardwired and to be decided during detail engineering.

4. Separate On, Off, Spring Charged, Trip Circuit Healthy, Process Trip, Breaker in Test, Breaker in Service indication lamps required.

5. Voltage level for Load Shedding shall be 66KV,33 KV,415V). Load shedding at 415V-PCC/EPCC level shall be 415V switchboard (I/C-ACB, B/C-ACB and outgoing ACB feeders).

6. In case of VFD/Soft starter, starting current shall be limited to 100% of FLC.

5.4.2 POWER ISOLATION FOR TRANSFORMERS LOCATED REMOTELY AWAY FROM EHV/HV SUBSTATION

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S.No.	Description	Selected Option	Available Options
1	Push button in transformer bay for tripping remote breaker	Yes (Break glass type)	a)YES b)NO
2	Local Primary isolating breaker	Standalone breaker (Indoor type) in respective substation.	a)YES b)NO
3	Protection relay required	Only feeder differential at receiving end.	a)YES b)NO

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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 note below)
(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(23)	YES(23)	-	-	-	-	-
4	Motor protection relay with (50, 50N,46, 49, 50L/R,86,95)	99	-	-	YES(3)	-	YES(3)	-	-
5	Instantaneous restricted earth-fault relay (Earthed side)	64R(11)	-	-	-	-	-	YES(24)	YES(24)
6	Instantaneous over-current relay	50	YES	YES	-	-	-	-	-
7	Instantaneous earth-fault relay	50N	YES(4)	YES	-	-	-	-	-
8	Differential protection relay	87	YES(5)(16)	YES(16)	YES(6)(16)	YES(7)(16)	-	YES(16)	-

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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(20)	YES	YES	YES	YES	YES	YES	YES
11	Transformer auxiliary relay	63	YES	YES	-	-	-	-	-
12	Under-voltage relay with timer	27/2	-	-	YES	-	-	YES(9)	YES(9)
13	Check synchronisation relay	25	-	-	-	-	-	YES(10)	YES(10)

5.4.3.2 POWER GENERATION AND EXTERNAL POWER SUPPLY

Minimum protection relays for Synchronous generator (GTG/STG), generator transformer Grid power supply incomer and Synchronous motors shall be as follows:
(YES - Applicable)

S.No.	Relay Description	NEMA Code	Generator	Generator Transformer	EHV Incomer	EHV Transformer	Syn. Motor
1	Distance protection	21	YES		YES		
2	Synchronous check	25	YES(27)	YES	YES		
3	Under voltage with timer	27	YES		YES		YES
4	Reverse power	32	YES				YES
5	Low power flow	37	YES				
6	Loss of excitation	40	YES				YES
7	Negative sequence	46	YES				YES
8	Over current	50				YES	YES

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S.No.	Relay Description	NEMA Code	Generator	Generator Transformer	EHV Incomer	EHV Transformer	Syn. Motor
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 and 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	
28	Bus bar differential and check	87B/ 87CH		YES			
29	Trip circuit supervision	95	YES	YES	YES	YES	

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S.No.	Relay Description	NEMA Code	Generator	Generator Transformer	EHV Incomer	EHV Transformer	Syn. Motor
30	Dead bus charging relay	98	YES(27)	YES	YES		
31	Over fluxing	99	YES	YES(28)			
32	Out of step	78	YES				YES
33	Thermal overload relay	49G	YES				
34	Local breaker backup protection	50LBB	YES				

5.4.3.3 RELAY PROTECTION PHILOSOPHY

S.No.	Project Philosophy
1	In case of HV switchboards with continuous parallel operation of incomers, following additional relays shall be provided: a. One set of 87B (Bus differential) and 95 B (Bus wire supervision) for each bus section. b. 67 and 67N (Directional IDMTL over current and earth fault) relays for the incomers.
2	Instantaneous earth fault (50N) shall be provided only for transformer with delta primary.
3	For breaker fed motor feeders. Relay 50 shall not be provided for contactor controlled feeders.
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 1200 kW and above, excluding VFD fed motors.***
7	For critical/long feeders and plant feeders connected to main power generation and distribution bus. A plant feeder implies outgoing feeders from one switchboard to another switchboard of same voltage level.
8	***Trip circuit supervision relay 95 shall be provided separately and NOT as part of the numerical relay for HV/ MV feeders wherever numerical relays are provided.***
9	Wherever auto-transfer feature is provided
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.

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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 & iMPR 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	One set of bus differential relays (87B) and bus wire supervision relay (95 B) for each bus section shall be provided for HV switchboards connected directly to generation buses.
17	In case of numerical relays, all relays shall be comprehensive units including all protection, metering and control having communication protocol of IEC 61850.
18	Under voltage and over voltage function along with associated timer shall be part of the numerical relays.
19	***Auto changeover logic/ABT is not envisaged in normal (GRID power) EHV, HV, MV, LV switchboards.*** ***However, for Emergency DG switchboard (EPCC/EPMCC etc.)shall have the facility of auto changeover/ABT.***
20	Tripping relays (86) & Trip Circuit supervision relay (95) shall NOT be part of numerical relay.
21	1 No. of 86 relay and 1 no. Auxiliary relay (VAA type) shall be considered for HV and MV motor rated 55KW and above and it shall be separate and not part of Numerical relays wherever provided. This is required to facilitate quick starting of the motor in case of tripping due to process/instrument interlock. VAA relay for process trip shall be auto reset but flag shall be hand reset type only.
22	Breaker control switch shall be hardwired type.
23	Stand by earth fault relay 51G shall be provided in the outgoing HV transformer feeder.
24	Restricted earth fault relay 64R shall be provided for transformer rating >= 2 MVA in the incomer of switchboard fed from transformers.
25	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.
26	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.
27	For directly connected generator.
28	For large transformer as per manufacturer's standard.
29	Relay 87 and 64R shall be numerical relay and shall not be part of main comprehensive numerical relay. CT for 87 and 64R can be clubbed, as two core of single CT.
30	Stabilizing resistor shall be provided in residual earth fault connection for all motors and transformers even in case of numerical relay to avoid spurious tripping during start up.
31	Feeder differential relay shall be connected with optical fibre cable for communication between two relays.

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S.No.	Project Philosophy
32	For transformer feeder, WTI/OTI/Buchholz relay alarm to be connected to hooter so that other can come to know on actuation of these alarms
33	Check zone scheme for bus-differential protection shall be provided wherever bus differential scheme is provided.
34	Process Trip indication on the LV motor feeders with rating less than 55KW with manual reset facility shall be considered. Also, the process trip contactor shall not be dependent on the Reset PB. The logic of process trip shall be independent of Reset PB and Process Trip Indication lamp.
35	Numerical relays shall be used for logic build-up in addition to protection & monitoring provided induced voltage phenomenon is taken care to prevent maloperation of digital inputs(DIs).
36	Interposing relays for all the DI signals from DCS/ PLC in VFD"s/ soft starters shall be considered.
37	***Low impedance-based busbar differential protection scheme shall be considered in 220kV & 66kV GIS***

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	-	-	-	-	-	-	-	-

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S.No.	Feeder Type	A	V	Hz	PF	MW	MWH	HM	MVAR	MVAH	MVA
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. In addition to conventional metering, all metering shall be provided through numerical relay in case respective switchboard is having numerical relay.

5. Field ammeters are to be provided for all motors.

6. Motor feeder shall be provided with 4-20mA current/ voltage/ power dual output transducers (as required) for feedback to DCS.

7. CT has to be 0.2s, burden 15 VA. PT has to be 0.2, burden 50 VA. Main and check energy meter shall be availability based tariff meter, 0.2s class accuracy, with feature of every 15 minutes recording of all the readings. The above is applicable for Petchem, open access power measurement.

8. Communicable Multifunction Meter (MFM) shall be used for metering purpose as per table above for all feeders.

9. Conventional ammeter, voltmeters and communicable multifunction meter shall be considered for all incomers of switchboards (HV/MV/PCC/EPMC/MCC/ASB/LDB).

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10. Communicable Multi function meters (MFM) shall be considered with interconnectivity to existing ECS system for Bina Refinery and new ECS system for Petchem.
11. Metering for generator shall be provided as minimum as specified above but not be limited to the same.
12. Ammeter provided at push-button station shall be 240 degree taut band moving coil type. However for smaller rating motor (less than 1 HP), this ammeter can be normal moving iron type.
13. Harmonic meter shall be considered in the incomers of 220kV, 66kV, 33kV, 22kV, 11kV & 6.6kV switchboards/Isolator breaker panels.
14. Metering facility for space heater current of transformer and bus duct shall be provided on Space hater distribution board (DB).
15. Metering facility shall be provided on switchboard panels(Motor Feeder > 22 KW) for Space heater current.

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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	a)IEC 61850 b)open protocol
3	System architecture	IEC 61850 RSTP	a)IEC 61850 RSTP b)IEC 61850 PRP c)Redundant architecture for other open protocols
4	Data concentrator for SAS	***Not required.***	a)Required b)Not Required
5	Communication with other devices		
5.1	Communication with ECS	Yes	
5.1.1	Protocol for communication with ECS	IEC 61850	a)IEC 61850 b)Modbus
5.2	Communication with DCS	Part of ECS RTU	a)Part of data concentrator b)Part of ECS RTU c)No d)Part of ethernet switch
5.2.1	Communication with DCS-HV Switchboard	Part of ECS RTU	a)Part of data concentrator b)Part of ECS RTU c)No d)Part of ethernet switch
5.2.2	Communication with DCS-PCC/PMCC	Part of ECS RTU	a)Part of data concentrator b)Part of ECS RTU c)No d)Part of ethernet switch
5.2.3	Communication with DCS-Conventional MCC	***Not Applicable***	a)Part of data concentrator b)Part of ECS RTU c)No d)Part of ethernet switch

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S.No.	Description	Selected Option	Available Options
5.2.4	Communication with DCS-Intelligent MCC	Part of ECS RTU	a)Part of data concentrator b)Part of ECS RTU c)No d)Part of ethernet switch
5.2.5	Protocol for communication with DCS	Modbus TCP/IP	
5.3	Communication with VFD & UPS	Part of ECS RTU	a)Part of data concentrator b)Part of ECS RTU c)No d)Part of ethernet switch
5.3.1	Protocol for communication with VFD & UPS	Modbus TCP/IP	
6	HMI for SAS	Operator Cum Engineering Workstation	a)not required b)operator cum engineering workstation c)1 operator & 1 engineering workstation
7	Laptop	Common laptop for EHV, HV & MV for each substation with all necessary software.	a)not required b)common for HV & MV for each substation c)seperate for HV & MV for each substation
8	Local storage of data	part of HMI	a)not required (part of ECS) b)part of HMI c)part of data concentrator
9	Relay parameterization	Through numerical relays / laptop & SAS HMI	a)SAS HMI b)ECS HMI

Notes:
1. Dual redundant gateway shall be provided for control/ communication with DCS/ PLC for i-MCC.
2. Communicable multi function meters installed on panels shall have communication facility with open protocol. Energy meter/MFM on panel shall have accuracy class min 0.2.
3. Parameterization and fault record downloading facility shall be provided from Engg. Station.

5.5.2 EHV OUTDOOR SWITCHYARD

S.No.	Description	Selected Option	Available Options
1	Type	220kV EHV GIS substation at Petchem	
2	Type of bus	Double bus bar system	a)String bus b)Tubular bus
3	Structure for outdoor	Not applicable	a)Galvanised b)Painted c)Not applicable
4	Bus material	As per type test design	a)ACSR b)Aluminium

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EHV Switchyard shall be read as EHV GIS SUBSTATION

5.5.3 SUBSTATION FEATURES

S.No.	Description	EHV	HV	MV	MCC/Elec. Room
1	Elevated with trays in cable cellar	YES	YES	Yes	***NO***
2	Raised with internal trenches	NO	NO	NO	***YES***
3	All top cable entry with trays below ceiling	NO	NO	NO	NO
4	Pressurisation against ingress of dust	NO	NO	NO	NO
5	Roof slab for				
5.1	Generator Transformer/ Tie transformer	NO	NO	NA	NA
5.2	Power transformer	***YES***	***YES***	***YES***	NO
5.3	Distribution transformer	YES	YES	YES	-
6	Air conditioning with false ceiling of switchgear hall	YES (Note-3)	YES	YES	***YES***
7	EOT Crane in EHV GIS area	YES (Note-2)	NA	NA	NA
8	Lift for substation having 2 Switchgear room floors	YES	YES	YES	NA
9	Electrical maintenance room	YES	YES	NO	NA
10	Electrical store room	YES	YES	NO	NO
11	Separate room for Instrumentation RIO panels	NO	***YES***	***YES***	***YES***
12	Exhaust fans/Ventilation fans for Switchgear room	NO	NO	NO	***NO***

Note :

1. Column HV is defined as Sub-station having full fledged EHV/ HV switchboard.
2. EOT Crane is not envisaged for isolator breaker panels located inside substation building.
3. False ceiling is not envisaged for areas where EHV GIS panels are located.
4. For 33 KV and above rated switchboards, Gas Insulated Switchgear (GIS) with double bus-bar shall be provided. GIS switch board shall have bus tie on each bus and bus-coupler between buses (In all 4 section i.e. Bus 1A / 1B and 2A / 2B).
5. DELETED.
6. Annunciation for tripping of HVAC system shall be provided in DCS.
7. Exhaust fans shall be provided in cable cellar at feasible location.
8. Each substation shall be provided with a toilet and maintenance room outside

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switchgear hall (with split AC) which shall have facility for workmen to keep their tools.
9. 20A single phase DP MCB with industrial socket shall be provided at every 20 mtr interval in the switchgear hall.
10. MCC/Electrical room shall be without any power/distribution transformer. Any building with power/distribution transformer shall be considered as substation.

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	Air conditioned room	a)Air conditioned room b)Non air conditioned room
3	Battery charger in control room	Air conditioned room	a)Air conditioned room b)Non air conditioned room
4	Variable speed drive panels	Air-conditioned room in substation	a)Air-conditioned room in substation b)SRR
5	Thyristor controlled panels	Air-conditioned room in substation	a)Air-conditioned room in substation b)SRR
6	UPS System	Air conditioned room in control room & substation	
7	Lead-Acid and Nickel-Cadmium	Separate room	a)Separate room b)Common room
8	Location of VRLA battery	Air conditioned room	
9	Annunciation panel	Not applicable (Note-6)	
10	Lighting Transformers	Switchgear room	a)Switchgear room b)Separate transformer room
11	Neutralisation pit with drain from flooded battery room	Required	a) Required b) Not required

Notes:-

1. Battery room shall be preferably located in corner side at Ground floor of the sub-station 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, receptacles shall be of flameproof construction and certified for gas group II-C classified locations. Heat detectors installed in battery room shall be of intrinsically safe type with zener barrier. Battery Circuit Breaker shall be located outside battery room.
4. Battery rooms shall be provided with wash basin, eye washer and safety shower. Acid resistant apron, face shield and gloves shall be provided in each battery room.
5. Exhaust fans and flameproof light fittings in battery rooms shall be installed in such a way that they can be accessed using suitable ladders without removing the batteries.
6. Annunciation is part of ECS & separate annunciation panel in not required. However, provision of annunciation with hooter shall be considered as part of HV AIS switchboards. IRF status of numerical relay and Fault alarm status for VFD/excitation

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system/FA/PA system shall also be provided.
7. Separate air conditioning system/ split air conditioning system shall be considered for UPS battery room in control room if battery type is VRLA.

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	***Not Applicable (Part of EHV GIS)***	a) Single Bus b) Double Bus c) Main and Transfer Bus
2	Circuit breaker type	Not Applicable	
3	Isolator type	***Centre rotating (For gantry Isolator)***	a)Pantograph b)Semi Pantograph c)Centre rotating d)Centre break

5.6.1.2 EHV SWITCHBOARD

S.No.	Description	Selected Option	Available Options
1	Type of Switchgear	Gas Insulated	
2	Busbar	Double	a)Single b)Double
3	Circuit Breaker Type	SF6	
4	Local Control Cabinet	***Separate free standing (for 220kV GIS) & Mounted on GIS (for 66kV GIS) (refer Note-2)***	a)Mounted on GIS b)Separate free standing c)As per vendor drawing

Note:
1. Short Circuit rating & duration : 50kA for 3 sec. (for 220kV GIS) & 40kA for 3 sec. (for 66kV GIS).
2. Local control cabinet for 220kV GIS shall be mounted in GIS hall.
3. Two relays of different make shall be used for Petchem 220 KV LILO incomer line side protection.
4. GIS switchboard shall have bus tie on each bus and bus-coupler between buses (In all 4 section i.e. Bus 1A / 1B and 2A / 2B).
5. Following equipment shall be supplied along with GIS of 220kV, 66kV and 66kV IBPs (for IBP's 1 set for each substation) :
a) SF6 Gas Leakage Detector
b) Online SF6 gas Filling and Evacuation Cart
c) SF6 Gas Analyser
d) Portable Partial Discharge (PD) Monitoring System

5.6.2 HV SWITCHBOARD

S.No.	Description	Selected Option	Available Options
1	Execution	Drawout (AIS) Fixed (GIS)	a)Drawout b)Fixed

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S.No.	Description	Selected Option	Available Options
2	Type of switchgear	Air Insulated & Gas insulated	a)Air insulated b)Gas insulated
3	Bus bar	Single bus & Double bus	a)Single bus b)Double bus
4	Circuit breaker type	VCB	a)SF6 b)VCB
5	Motor Control	Breaker	a)Breaker b)Vacuum contactor
6	Marshalling Cabinet	Part of HV Switchboard	a)Part of HV Switchboard b)Separate c)Not Applicable
7	Internal Arc Classification		
7.1	Short Circuit Current (kA)	40	a)40 b)25 c)Any Other
7.2	Duration (Second)	1	a) 0.1 b) 0.2 c) 0.5 d) 1.0 e) Other
8	No. of bus-coupler	Two	a)One b)Two c)Other
9	Thermography window	No	a)No b)Yes
10	Online temperature monitoring system	Yes	a)No b)Yes

Notes:
1. Short Circuit Rating and duration:
i) DELETED.
ii) 33kV HV (GIS) at Bina Refinery location - 40kA for 1sec.
iii) 6.6kV HV (AIS) at Bina Refinery & at Petchem location - 40kA for 1Sec.
2. LOTO facility shall be provided for each module.
3. ON/OFF indication shall also be provided on rear side of panel.
4. Auto tripping of HT circuit breaker upon opening rear side cover shall be provided.
5. All the numerical relays used in a particular substation shall be time synchronized with GPS.
6. 6.6 KV and above rating HV switch boards shall have two bus couplers.
7. For HV switchboards, the number of spares shall be as indicated in SLD.
8. The back side cable compartment cover of HV switchboard shall not be able to open while the feeder is electrically connected. Breaker shall trip if any person opens the back side cover preferably by mechanical interlock otherwise on electrical interlock. Back side cover shall have on / off LED indication lamp.
9. Breaker operated direct contacts to be used to the maximum extent for DCS / interlock. If it is not possible than same to be given through bi-stable relays.
10. HT off load isolator shall not be used, in its place normal VCB panel shall be used.
11. Instrumentation remote IO panels are envisaged in substation for command interface. whereas all status signals to DCS shall be through ECS on Modbus TCP IP protocol except critical process signals used in interlocking through PLC which shall be hardwired and to be decided during detail engineering.
12. GIS Isolating breaker panels (for 33kV & 66kV) shall be single bus type.

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

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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	
2	VT Secondary	110V AC	

5.6.4 TRANSFORMERS (POWER/DISTRIBUTION)

S.No.	Transformer	Voltage Ratio	Vector Group	Tap Changer	Cooling
1	Grid power transformer	220/66kV	YnYn0	OLTC	ONAN/ONAF or ONAN/ONAF/OFAF
2	Generator transformer	11/66kV	YNd 11	Off-circuit	ONAN or ONAN/ONAF
3	Tie Transformer	During detail engg.	During detail engg.	Off-circuit	ONAN/ONAF
4	Generator auxiliary transformer	During detail engg.	During detail engg.	Off-circuit	ONAN/ONAF
5	Intermediate power transformer	33/6.9kV for Bina Refinery 66/6.9kV for Petchem	Dyn 11	OLTC	ONAN/ONAF
6	Dedicated (e.g. for VFD)	As per OEM	As Reqd.	Off-circuit	Dry type
7	Distribution transformer (<= 3150 KVA)	6.6/0.433kV	Dyn 11	Off-circuit	ONAN

Note:
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) DELETED.
3) Automatic fixed Fire fighting system of Nitrogen Injection Fire Protection System (NIFPS) type shall be provided for transformers rated 10MVA and above or Oil quantity greater than 2000 litres.
4) Lighting transformer and dedicated transformer for VFD shall be dry type.
5) Flexible oil resistant air bag shall be provided for conservator for transformer rated above 750KVA.
6) All the power and distribution transformers shall be high efficiency. Distribution Transformer rated upto 2500 kVA shall be minimum Energy efficiency level-2 as per IS:1180 (Part-1) table-6/Table-3 of GOI notification dtd. 08 Dec 2023, BEE star rating 2 (including latest GOI notifications).
7) Emergency stop PB station shall be provided for tripping of transformer. The emergency trip PB station shall be located outside the transformer yard and shall have on / off indication & protective shroud for avoiding inadvertent operation.

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8) In case of space constraint, dry type transformers shall be considered with rating up to 2MVA and temperature rise shall not be more than 95 deg. C over and above ambient temperature.
9) Transformer terminal box shall be properly approachable and platform shall be provided for primary and secondary terminal box inspection for cover opening / maintenance purpose wherever feasible.

5.6.5 MV SWITCHBOARD

S.No.	Description	Selected Option	Available Options
1	PCC / PMCC		
1.1	Breaker panels	Drawout Single front	
1.2	Contactor feeders	Drawout Double front	a)Drawout Single Front b)Drawout Double front c)Fixed Single front
2	MCC	Drawout Double front iMCC (Intelligent MCC)	a)Drawout Single Front b)Drawout Double front c)Fixed Single front
3	ASB	Drawout Double front	a)Drawout Single Front b)Drawout Double front c)Fixed Single front
4	LDB	Drawout Double front	a)Drawout Single Front b)Drawout Double front c)Fixed Single front
5	Motors		
5.1	PMCC	FVNR feeder with iMPR for motors rating upto 45kW. ACB motor feeder with NR for motors rated 55 kW and above	
5.2	MCC	FVNR Feeder with iMPR for Motors rating upto 45KW.	
6	Switchboard for small package (AC system, Pressurisation system ,Bagging plant etc)		
6.1	Type	***Compartmentalised Fixed type, single front***	a)Compartmentalised Fixed type b)Drawout type
6.2	Configuration	Two incomers without Bus coupler	a)Single incomers b)Two incomers without Bus coupler c)Two incomers with Bus coupler
7	Marshalling Cabinet	Separate (Note-11)	a)Part of MV Switchboard b)Separate c)Not Applicable
8	Internal Arc Classification		
8.1	Short Circuit Current (kA)	65 kA	a)65 kA b)50 kA c)35 kA d)25 kA e)Any other

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S.No.	Description	Selected Option	Available Options
8.2	Duration (Second)	0.1	a)0.1 b)0.2 c)0.5 d)1.0 e)Any other
9	Bus-bar material	Aluminium	a)Aluminium b)Copper c)Any other
10	Closed door operation required	No	a)Yes b)No
11	Type of cooling for switchboard (Note-2)	Natural	a)Natural b)Forced
12	Incomer & bus-coupler for MCC & ASB	ACB	a)ACB b)Heavy duty switch
13	Incomer & bus-coupler for LDB	MCCB	a)MCCB b)Heavy duty switch

Notes:

1. MCC shall be limited to 1250A and ASB shall be limited to 800A.
2. Up to 4000A rating, forced cooling shall not be provided.
3. Power Panel and Lighting Panel shall be wall mounted fixed type.
4. IP plate of LV MCC shall have control on/ off switch & on / off / trip indication lamp in case same cannot be accommodated in relay LED.
5. LOTO facility shall be provided for each module.
6. Breaker operated direct contacts to be used to the maximum extent for DCS / interlock. If not possible same to be given through bi-stable relays.
7. Separate control switch & control fuse for isolation of control supply in all the motor feeders shall be provided. Separate control supply facility from space heater bus for checking module healthiness in TEST position shall not be provided.
8.All the numerical relays & iMPR used in a particular substation shall be time synchronized with GPS.
9. iMPR & Numerical relays shall also be used for for control logic except Start/ Stop command. For iMPR, PLC and DCS signals shall be through relay logic provided timing shall be less than 50ms as per instrument/ process requirement.
10. DELETED.
11. Marshalling Cabinet for MV Switchboard shall be standalone type (not part of MV switchboard panel). However, separate marshalling panel not required wherever remote I/O panels are located in substation.
12. Instrumentation remote IO panels are envisaged in substation for command interface. whereas all status signals to DCS shall be through ECS on Modbus TCP IP protocol except critical process signals used in interlocking which shall be hardwired and to be decided during detail engineering.
13. MV switchboard (PCC/EPCC) shall be provided with 2 bus couplers.
14. All the MV switchboards (PCC/PMCC/EPC/EPMCC/MCC) shall be provided with online temperature monitoring system.
15. Floor mounted fixed type non-compartmentalised space heater DB (SHDB) with 2 incomers shall be considered for space heater power supply in substations for EHV,HV,MV,LV switchboards.

5.6.6 MEDIUM VOLTAGE MOTOR STARTER TYPE

S.No.	Description	Selected Option	Available Options

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S.No.	Description	Selected Option	Available Options
1	Contactor and switch fuse with overload relay	Not Applicable	
2	Contactor, switch fuse and overload relay with CBCT & ELR	Not Applicable	
3	Contactor and switch fuse with communicable motor protection relay	Not Applicable	
4	Air circuit breaker with numerical motor protection relay	***55kW and above***	
5	Contactor and MPCB with overload relay	Not applicable	
6	Contactor, MCCB with CBCT & ELR	Not Applicable	
7	MCCB with contactor and communicable Motor Protection Relay	< 37kW (Note-1)	
8	Contactor and MCCB with overload relay with CBCT & ELR	37kW & 45kW (Note-1)	
9	Contactor, MCCB with O/L Relay	Not applicable	

Note-

1. Instead of overload relay, all motor feeders upto 45kW shall be provided with iMPR (intelligent motor protection relay) for Draw-out type switchboards, whereas for Fixed type switchboards (in HVAC pkg, Lift/elevator etc.) it shall be with non-communicable DMPR (Digital motor protection relay).
2. Double Break MCCB with LOTO facility shall be provided in MV switchboard panels.
3. R-C Circuit across power contactor and low-burden auxiliary contactor for receiving start/ stop command from field shall be provided in all DOL starter feeders.

5.6.7 MEDIUM VOLTAGE OUTGOING FEEDER TYPE

S.No.	Description	Selected Option	Available Options
1	MCCB and CBCT with ELR	Not Applicable	a)___A and up to ___A b)Not Applicable
2	Switch fuse	Not applicable	
3	Switch fuse with Contactor and CBCT & ELR	Not applicable	
4	MCCB with Contactor and CBCT & ELR	***250A & upto 400A (refer Note-2). 32A/63A for Aux. heater feeders.***	a)___A and up to ___A b)Not Applicable
5	***MCCB with E/F release***	***below 250A***	a)___A and up to ___A b)Not Applicable

Note-

1. All MCCBs shall be provided with shunt trip coil and shall be microprocessor based.
2. CBCT+ ELR & contactor shall be provided for all MCCB feeder for E/F protection for 250A and above rated feeders.

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

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

Notes;
1. To be made available at switchgear as per Instrumentation philosophy.

5.6.9 CONTROL SUPPLY VOLTAGE

S.No.	Description	Selected Option	Available Options
1	Breaker control	110V DC	a)220V DC b)110V DC
2	Breaker spring charging	110V DC	a)240V AC b)220V DC c)110V DC d)230V AC UPS
3	Contactor feeder	240V AC	a)240V AC b)220V DC c)110V DC d)230V AC UPS
4	Control supply for earth fault relay in contactor feeder	***110V DC (iMPR – for Drawout swbd) / 240V AC (DMPR – for fixed type swbd)***	a)240V AC b)220V DC c)110V DC d)230V AC UPS
5	Control supply for contactor motor starter and contactor feeder	***Tapping P-N of Respective Feeder***	a)Control Transformer common for each bus b)Tapping P-N of Respective Feeder c)Control transformer in individual DOL starter d)NA
6	MCCB/ MPCB shunt trip voltage	240V AC	a)220V DC b)110V DC c)240V AC

Notes:
1) DELETED.
2) DC control supply to MCC is applicable for main substation where DC power supply is available.
3) Control supply of VFDs and exciter panel supply shall be from UPS. Dual redundant battery banks shall be provided for each UPS.
4) All modules in LT shall have isolate, test and service position

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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	30 kW and Above
4	Additional canopy (outdoor motors)	Yes	Yes
5	Design voltage variation	±10%	±10%
6	Design frequency variation	***±5%***	***±5%***
7	Combined voltage / frequency variation (Design)	±10 % Any combination of above	±10 % Any combination of above
8	Energy efficient IE motors	NA	Yes (Refer Note-2)

Notes:

1. MOV Actuators:
1.1. Motors for MOV actuator shall have F class of insulation with temperature rise limited to class-B.
1.2. MOVs shall not change their status during voltage drop/power outages. The control supply for MOV shall be tapped internally from the 415V, 3ph supply to MOV. No separate DC/UPS control supply provision shall be made by the Owner.
1.3. Actuator of MOV shall have provision for Partial Stroke Test (PST). Actuator of MOVs shall be commissioned by OEM.
2. Motor Efficiency class shall be IE3 (for Hazardous area) / IE4 (for Safe area) as per latest IS 12615 /IEC 60034-30.
3. Permanent arrangement for monsoon protection for AFC motors shall be provided. Necessary arrangement shall be provided so that water ingress through the shaft in the motors can be avoided.
4. Thermistors shall be provided in VFD driven motors and the provision for tripping the motor in case of excess temperature shall be considered.
5. DELETED.
6. Motor antifriction bearings on DE & NDE shall have greasing facility to lubricate the bearings at site.
7. There shall be proper provision for carrying out the greasing of NDE/DE side of AFC/Vertical HT motor from ground floor. Longer length of grease pipe shall be made available for AFC/vertical HT motors with grease nipple at bottom of the pipe for ease of greasing.

5.6.11 UPS SYSTEM

S.No.	Description	Selected Option	Available Options
1	Redundancy	100%	a)50% b)100%
2	Type of redundancy	Parallel redundant (Note-10)	a)Parallel redundant b)Hot standby c)Dual redundant
3	Back-up time	60 minutes	a)30 minutes b)60 minutes c)120 minutes

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S.No.	Description	Selected Option	Available Options
5	Separate fault diagnostic unit (Note 1)	No	a)YES b)NO
6	Battery type	Ni-Cd	a)Ni-Cd b)Lead acid c)VRLA
7	Battery configuration	(2 x 100% configuration)	a)(2 x 50% configuration) b)(2 x 100% configuration) c)(1 x 100% configuration)
8	UPS Output Supply	Single Phase	a)Single Phase b)Triple Phase
9	UPS Output Voltage	110V AC (Final voltage shall be as per Instrumentation Design Basis)	
10	ACDB outgoing feeder type	Switch fuse unit	a) Switch fuse unit b) MCCB c) MCB

Note-

1. Separate Fault Diagnostic Unit (FDU) is not required.
2. UPS for CFAP of FA system, PA system, Rim Seal fire protection system & Weigh bridge shall be non redundant with bypass type with VRLA/SMF battery.
3. By pass supply shall be through SVR (static voltage regulator) only.
4. UPS & ACDB shall be as below:
a) Output of UPS-1 & 2 along with SVR output shall be paralleled.
b) ACDB shall be provided with 2 incomers (incomer-1 from UPS-1/SVR, incomer-2 from UPS-2/SVR). Both incomer and bus coupler shall always be NC (normally closed).
5. All outgoing feeders in UPS ACDB which are going to the field shall be provided through isolating transformers as per instrumentation requirement.
6. Outgoing feeders with isolation transformer shall be provided with HRC type switch fuse on primary side and semi-conducting type fuse along with switch on secondary side.
7. Outgoing feeders without isolation transformer shall be provided with semi-conducting type fuse along with switch.
8. DELETED.
9. DC to DC convertor between UPS charger and battery bank is not acceptable i.e. battery bank float voltage shall be equal to charger float voltage.
10. UPS shall be designed with 100% isolation with UPS-1 and 2.
11. Type of switchboard for DCDB, UPS ACDB, PDB, MDB, weatherproof/flameproof (as per hazardous area classification) outdoor type switchboards: Compartmentalized Fixed type, single front.
12. UPS for VFDs/soft starter, ECS, sub-station Automation system (SAS) HMI, Thyristor control panel shall be parallel redundant type with Ni-cd battery (2 x 100%)". LAN UPS Power requirement (substation/MCC, SRR/CR etc.) shall also be fed from this UPS through isolation transformer. In case of UPS for LAN system is required for remote buildings where substation UPS is not available, the same shall be with non-redundant with bypass type with VRLA battery.
13. 230V AC LAN Power requirement for substation, MCC room, SRR & CR shall be fed from respective UPS of the buildings.

5.6.12 COMMUNICATION SYSTEM

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S.No.	Description	Selected Option	Available Options
1	Plant Communication System	Yes	a)YES b)NO
2	Telephone System	***IP based (Refer Instrumentation EDB & Note-1 below)***	a)YES b)NO c)Separate
3	Telephone system and plant Communication system	Separate	a)Separate b)Integrated
4	Interface of Communication system		
4.1	With fire alarm system	Yes	a)YES b)NO
4.2	With telephone system	Yes	a)YES b)NO
5	FLP Telephone for process units	Yes (Note-2)	a)YES b)NO
6	Telephone cable type (Outdoor)	***Non Jelly filled (copper) for Analogue telephones only. for IP telephones refer Instrumentation EDB.***	a)Non Jelly filled b)Jelly filled

Notes:
1) At least 2 phones per switchgear floor, shall be provided in the substation.
2) FLP telephones shall be provided for process units, and process plant lifts also.

5.6.13 FIRE DETECTION AND ALARM SYSTEM

S.No.	Description	Selected Option	Available Options
1	Type	Digital addressable	a)Conventional b)Analogue addressable
2	Name of buildings to be provided with Detectors	Control room, sub-station, SRR, Administration building/office, other buildings as required.	
3	Detection System	Break Glass, Multi sensor detection, heat detector, Linear heat sensing cables (if required), Linear beam detector (if required)	
4	Type of manual call point	Without call back facility	a)With call back facility b)Without call back facility
5	Qty of Siren and location	***1 no. at each substation and Petchem MCR***	
6	Power supply for Siren	***415V AC (Emergency)***	a) 415V AC b) 110V AC UPS c) 240VAC
7	Siren range	8 Km(Diametrically)	a)5 Km(Diametrically) b)8 Km(Diametrically)
8	Response indicator for rooms and concealed area for Addressable Fire alarm system	Yes	a)YES b)NO c)Not Applicable

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S.No.	Description	Selected Option	Available Options
9	Detector type for battery room	Intrinsically safe-IIC	a)Flameproof b)Intrinsically safe-IIC

Notes:
1. All the FA system shall have the facility to communicate with DCS and it shall be compatible with DCS protocol and existing central FA panel at BPCL fire station in case of Bina Refinery.
2. FA Interface with DCS shall be Modbus Communication only.

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	a)Lead acid b)Ni-Cd c)VRLA
1.2	Instrumentation System	Not Applicable	a)Lead acid b)Ni-Cd c)VRLA
1.3	Diesel Engine Starting	Lead Acid	
1.4	DC Motors	Not Applicable	a)Lead acid b)Ni-Cd c)VRLA
1.5	Fire alarm system	***VRLA/SMF***	
1.6	Telephone system	***As per Instrumentation EDB***	
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	1.0 VOLT	
2	Battery backup time		
2.1	Switchgear Protection and Control	120 minutes	a)30 minutes b)60 minutes c)120 minutes
2.2	DC Critical lighting	120 minutes	a)30 minutes b)60 minutes c)120 minutes
2.3	Instrumentation	60 minutes	a)30 minutes b)60 minutes c)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	2X100% (for substation control) 1x100% (for DC critical lighting)	a)2X50% b)1X100%
4	DCDB outgoing feeder type	Switch fuse unit	a)Switch fuse unit b)MCCB c)MCB

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Notes:
1. Battery for Plant communication system shall be VRLA/SMF type.
2. All intercell & inter row links shall be of copper with lead coating. Al links are Not acceptable.
3. Chargers shall be provided with voltage dropping diodes with bypass facility to maintain terminal voltage at level to suit instrument requirement at field. Annunciation for failure of the dropping diode shall be given.
4. All the battery chargers shall be designed to have on-line battery load testing facility.
5. The battery charger for switchgear control and critical lighting shall be Thyristor based.
6. All the chargers shall have inbuilt load test provision.
7. Common cell booster suitable for largest battery rating shall be provided in each substation building for similar battery systems.

5.6.15 VARIABLE FREQUENCY DRIVE

S.No.	Description	Selected Option	Available Options
1	By pass feature required	Yes(Note-1)	a)YES b)NO
2	VFD rated output voltage(in case bypass is not provided)		
2.1	MV Inverter	i) Motor kW rating upto 315kW at 415V without bypass (Note-3) ii) Motor kW rating above 315kW & up to 700kW at voltage up to 690V without bypass (Note-4)	
2.2	HV Inverter	>1100V for Motor rating more than 750kW (Note-5)	

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. VFD control supply shall be from 230V AC UPS.
3. 415 V – For VFD fed motor with bypass facility with rating less than or equal to 132 KW.
4. 6.6kV – For VFD fed motor with bypass facility with rating above 132kW and upto 750KW.
5. For motors > 750kW, 6.6 KV voltage shall be used. For higher rated motors such as MAB, WGC etc.(in ECU) & Extruder (in PPU & LDDPE), input supply shall be provided at 66kV level respectively which will be step-down to suitable voltage level for feeding respective motors

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

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S.No.	Description	Selected Option	Available Options
1	Medium voltage power cable	25mm^2(Aluminium)/2.5 mm^2 to 16 mm^2(Copper)	a)Above 16 sqmm (Aluminium) b)2.5 sqmm to 16 sqmm (Copper)
2	Control cables	2.5 mm^2 (Copper) twisted pair, multi strand, flexible, shielded (individual pair shielded & overall shielded)	
3	Lighting	2.5 sqmm (Copper), multistrand, flexible	
4	Communication system	0.63 sq.mm i.e. 0.9 mm dia (Copper) for telephone and FO cables for Electrical network PLC system	
5	Telephone System	0.63 mm dia.(Copper) Non Jelly Filled cable	
6	Fire alarm system	1.5 sqmm (Copper)twisted pair	

Notes:

1. For lighting inside the building, minimum 2.5 sqmm. Copper conductor, PVC insulated FRLS wire shall be used in conduit system (for circuit and point wiring), with proper color 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. All power cables 2.5 sqmm upto 16 sqmm shall be with copper conductor and above 16 sqmm shall be aluminium/copper conductor.
5. Control cable shall be twisted pair shielded (individual pair shielded & overall shielded type).
6. Outer PVC sheath of all cables shall be flame retardant type. Cables shall have low smoke properties i.e. FRLS type with 60% (Max) smoke density.
7. Earthing cable shall have multi strand copper conductor & overall insulation above the conductor.
8. All control cables, Fire alarm cable and Plant communication cables shall be XLPE insulated.
9. Medium voltage power cable for motors shall be minimum 4 sq.mm (Copper).

5.6.17 BUS DUCT

S.No.	Description	Selected Option	Available Options
1	HV Bus Duct (Phase segregated type)	Conventional	a)Conventional b)Sandwich type c)Cast resin type
2	MV Bus Duct (Non-phase segregated type)	Conventional	a)Conventional b)Sandwich type c)Cast resin type

5.6.18 CAPACITOR BANK

S.No.	Description	Selected Option	Available Options

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S.No.	Description	Selected Option	Available Options
1	Voltage Level (kV)	6.6KV	a)0.415KV b)6.6KV c)11KV d)Other
2	Location	Indoor (Panel mounted)	a)Outdoor b)Indoor
3	Type of series reactor	Dry type (panel mounted)	a)Oil filled b)Dry Type
4	APFC Panel	Required (Indoor)	a)Required (Indoor) b)Not Required c)Other

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	Cable	Cable
2	Loads located 200-1000 m	1 core cable	1-core cable/ 3-core cable	1-core / 3 1/2-core cable
3	Loads located upto 200 m	1 core cable	Cable	Cable
4	Loads beyond 1250A rating and located near the transformer	GIBD/ 1 core cable	Bus duct /1 core cable	Bus duct /1 /3.5 core cable
5	Recommended limiting size of multi-core cable (sqmm)	NA	300	300
6	Short-circuit withstand time (seconds)	1.Incomer from transformer:1 2.Incomer from other switchboard:0.6 3.Plant feeder:0.6 4.Transformer feeder:0.2	1.Incomer from transformer:1 2.Incomer from other switchboard:0.6 3.Plant feeder:0.6 4.Motor/Transformer feeder:0.2 5.Capacitor feeder:0.4	Not Applicable
7	Insulation voltage grade	Earthed	Unearthed for 6.6kV cable. Earthed for 66kV cable in Petchem & 33kV cable in Bina refinery	Earthed
8	Type of cable insulation	XLPE	XLPE	XLPE
9	Fire survival (Resistant) cable for Fire proof MOV and NIFPS	NA	NA	Yes
10	Power Cable for Motors/MOV	NA	3 core	3 core
11	Cable Conductor	***Copper***	Copper/ Aluminium	Refer Cl. 5.6.16

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S.No.	Design Criteria	EHV	HV	415 volts
12	Armouring	Unarmoured or Armoured	Power cable Armoured Earthing cable un-armoured	Power cable Armoured Earthing cable un-armoured
13	Type of Moisture barrier	***Corrugated Aluminium***	NA	NA
14	Termination Type	Cold Shrink/ Hot Shrink/ Premoulded	Cold Shrink/ Hot Shrink	NA
15	Screen Bonding arrangement for single core cables	Single point or Cross bonding	Single point or Cross bonding	NA

Notes:
1. EHV GIBD shall be phase separated SF6 insulated type.
2. Following color code shall be used for power cables:
220kV: Black
66kV: Violet
33kV: Pink
6.6kV: Yellow
1.1kV: Black
FS (Fire survival cables for MOV power & control): White
PA: Grey
FA: Red
Control: Black

5.7.2 CABLE LUGS MATERIAL

S.No.	Description	Selected Option	Available Options
1	Copper conductor cable & copper bus bar/ terminals	Tinned Copper	a)Tinned Copper
2	Copper conductor cable & Aluminium bus bar/ terminals	Tinned Copper	a)Tinned Copper b)Bi-metallic (Aluminium palm with Copper barrel)
3	Aluminium conductor cable & Copper bus bar/ terminals	Bi-metallic (Aluminium barrel with Tinned Copper palm)	a)Bi-metallic (Aluminium barrel with Tinned Copper palm) b)Tinned Copper
4	Aluminium conductor cable & Aluminium bus bar/ terminals	Aluminium	a)Aluminium b)Tinned Copper

5.7.3 CABLE LAYING PHILOSOPHY

S.No.	Description	Selected Option	Remarks
1	Process area where pipe-rack/sleeper is available	Above ground cable tray	a)Above ground cable tray b)RCC Trench
2	Process area where pipe-racks/ sleeper is not available	***Overhead cable tray/RCC trench sand filled without racks (localised), wherever overhead cable tray route is not possible***	a)Overhead cable tray b)RCC trench, sand filled without racks

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S.No.	Description	Selected Option	Remarks
3	Offsite paved area where pipe-rack / sleeper is available	Above Ground cable tray	a)Above Ground cable tray b)Overhead rack c)RCC trench d)Other
4	Offsite paved area where pipe-rack / sleeper is not available	RCC trench, sand dust filled without racks	a)Above ground cable tray b)Overhead rack c)RCC trench, sand filled without racks d)RCC trench,without sand filling with racks
5	Offside unpaved area where pipe-rack/ sleeper is available	Above Ground cable tray	a)Above Ground cable tray b)Overhead rack c)RCC trench d)Other
6	Offside unpaved area where pipe-rack/ sleeper is not available	Directly buried/RCC trench as per site conditions	a)RCC Trench b)Directly buried
7	Type of cable trays	Galvanized prefabricated FRP type for CT & CWPH	a)Galvanized prefabricated b)Site fabricated and Painted c)FRP type
8	Road Crossings for underground cables	***Cable culvert/ERC***	a)PVC Pipes b)Cable culvert
9	Road Crossings for Above ground cables	Overhead cable bridge / culvert	a)Overhead cable bridge b)Culvert
10	Walkway, handrail and ladder for overhead cable trays	Required	a)Required b)Not Required
11	Cable entry into Blast resistant CR/SRR	Through MCT	a)Through MCT b)Without MCT through trench c)Without MCT through sleeves below ground
12	Cable entry into Sub-station	Underground through trench	a)Underground through trench b)Overhead through trays

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. FO Cable shall be laid through HDPE / GI conduit.
3. All hardware used for joining cable trays shall be of SS material.
4. Cables shall not pass through area where high temperature lines, steam vents / drains etc are provided. Adequate precautions shall be taken in un-avoidable cases.
5. Signal cables i.e. Instrument, communication, fire alarm, LAN and data highway, etc. shall preferably not be laid in the same trench / tray along with electrical cables. In case they are laid in the same trench / tray, a clearance of minimum 300 mm from electrical cables shall be provided. The overall cable layouts shall be designed for minimum interference between signal and power cables.
6. Cable entry to CR/SRR - Through MCT.
7(a). Walkway, handrail and ladder for overhead cable tray - Required.
7(b). No cable joints in overhead cable trays is permitted in Process unit/Hazardous

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area.
8. EHV (220kV) cables shall be laid in RCC Trench, filled with stone dust without racks.
9. Cable laying philosophy
a) Cables in general shall be laid in overhead cable trays in the unit area & in overhead cable trays/cable trenches in offsite paved and unpaved areas.
b) Lighting cables in unit area shall be laid overhead in cable trays
c) For Offsite unpaved area, cable may be buried underground built-in cable trench depending on number and criticality of cables which may accordingly be decided during detailed engineering.
d) Cable shall cross the road through cable culvert or ERC. For ERC details, refer structural design basis.
e) FO cables shall be laid in HDPE / GI conduit.
f) No process pipe shall pass through cable trench. If unavoidable, minimum 300mm clearance to be provided between pipe and cables. In this case, either pipe or cables shall be taken through RCC congregate.
g) Ensure no hydrocarbon or water seepage into the cable trench.
h) All cables shall be provided with Fire proofing coating upto 1.0m from termination point as per OISD requirement.
10) All new substations shall be connected to MRS through fibre optic cable network. FO cable laying can be planned along with Power cable from MRS. All interfacing shall be through OFC cables such as differential protection, inter-tripping & ECS connectivity etc.
11) Fire proofing of all substation entries for cable / bus duct shall be done.
12) In case of direct burial, cable route markers shall be installed at 15 m interval all along the cable routes and where the direction of cable trench changes.
13) All cables shall have cable lead marker wrapped on cables for easy identification indicating Tag No., Size, voltage grade & source. These lead markers shall be put at each 15m interval, at all bend and at places from where cables come out from ground.
14) In case when cable is laid underground in normal soil (not in trench) then a layer of stone dust up to 150 mm shall be provided over laid cables, over the stone dust a single layer of bricks shall be provided and then the area shall be filled with loose soil. A PCC shall be made over these type of cable trenches which shall be of min. 100mm thickness. A red colour marking shall be done over the PCC for easy identification.

5.8 EARTHING SYSTEM

S.No.	Description	Selected Option	Available Options
1	Earth electrode	***Chemical earth electrode***	
2	Main earth loop material	GI main earth grid upto Earth plate. Earth plate to Equipment by Copper cable	
3	Substation earth loop	Combination of GI strip and CU cable	
4	EHV switchyard earth grid	YES for EHV GIS	

Notes:
1. Earth pits shall be painted as per standard for e.g. earth pit for equipment earthing, body earthing etc. shall be green, transformer neutral earthing shall be black and lightening arrestors shall be blue.
2. Earth pit number shall be marked on each earth pit.
3. Earth pit cover size shall be min 650 X 650 mm.
4. Earth pit chamber covers shall be flushed with FFL for paved area. For unpaved area, it

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should be elevated.

5.9 LIGHTING SYSTEM

5.9.1 SUPPLY SYSTEM

S.No.	Description	Selected Option	Available Options
1	Centralised with Lighting distribution board-LDB	***NO***	a)YES b)NO
2	LDB at each substation	Yes	a)YES b)NO
3	Lighting transformer required	Yes	a)YES b)NO
4	100% Standby transformer for normal lighting system	***Yes***	a)YES b)NO
5	100% Standby transformer for emergency lighting system	***Yes***	a)YES b)NO
6	Lighting transformer voltage ratio	415V/415V with tapping (Note-1)	a)415V/415V b)415V/400V c)Other

1) Off circuit tap changer shall be with voltage variation in steps of +/- 2.5% with tap range +10% and -5%.
2) Following philosophy shall be followed for lighting system:
a) The Lighting distribution board (LDBs) shall have outgoing feeders to feed Indoor & Outdoor lighting panels of each unit and U&O. 240V convenience sockets in plant area shall be fed through power panel which in turn will get feeder from ASB.
b) LDBs shall be provided with Astronomical type digital timer with programming over full year for outdoor/plant lighting auto control.
c) The outdoor lighting in unit shall be done using multi-way FLP lighting panels.
d) DC critical lighting is required in Plant / Substation / SRR / Control room through separate 110 V DC battery charger so that fault in lighting circuit will not affect substation charger. DC critical lighting shall be 110V LED type.
e) For LED fixture, integral junction box shall be provided with 3 nos. cable entries for loop-in, loop out and associated wiring to fixture. Alternatively 2 nos. cable entries for loop-in and loop-out shall be provided with internal wiring for driver and lamp.
f) For emergency lighting in the plant, there shall be separate Emergency Lighting distribution board (ELDBs). Distribution to emergency light fitting shall be similar to normal light fitting i.e. from ELDB to flameproof multiway lighting panel & from this to individual light fitting.
g) For platform mounted poles, bottom of light fitting shall be 2 metre from floor/platform. All platform mounted poles shall be of GI type with all SS mounting hardware including SS U clamps & SS platform mounting lock nuts.
h) For light fitting, 4 core cables shall be used. 4 core cable for lighting shall be stranded type. Cables shall be connected at terminals with use of lugs.
i) Final LUX level study shall be carried out after mechanical completion of project activities.
j) LDB & ELDB shall have different compartments as per project datasheet to feed lighting supply for different areas either in auto/manual mode. Each LDB & ELDB board for auto circuit shall be provided with one common astronomical type digital timer to control outdoor plant lighting. Also one unwired additional astronomical timer shall be provided in the timer compartment of LDBs & ELDBs.
k) LED light/latest energy efficient light fittings shall be provided for plant area lighting, street lighting, transformer bay lighting, substation, control room and office lighting. All these fittings shall be covered under 5 year warrantee. Flameproof well

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glass type LED fitting shall be provided for plant area lighting. Wire Guard of FLP light fittings shall be made up of SS304 material (min. 4mm thickness). However, flameproof focus LED lights need not be well glass type.
l) Surge suppressor for LED fitting shall be suitable for 10KV. LED fitting driver shall take care of neutral opening for long sustained cases.
m) Goose neck poles mounted light fittings to be used wherever gratings are there e.g. on the columns, heaters, stair case etc. The bottom of light fitting from the grating shall be 2 metre. Goose neck pipes shall be installed on the railings and orientation shall be parallel to the railing and shall not obstruct the walkway. On the grating area where goose neck pole cannot be installed, lighting fittings can be installed on the structure in such a way that fitting height is 2 metre. Goose neck poles shall be of GI with coating of 100 microns.
n) The lighting fittings on ground floor shall be approachable by max 12 feet ladder and on upper floors wherever solid concrete surface is available the lighting fittings shall be approachable by max 8 feet ladder.
o) All lighting fittings and junction boxes shall be properly approachable. For e.g. location of lighting fitting should not be above any equipment motor/pump/panel etc.).
p) All hardware such as Nuts, Bolts & washers used for light fittings, JBs, goose neck pole etc shall be of SS304 material.

5.9.2 CONTROL PHILOSOPHY

S.No.	Description	Selected Option	Available Options
1	Outdoor yard	Auto	a)Auto b)Manual c)Centralised d)Local
2	Street lighting	Auto/Manual/centralised	a)Auto b)Manual c)Centralised d)Local
3	Outdoor process area	Auto/manual; centralised/local	a)Auto b)Manual c)Centralised d)Local
4	Process building	Auto/manual/Local	a)Auto b)Manual c)Centralised d)Local
5	Auto control	Astronomical timer with programming over full year	a)Synchronous timer b)Photocell c)ECS
6	Lamp type for all types of lighting fixtures.	LED	
7	ELCB in outgoing of LDB/ ASB feeding Lighting/ Power Panels	Yes sensitivity of 300mA*	a)YES b)NO
8	ON /OFF Push button at substation entry	Yes	a)YES b)NO
9	ELCB (30mA) in each circuit of LP/PP	Yes (2-pole)*	a)YES b)NO

Notes:
1) ELCB indicated in the above clause shall be referred as "RCCB".

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2) Substation lighting control switch shall be provided outside the substation room (both side doors) for switching ON and OFF the substation lighting (normal) from outside.

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, Fire Water Pump House, Admin Building, Lab., Workshop, Canteen, Warehouse (Office Area) etc.	
3	Power supply source	Diesel generator	

5.9.4 DC CRITICAL LIGHTING FOR ESCAPE

S.No.	Description	Selected Option	Available Options
1	Name of process units	Required (as per OISD)	
2	Name of building	Substation, control room, SRR, Administration building, FWPH, Fire Station, Emg. generator shed, First Aid Center	
3	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	Surface conduit	
3	Buildings with false ceiling	METSEC/Surface conduit above false ceiling	a) Surface conduit above false ceiling except in switchgear room, concealed conduit below false ceiling b) Cables c) Perforated cable tray
4	Substation (Switchgear Room)	METSEC channel/Concealed conduit	a)METSEC channel b)Concealed conduit
5	Substation (Cable Cellar)	Surface Conduit	a)Surface Conduit b)Armoured cable c)METSEC channel d)Concealed conduit
6	Other buildings in safe area	Surface conduit/cable (armoured)	

5.9.6 SPECIFIC LIGHTING REQUIREMENTS

S.No.	Description	Selected Option	Available Options
1	Aviation warning lighting	Yes, LED based Flashing	a)YES b)NO

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S.No.	Description	Selected Option	Available Options
2	Security lighting for peripheral road boundary wall	Required for Petchem	a)Required b)Not Required
3	Type of high mast flood light	30 meters Telescopic tubular with LED lamps (Note-3)	a)30 meters Telescopic tubular b)Lattice structural mast
4	Overall general lighting	High Mast	a)High Mast b)Street Lighting c)High mast with street lighting d)Photovoltaic solar hybrid street light e)Other

Notes:
1. Type of Fitting for indoor and outdoor lighting : LED Lamp
2. 30m High mast control panel and motor shall be FLP type for Hazardous area.
3. The high mast shall be smart enabled consisting of dimmable type lighting fixtures, along with dimmable drivers, dimming controller, smart high mast feeder pillar panel, associated cabling between drivers & controllers, controller & smart high mast feeder pillar panel etc.
4. Adequate number of street lighting poles shall be provided along the peripheral roads of the unit. The supply to street light shall be taken through plant lighting DB at substation. Street lighting poles shall be octagonal type, hot dip galvanised to 100 micron.
5. Lighting mast provided in the plant area during construction time shall have flame proof motor and flame proof starter with 24 nos. of LED lighting fitting/fixture(400W). The LUX level shall be minimum 5 LUX at 80 m radius of lighting mast. Height of the lighting mast shall be 30 meter. Lighting mast shall be installed during construction stage in such a way that same can be used after commissioning of the plant. Light Fittings on top of the mast shall be LED based with individual fuse for protection.

5.10 ELECTRIC HEAT TRACING SYSTEM

S.No.	Description	Selected Option	Available Options
1	Maximum sheath temperature of Tracer	Product classification approach for SR	a) Product classification approach for SR b) System approach for PL/ MI
2	Skin effect heat tracing	Not required	a)Required b)Not Required
3	Circuit Temperature Control	RTD	a)RTD b)Thermostat
4	Central Monitoring System	Yes (Note-2)	a)Yes b)No

Note:
1. Skin Effect Heat tracing system shall be provided for long length pipeline application based on requirement.
2. Corresponding central monitoring units of respective Electrical heat tracing system shall be located in SRR/MCR for which exact location shall be decided during detail engineering.

5.11 ELECTRICAL EQUIPMENT FOR HAZARDOUS AREAS

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The electrical equipment for hazardous areas both for flammable gas & vapour areas and for explosive dust areas shall be selected as per IS-16724, OISD-149 and Petroleum rules. The Gas/ Dust group and Temperature class shall be selected based on the hazardous area classification. The minimum requirement is summarised below (for flammable gas and vapour areas):

S.No.	Equipment	Zone-1	Zone-2
1	MV Motors	Ex-d	Ex-d
2	HV Motors	Ex-d / Ex-p (Note-2.8)	Ex-d / Ex-p (Note-2.8)
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-d
8	Junction Boxes	Ex-d	Ex-d
9	Transformer Unit	Ex-d	Ex-d
10	Plug & Socket	Ex-d	Ex-d
11	Break Glass Unit (Fire Alarm System)	Ex-d	Ex-d
12	Lighting Panel/Power Panel	Ex-d	Ex-d
13	Transformers	Hermetically sealed with surface temperature not exceeding 200 DEG C	Hermetically sealed with surface temperature not exceeding 200 DEG C
14	Plant communication system	Ex-d / Intrinsically safe	Ex-d / Intrinsically safe
15	Plant Lift	Ex-d	Ex-d
16	Aviation lighting fitting	Ex-d	Ex-d

For additional Hazardous Area requirements, refer notes 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	The electric motors for agitators/mixers, metering pumps and canned 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. (Ex-d)
2.3	Irrespective of the area classification (whether zone 1 or zone 2), all lighting fixtures within the storage areas shall be flameproof type. (Ex-d)
2.4	Irrespective of the area classification (whether zone 1 or zone 2), all motors and lighting fixtures within the pump house/pump station/ compressor house associated with offsite tank farm, within the loading/unloading gantries shall be of flameproof type. (Ex-d)
2.5	The emergency/critical lighting fixtures and associated junction boxes in hazardous areas (whether zone-1 or zone-2) shall be flameproof type. (Ex-d)
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.

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S.No.	Notes
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	The motors for hazardous area Zone-1 shall preferably be flameproof type. Pressurised motors may be provided in exceptional cases, when flame proof motors are not available.
2.9	In zone-1 areas, Ex-de motor i.e. Ex-d motor with Ex-e terminal box is acceptable provided the motor has been tested/ certified by CIMFR or equivalent testing agency and approved by PESO
3	Statutory Approval 1. Statutory Authority for Electrical Installation: State Electrical Inspectorate/CEA 2. Statutory authority for hazardous area: DGMS:For mining area PESO:For area other than mines

5.12 ELECTRICAL CONTROL SYSTEM-ECS

S.No.	Description	Selected Option	Available Options
1	Extent of coverage	APPLICABLE FOR PETCHEM LOCATION	
1.1	No of substations	All	
1.2	Monitoring		
1.2.1	EHV/HV switchboard	Yes	a)YES b)NO
1.2.2	415V switchboard (I/C, B/C & outgoing breaker feeders)	Yes	a)YES b)NO
1.2.3	Emergency DG set	Yes	a)YES b)NO
1.3	Control		
1.3.1	EHV/HV switchboard	Yes	a)YES b)NO
1.3.2	415V switchboard (I/C, B/C & outgoing breaker feeders)	No	a)YES b)NO
1.3.3	Emergency DG set	No	a)YES b)NO
2	Base ECS functionalities		
2.1	Breaker control in CPP & Switchyard	OFF control for motor feeders, ON/OFF for all other breakers	
2.2	Breaker control in other substations	ON/OFF Control for Capacitor feeder. OFF control for all feeders	
2.3	Area lighting	ON/OFF control	
2.4	Electrical plant data acquisition and display	Yes	a)YES b)NO
2.5	Routine log report generation and energy balance report	Yes	a)YES b)NO
2.6	Detection and reporting of alarms	Yes	a)YES b)NO
2.7	Sequence of event recording	Yes	a)YES b)NO

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S.No.	Description	Selected Option	Available Options
3	Advanced ECS functionalities		
3.1	Load shedding including maximum demand limit control	YES (Note-1)	a)YES b)NO
3.2	Synchronization	YES	a)YES b)NO
3.3	Capacitor feeder control for power factor improvement	No	a)YES b)NO
3.4	Active & Reactive power control	YES	a)YES b)NO
3.5	Frequency & load control of all generators except DG	YES	a)YES b)NO
3.6	Excitation control of synchronous motors	NO	a)YES b)NO
3.7	Grid transformer OLTC control	YES	a)YES b)NO
4	Communication with other systems	Refer communication requirements in SAS	

Notes: 1.
Dedicated load shedding scheme shall be provided for Petchem Project.

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	One set of spare for each Generator
1.1	Generator relay	One set (each type & make)
1.2	DVR - all control card	One 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	66kV / 33kV Gas Insulated Switchboard (GIS)	One set of spare for each switchboard (Refer Note-7 & 10)
2.1	Portable gas filling equipment/SF6 gas cart	1 No.
2.2	Handle for disconnector switch drive	4 Nos.
2.3	Handle for earthing switch drive	4 Nos.
2.4	Pre selection / Mechanical key	1 No.
2.5	Power cable termination kit along with plug and socket (R,Y,B Phases)	2 Sets
2.6	Tripping coil	2 No.
2.7	Closing coil	2 No.
2.8	Capacitive type voltage detectors	1 Set
2.9	Control fuses / MCB	10 Nos. of each rating & type

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S.No.	Part Description	Description
2.10	Density monitoring device	2 Nos of each type
2.11	Indicating lamps covers	5 nos. of each colour
2.12	Indicating lamps	20% or 3 nos. (min.), whichever is more
2.13	Portable SF6 Gas Leakage Detector	1 Nos.
2.14	Ethernet Switch	1 no. of each type (Refer Note-10)
2.15	Pressure Gauge	2 Nos of each type
3	Power Transformer	One set of spare for each power 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
3.5	OTI	1 no.
3.6	WTI	1 no.
3.7	Buchholz relay	1 no.
3.8	OLTC Diverter switch along with transition Resistance	1 set
3.9	OLTC fixed & moving contacts along with transition resistance	1 set
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 & MV bushings	One set of each type and rating
4.5	OTI	1 no.
4.6	WTI	1 no.
4.7	Buchholz relay	1 no.
5	HV Air Insulated Switchboard (AIS)	One set of spare for each switchboard (Refer Note-7 & 10)
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 (all type & rating)	10 Nos. of each rating & type
5.4	Breaker Finger jaws	1 set for each rating and type
5.5	Indicating lamps covers	5 Nos. of each colour
5.6	Indicating lamps	20% or 3 Nos. (min.), whichever is more
5.7	Ethernet Switch	1 no. of each type (Refer Note-10)
5.8	Spring Charging Motor	1 no. each type
5.9	Numerical Protection relays	1 no. each type
6	415V MV Switchboard & iMCC (Intelligent MCC)	One set of spare for each switchboard (refer Note-9 & 10)
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
6.6	Breaker finger jaws	1 set for each rating and type
6.7	Contactor contacts	1 set for each rating and type
6.8	Ethernet Switch	1 no. of each type (Refer Note-10)

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S.No.	Part Description	Description
6.9	Electronic modules of iMCC (Intelligent MCC)	20% electronic modules of each type
6.10	Spring Charging Motor	1 no. of each type
6.11	Numerical Protection relays	1 no. of each type
6.12	Contactors(Beyond 400 Amps)	1 No. of each rating
7	Variable Frequency Drive (one set of spare for each VFD) and Soft Starter	Quantity is per VFD and Soft Starter
7.1	IGBT / Thyristor /IGCT/ Other Power Semiconductor devices	3 No. of each type & rating
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	Drive Unit	1 No. of each 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
7.10	Control power supply module	1 No of each rating & type
7.11	Power module	3 No of each rating & type
7.12	Inverter Cell for Drive (Only HV)	1 No 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 GIS/ Switchboard / Relay control Panel	One set of spare for each GIS/ Switchboard (Refer Note-8) /Relay control Panel
9.1	Protection Relays	1 No. of each type
9.2	Auxiliary Relays	10% or minimum 2 Nos. of each type
10	UPS System	One set of spare for each UPS system
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

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S.No.	Part Description	Description
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
11.9	Thyristors/Transistors/ IGBT/ IGCT	3 Nos. of each rating & type
11.10	Power fuses	3 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)	1 set
12.4	Control cards	1 No. of each type
12.5	Terminal studs/bushing assembly	1 set each
12.6	Exciter Diodes and fuses	1 set
13	HV induction motors	One set of spare for each rating & type
13.1	Bearing (DE & NDE)	1 set
13.4	Purge panel	Complete 1 Panel (for Ex """"P"""" motor)
13.2	Terminal studs/bushing assembly	1 set each
13.3	speed switch	1 set each type
14	MV induction motors 37 kW & above	One set of spare for each rating & type
14.1	Bearing (DE & NDE)	1 set
14.3	Speed switch	1 set each type
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	Smoke/Multisensor/Heat 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
15.7	Ethernet Switch	1 No. of each type
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
16.4	Ethernet Switch	1 No. of each type
17	Thyristor control panel for heaters	
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

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S.No.	Part Description	Description
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
17.10	Power Module	1 No. of each rating and type
17.11	Thyristors	6 Nos. each rating
17.12	Transducer,Signal Isolator /Multiplier	1 No. each rating
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.
18.7	Ethernet Switch	1 No. of each type
19	Electrical Heat Tracing System	
19.1	RTD/Thermostat	1 no. of each type
19.2	Control fuses/ MCB/ELCB	5 Nos. each rating & type
19.3	Indicating lamps	10% or 2 nos. (min.) whichever is more
19.4	Indicating lamps covers	5 nos. of each colour
19.5	Contactor contacts	1 set for each rating and type
20	APFC panels for Capacitor Bank	One set of spare for total APFC panels
20.1	Control cards	One no. of each type
20.2	Power supply cards	One No of each rating & type
20.3	Power fuses	20% for each rating or one no. (min.) of each rating, whichever is more
20.4	Control fuses/ MCB	10 Nos. of each rating & type
20.5	Auxiliary Contactors	10% of each type or 1 no. (min.) of each type, whichever is more
20.6	Numerical Relays	One no. of each type
20.7	Indicating lamp covers	2 nos. of each colour
20.8	Indicating lamps	20% or 1 no. (min.), whichever is more
21	Solar Photovoltaic System	One set of spare for each system
21.1	Power Thyristor / Transistors / IGBT / IGCT	1 No. of each rating & type
21.2	Control cards	1 No. of each type
21.3	Power supply cards	1 No. of each rating and type
21.4	Cable connectors	10% or minimum 2 Nos. of each type
22	Lift	
22.1	Control Card	1 No. of each type
22.2	PLC/VFD	1 No. of each type
22.3	Floor Level indicator	1 no. of each type
22.4	Limit switches	1 no. of each type
22.5	Brake assembly	1 no. of each type
22.6	Complete Gear box Assembly	1 No. of each type
22.7	Relays & contactors	1 no. of each type
23	220kV GIS for Petchem Project	One set of spare for each GIS
23.1	SF6 Gas Leakage Detector	1 nos.

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S.No.	Part Description	Description
23.2	Portable Gas filling and evacuating cart	1 nos.
23.3	SF6 Gas Analyzer	1 nos.
23.4	Portable Partial Discharge Monitoring System	1 nos.
23.5	SF6 Gas topping system	1 nos.
23.6	Handle for Disconnector switch drive (If applicable as per standard design)	4 nos.
23.7	Handle for earthing switch drive (If applicable as per standard design)	4 nos.
23.8	Tripping coil	2 nos.
23.9	Closing coil	2 nos.
23.10	Density monitoring device	2 Nos. of each type
23.11	Pressure Gauge	2 Nos. of each type
23.12	Ethernet Switch	1 Nos. of each type
23.13	Capacitive type voltage detectors	1 set
24	Excitation system for motors	
24.1	Transistors/IGBT/IGCT	3 Nos. of each rating & type
24.2	Controls cards	1 No. of each type
24.3	Power supply Cards	1 No. of each type
24.4	Power Fuses	3 Nos. of each rating & type
24.5	Contactors	no. of each rating and type (for rating > 400A)
25	Igniters	
25.1	Ignition transformer	1 No. of each rating & type
25.2	Control Card	1 No. of each rating & type
25.3	Ignition tip	1 No. of each type
26	Desalter	
26.1	Entrace Bushing	3 Nos. of each rating
26.2	Transformer Bushing	3 nos. of each rating
26.3	Insulators	3 Nos. of each rating
27	Flameproof Light Fitting	5% LED drivers for each type of FLP light fitting.

NOTES:

1. The word 'TYPE' means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable.
2. Wherever % age is identified, Contractor shall supply next rounded figure.
3. The terminology used under 'Part Description' is the commonly used name of the part and may vary from manufacturer to manufacturer.
4. Mandatory spares as indicated above do not cover commissioning spares.
5. Mandatory spares as indicated above do not cover two year O&M spares.
6. Mandatory spares shall be applicable for electrical items of motors / sub-packages as per mandatory spares philosophy specified elsewhere in the bid document.
7. 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).
8. 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).
9. MV Switchboard shall include fixed and drawout type of switchboards such as PCC, MCC, PMCC, EPCC, EPMCC, ASB, LDB, ELDB, package switchboards etc.
10. 1 no. Ethernet switch of each type shall be provided for all switchboards put together.

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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.

Minimum 2 nos. Breaker handling trolley, 5 nos. each Breaker racking / rack out handle, Breaker spring charging handle and Fuse puller shall be procured for each type of switchboard.

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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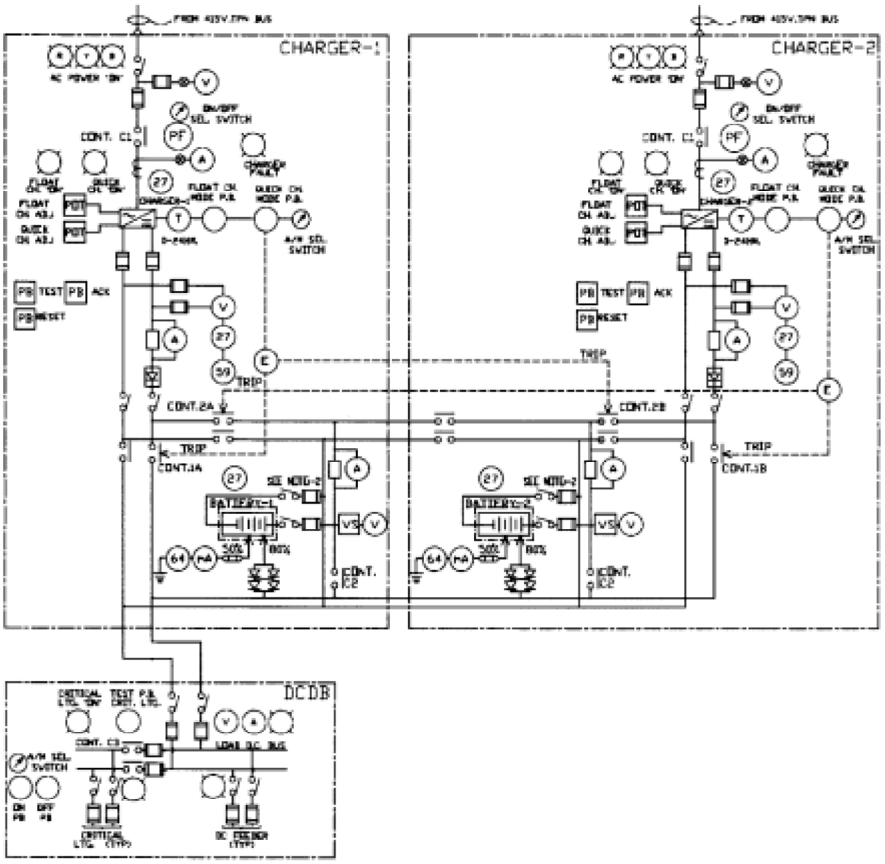
EDB Annexure-1

OPTION–II



1. a) THE DC CONTACTORS SHALL HAVE A TESTED/ PUBLISHED DC RATING EQUAL TO OR EXCEEDING THE MOST STRINGENT CURRENT CARRYING AND BREAKING REQUIREMENTS CONSIDERING ADEQUATE DESIGN MARGINS.
   b) PUSH BUTTONS ARE NOT ACCEPTABLE IN PLACE OF SELECTOR SWITCHES FOR THE ON/OFF SWITCHING OPERATIONS OF THE CONTACTORS.
   c) THE DC CONTACTORS SHALL BE OPERATED WITH A DC CONTROL SUPPLY.
2. SUITABLY RATED DC MCCB CAN BE ACCEPTED IN PLACE OF SWITCH FUSE UNIT AT BATTERY OUTPUT.
3. BATTERY CONFIGURATION SHALL BE 2X50% AH CAPACITY UNLESS SPECIFIED OTHERWISE IN DATASHEET/ JOB SPECIFICATION

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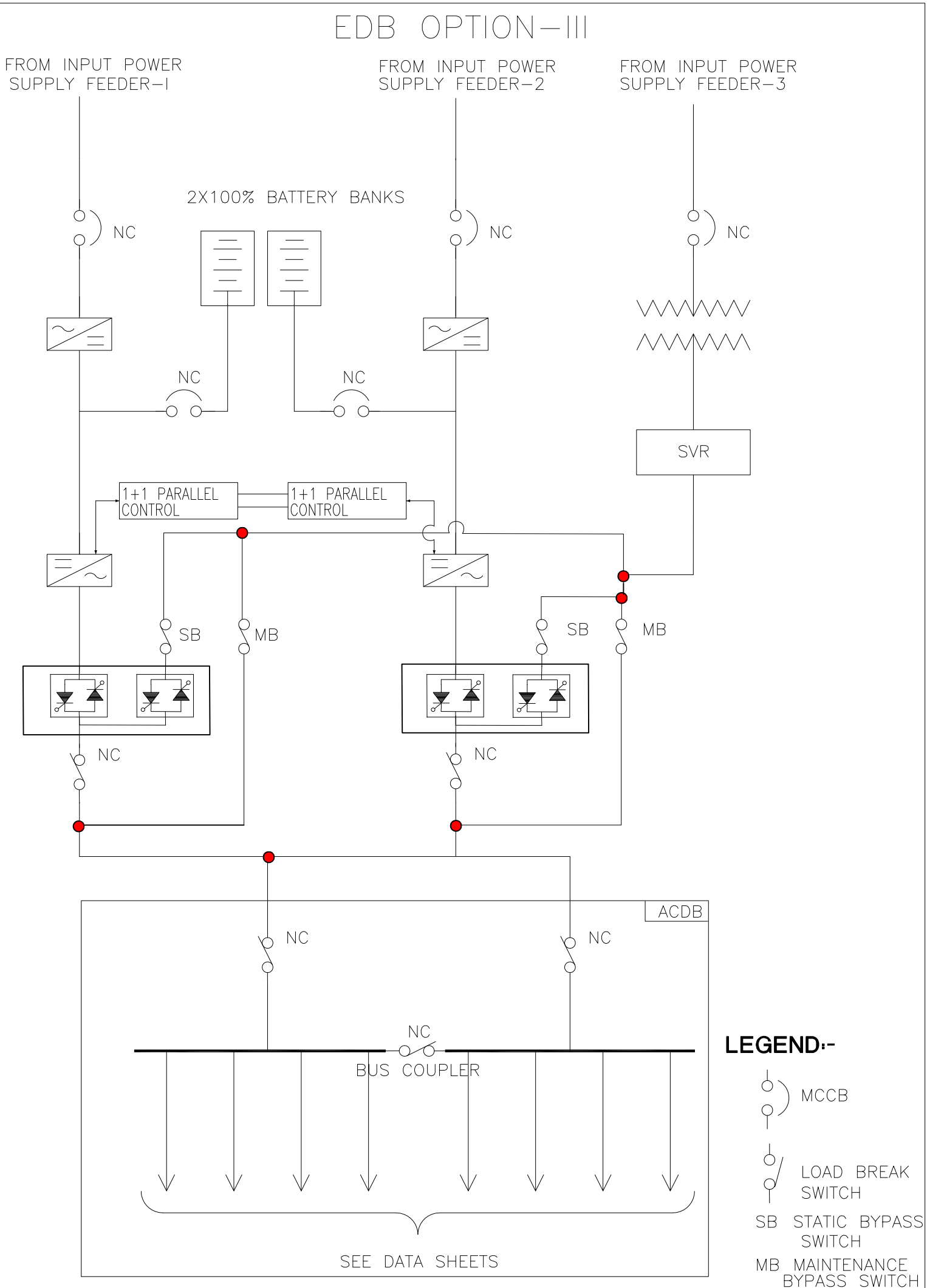
EDB OPTION–III
FROM INPUT POWER SUPPLY FEEDER–1
FROM INPUT POWER SUPPLY FEEDER–2
FROM INPUT POWER SUPPLY FEEDER–3
2X100% BATTERY BANKS
NC
NC
NC
NC
NC
SVR
1+1 PARALLEL CONTROL
1+1 PARALLEL CONTROL
SB
MB
SB
MB
NC
NC
ACDB
NC
NC
NC
BUS COUPLER
SEE DATA SHEETS
LEGEND:-
MCCB
LOAD BREAK SWITCH
SB STATIC BYPASS SWITCH
MB MAINTENANCE BYPASS SWITCH

ENGINEERING DESIGN BASIS
(ELECTRICAL)
TECHNICAL AMENDMENT

PROJECT : **BINA PETCHEM & REFINERY EXPANTION PROJECT (BPREP)**

OWNER : **M/s BHARAT PETROLEUM COOPERATION LIMITED**

PMC : **ENGINEERS INDIA LIMITED**

JOB NO. : **B857, B925, B933 & B957**

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
0	03.07.2025	ISSUED FOR IMPLEMENTATION	MKM/SK	RSR	HK

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Following Modification/Addition/Deletion to be noted w.r.t. Engineering Design Basis (Electrical)
(B857-999-16-50-EDB-1001, Rev.1)

1. **Note 2.8 under clause 5.11.1 of EDB is Modified as below:**

   The motors for hazardous area **Zone-1 and Zone-2** shall preferably be flameproof type. Pressurised **HV motors** may be provided in exceptional cases, when flame proof **HV** motors, **indigenously as well as imported,** are not available".

2. **Note 2.9 under clause 5.11.1 of EDB shall be Modified as below:**

   Selection /use of Ex-de motor in Zone-1 and Zone-2 vide Note 2.9 is not applicable and shall not be considered.

3. **Note 2.10 as below is added under clause 5.11.1:**

   For areas with hazardous dust (Zone-21 & 22), motors with enclosure "tD" or "pD" shall be provided.

4. **Clause 5.6.16 Cable Sizes. Note 7. shall be Modified as below:**

   Earthing cable **(as applicable)** shall have multi strand copper conductor & overall insulation above the conductor.

5. **Clause 5.8 Earthing System, Table shall be modified as below**

S. No	**Description**	**Selected Option**	**Available Options**
1	Earth electrode	Chemical earth electrode. 3-metre-long Copper Bonded Steel Earth Electrode of minimum diameter 14mm (solid round) and minimum cross-sectional area 150 sq. mm. shall be driven into the pit. Copper shall be intrinsically bonded to steel. There should be minimum 250 µm radial copper coating with 99.9% copper content in line with IEC 62561-2.	
2	Main earth loop material	GI main earth grid upto Earth plate. Earth Plate: GI Earth pit to GI earth plate connection: GI Strip Earth Plate to Equipment connection: GI Strip/GI Wire rope / GI Wire etc. as per attached EIL standard 7-51-0116, Sheet 1 of 2.	
3	Substation earth loop	GI Strip	
4	EHV switchyard earth grid	YES for EHV GIS	

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6. **Refer S. No. 4.80 under clause 4.0 Specific Design Requirements:**

   "New cl. no. 6.26: Add "Insulation paint (epoxy coating) shall be applied in substations as per the highest system voltage in respective substations subject to market availability."

   Shall be replaced with following:

   New cl. no. 6.26: Add "Insulation paint (epoxy coating) shall be uniformly applied in substations switchgear hall floor as per the highest system voltage of AIS in respective substations (insulation paint corresponding to highest system voltage of 7.2kV for 6.6kV AIS and 12.1kV for 11kV AIS). Same voltage grade of insulating paint as applied for AIS shall also be considered for 220kV/ 66kV/33kV GIS portion to maintain uniformity within substation.

7. **Refer S. No. 2 under clause 5.3.5 OPERATING PHILOSOPHY. Reference of Note-1 shall be added here:**

   Note 1. Auto changeover logic/ABT is not envisaged in normal (GRID power) EHV, HV, MV, LV switchboards. However, for Emergency DG switchboard (6.6kV Emergency / EPCC/EPMCC etc.) shall have the facility of auto changeover/ABT.

8. **Refer S. No. 1 under clause 5.5.1 Substation Automation System (SAS)**:

   SAS in one substation shall include redundant master ethernet switches for 66kv, 33kV, 6.6kV/11kV to be supplied by 6.6kV switchboard vendor and redundant master ethernet switch for 415V system to be supplied by LT switchboard vendor. Laptop for switchboards shall be common to be supplied by 415V switchboard vendor with software to be provided by respective switchboard vendors.

9. **Refer Note-5 under clause 5.6.1.2 EHV Switchboard. This Note stands modified as below:**

   Note 5 "Following equipment shall be supplied along with 66kV IBPs (for IBP's 1 set for each substation):

   a) SF6 Gas Leakage Detector
   b) Online SF6 gas Filling and Evacuation Cart
   c) SF6 Gas Analyser
   d) Portable Partial Discharge (PD) Monitoring System
   e) Also refer Note 7, 8 & 10 under clause 6.1 Mandatory spares of EDB (Engineering design basis) B857-999-16-50-EDB-1001, Rev.1

10. **Refer S. No. 5 of clause 5.6.4 TRANSFORMERS (POWER/DISTRIBUTION):**

    For Intermediate power transformer, vector group shall be read as Dyn1 instead of Dyn11.

11. **Refer S. No. 1.7.3 under clause 5.6.14 DC System.**

    End cell voltage for Ni-Cd battery shall be 1.16V instead of 1.0V.

12. **Refer S. No. 2 of clause 5.7.2 Cable Lug Material:**

    For Copper conductor cable & Aluminum bus bar/terminals, Bi-metallic (Aluminum palm with copper barrel) lug shall be used instead of Tinned Copper.

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13. Refer S. No. 32 under clause 5.4.3.3 RELAY PROTECTION PHILOSOPHY.

In view of no separate annunciation panel as annunciation is part of SAS/ ECS, clause 32 “For transformer feeder, WTI/OTI/Buchholz relay alarm to be connected to hooter so that other can come to know on actuation of these alarms” stands deleted.

14. Refer S. No. 12 of clause 5.7.3 Cable Laying Philosophy:

For Cable entry into Sub-station, overhead through trays (as far as possible) shall be read instead of Underground through trench.

15. S. No. 4.92 under clause 4.0 SPECIFIC DESIGN REQUIREMENTS shall be read as below

cl. no. 7.4.12: The statement shall be read as "Lighting system design shall be based on minimum illumination levels as specified in latest PNGRB guidelines. However, illumination level in cable cellar shall be as per 6-51-0099."

16. Refer clause no. 6.1 Mandatory Spares. Following changes to be noted:

a) S. No. 2 Part Description under clause 6.1 Mandatory spares shall be read as “33kV Gas Insulated Switchboard (GIS)” and Description shall be read as “One set of spares for each switchboard (Refer Note-7, 8 & 10).

b) S. No. 2a under clause 6.1 Mandatory spares is added as below

S.No.	Part Description	Description
2a	66kV Gas Insulated Switchboard (GIS)	One set of spare for each GIS
2a.1	Online portable SF6 gas Filling and Evacuation Cart	1 No.
2a.2	Handle for disconnector switch drive	4 Nos.
2a.3	Handle for earthing switch drive	4 Nos.
2a.4	Pre selection / Mechanical key	1 No.
2a.5	Power cable termination kit along with plug and socket (R,Y,B Phases)	2 Sets
2a.6	Tripping coil	2 No.
2a.7	Closing coil	2 No.
2a.8	Control fuses / MCB	10 Nos. of each rating & type
2a.9	Density monitoring device	2 Nos of each type
2a.10	Indicating lamps covers	5 nos. of each colour
2a.11	Indicating lamps	20% or 3 nos. (min.), whichever is more
2a.12	Portable SF6 Gas Leakage Detector	1 Nos.
2a.13	Ethernet Switch	1 no. of each type
2a.14	Pressure Gauge	2 Nos of each type
2a.15	SF6 Gas Analyser	1 No.
2a.16	Portable Partial Discharge (PD) Monitoring System	1 No.

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c) S. No. 7 under clause 6.1 Mandatory spares is deleted and following clauses are added

i. S. No. 7 a. is added under clause 6.1 Mandatory spares for HT VFD & Soft Starter (greater than 690V)

7a.	**Variable Frequency Drive (one set of spare for each VFD) and Soft Starter**	**Quantity is per VFD and Soft Starter**
7a.1	IGBT / Thyristor /IGCT/ Other Power Semiconductor devices	3 No. of each type & rating
7a.2	Control cards	1 No of each type
7a.3	Power supply cards	1 No of each rating & type
7a.4	Power fuses	20% for each rating OR 1 no. (min.) of each rating, whichever is more
7a.5	Contactors	10% of each type OR 1 no. (min) of each type, whichever is more
7a.6	Indicating lamps	20% OR 1 nos. (min.), whichever is more
7a.7	Indicating lamps covers	2 nos. of each colour
7a.8	Blocker Diode (Refer Note-1 below)	2 nos. of each rating & type
7a.9	Control power supply module (Refer Note-1 below)	1 No of each rating & type
7a.10	Power module (Refer Note-1 below)	3 Nos of each rating & type
7a.11	Inverter Cell for Drive (Only HV)	1 No of each rating & type
7a.12	VFD program logic software	1 no.

ii. S. No. 7 b. is added under clause 6.1 Mandatory spares for LT VFD and soft starter (up to 690V)

7b.	**Variable Frequency Drive (one set of spare for each VFD) and Soft Starter**	**Quantity is per VFD and Soft Starter**
7b.1.	IGBT / Thyristor /IGCT/ Other Power Semiconductor devices (Refer Note-1 below)	3 No. of each type & rating
7b.2	Control cards (Refer Note-1 below)	1 No of each type
7b.3	Power supply cards (Refer Note-1 below)	1 No of each rating & type
7b.4	Power fuses	20% for each rating OR 1 no. (min.) of each rating, whichever is more
7b.5	Drive Unit (Refer Note-2 below)	1 No. of each type (Refer Note-2 below)
7b.6	Contactors	10% of each type OR 1 no. (min) of each type, whichever is more
7b.7	Indicating lamps	20% OR 1 nos. (min.), whichever is more
7b.8	Indicating lamps covers	2 nos. of each colour
7b.9	Blocker Diode (Refer Note-1 below)	2 nos. of each rating & type
7b.10	Control power supply module (Refer Note-1 below)	1 No of each rating & type
7b.11	Power module (Refer Note-1 below)	3 Nos of each rating & type
7b.12	VFD program logic software	1 no.

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Note-1: 1 No. separate Variable Frequency Drive Module and Soft Starter Module (for each variable frequency drive and soft starter panel) shall be provided in case these components are not being supplied separately.
Note-2: In case vendor offers 1 No. separate Variable Frequency Drive Module and Soft Starter Module (for each variable frequency drive and soft starter panel) in lieu of S. No. 1.1, 1.2, 1.3, 1.9, 1.10 & 1.11 as per note-1 above, S. No. 1.5 in above table shall not be applicable. However, in case vendor offers individual components as per S. No. 1.1, 1.2, 1.3, 1.9, 1.10 & 1.11 of above table, 1 No. of each type of drive (proposed drive model) shall be supplied as mandatory spare.

d) Refer S. No. 11.1 under clause 6.1 stands deleted. Description of S. No. 11.9 is modified as **Power Thyristors / Transistors / IGBT / IGCT**

e) S. No. 23 under clause 6.1 Mandatory spares stands modified as below:

S.No.	**Part Description**	Description
23	220kV GIS for Petchem Project	One set of spare for each GIS
23.1	Portable SF6 Gas Leakage Detector	1 Nos.
23.2	Online portable SF6 gas Filling and Evacuation Cart	1 No.
23.3	SF6 Gas Analyser	1 No.
23.4	Portable Partial Discharge (PD) Monitoring System	1 No.
23.5	Handle for disconnector switch drive (If applicable as per standard design)	4 Nos.
23.6	Handle for earthing switch drive(If applicable as per standard design)	4 Nos.
23.7	Tripping coil	2 Nos.
23.8	Closing coil	2 Nos.
23.9	Density monitoring device	2 Nos of each type

17. Refer to UPS sketch (EDB Option -III) “Configuration of UPS, ACDB and battery “shall be as per modified sketch doc. No. B957-000-16-50-SK-0440 attached/

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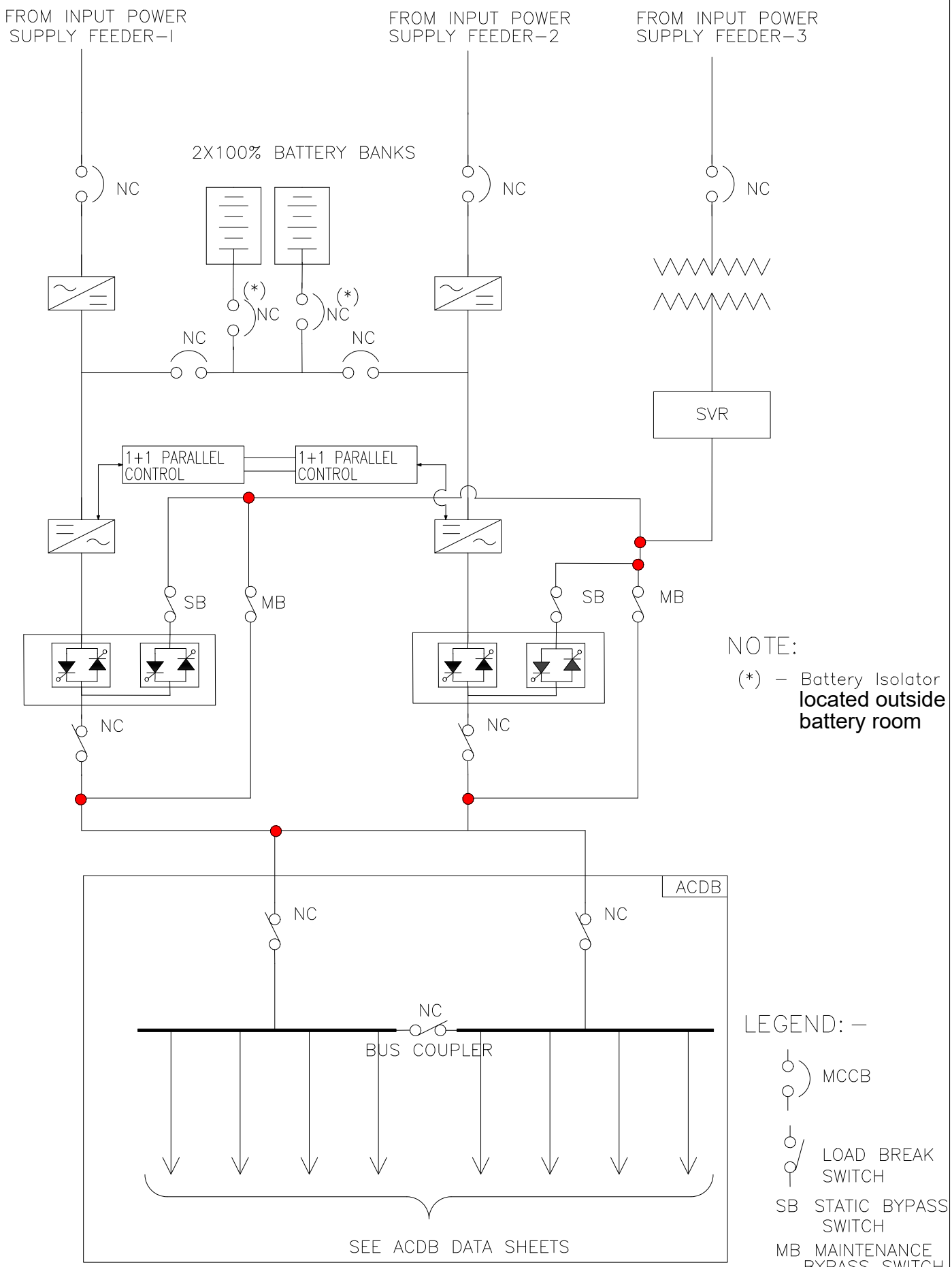
UPS SKETCH


FROM INPUT POWER SUPPLY FEEDER-1
FROM INPUT POWER SUPPLY FEEDER-2
FROM INPUT POWER SUPPLY FEEDER-3
2X100% BATTERY BANKS
NC
(*)
SVR
1+1 PARALLEL CONTROL
SB
MB
ACDB
BUS COUPLER
SEE ACDB DATA SHEETS
NOTE:
(*) - Battery Isolator located outside battery room
LEGEND: -
MCCB
LOAD BREAK SWITCH
SB STATIC BYPASS SWITCH
MB MAINTENANCE BYPASS SWITCH

JOB SPECIFICATION
(ELECTRICAL)

PROJECT : **OVERALL PROJECT MANAGEMENT AS MPMC AND PMC /EPCM SERVICES FOR ETHYLENE CRACKER UNIT AND U&O FOR BPREP**

OWNER : **M/s BHARAT PETROLEUM CORPORATION LIMITED**

UNITs : **U&O**

JOB NO. : **B957**

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
A	17.03.2026	ISSED FOR TENDER	SK	RSR	RSR

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1.0 GENERAL

1.1 INTRODUCTION

1.1.1 M/s Bharat Petroleum Corporation Limited (M/s BPCL), is implementing Bina Petchem and Refinery Expansion Project (BPREP). Contractor shall execute and implement the Electrical works and power distribution system for BPREP Project at Bina Refinery.

1.1.2 The project comprises of various new units (ECU, PP, LLDPE/HDPE/SWING, BUTENE-1), Offsites & utilities, buildings such as Substations, Control Rooms/SRRs, process pump stations, various intermediate and product tanks, loading gantries etc. and other associated offsites facilities.

1.1.3 The intent of this specification is to define the basic requirements of electrical power distribution system consisting of various electrical equipment, earthing & lightning protection system, cabling system, and other miscellaneous works for new petrochemical complex of BPREP Project of M/s BPCL.

1.1.4 This specification along with the scope of work, data sheets, standard specifications, installation standards, drawings and documents shall form the basis for developing detailed design and execution of electrical works and shall be read in conjunction with all the documents / drawings attached with the tender.

1.1.5 It shall be Contractor's responsibility to visit site and acquaint themselves with the existing situations at Site and consider all such aspects for making the quotation. Upon receipt of quotation, it shall be deemed that Contractor has taken all aspects related to Site conditions into consideration in their offer.

1.2 CODES &STANDARDS

The work shall be performed in conformity with these specifications, standard specifications, installation standards and Codes of Practice specified or referred in the tender. In case of any conflict between the various documents, the most stringent one shall be followed and Owners/ EIL decision in this regard shall be final and binding. It is contractor's responsibility to bring the same to the notification of EIL.

1.2.1 In addition, work shall also conform to the requirements of latest editions/ amendments of the following:

a. Regulations laid down by the Central Electricity Authority
b. Fire Insurance Regulations
c. Indian Petroleum Rules.
d. Regulations laid down by the Electrical Inspectorate
e. Regulations laid down by the Factory Inspectorate
f. OISD standards
g. Regulations laid down by the Chief Controller of Explosives, TAC, LPCB
h. Applicable Codes of Practice of the Bureau of Indian Standards
i. Any other regulations laid down by the Central, State or Local Authorities from time to time and during the execution of this contract.

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1.3 GUARANTEE

1.3.1 The CONTRACTOR shall guarantee the installation against any defects of workmanship and materials (supplied by the CONTRACTOR) for time period defined elsewhere in the tender document. Any damage or defects connected with the erection of material(s)/ equipment or fittings supplied by the contractor that may be discovered at the time of issue of completion certificate or may arise or come to light thereafter, shall be rectified or replaced by the CONTRACTOR at his own expense as deemed necessary and as per instructions of Engineer-in-Charge/Owner/EIL, within time limit specified by the Owner/EIL/Engineer-in-Charge.

1.3.2 The above guarantee shall be applicable for the quality of the work executed as well as for all equipment/ cables/ fixtures/ fittings/ other materials supplied by the contractor.

1.4 SITE CONDITIONS

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

Maximum/ Minimum Ambient Temperature	:	48 °C/ 1.1 °C
Equipment design temperature (IS-9676)	:	45 °C
Altitude above mean sea level	:	Less than 1000m above MSL
Humidity	:	86%
Environment	:	Dusty, Tropical and Corrosive as found in Hydrocarbon Industry

1.5 UTILIZATION VOLTAGES

a. **AC Voltage and frequency variation**

i.	Voltage	:	± 10%
ii.	Frequency	:	± 5%

•

b. **Utilization Voltage**

i.	Primary MV distribution voltage	:	66 kV
ii.	Primary MV distribution system neutral earthing	:	Solidly earthed
iii.	Secondary MV distribution voltage	:	6.6 kV
iv.	Secondary MV distribution system neutral earthing	:	NGR
v.	MV motor voltage (>132kW) for DOL	:	6.6 kV
vi.	LV motor voltage (0.18≤kW ≤132)	:	415 V AC except VFD motor

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vii.	AC Motors rated below 0.18 kW for process area	:	240 V AC (except MOVs)
viii.	Actuators for Motor operated valves	:	415 V AC, TP
ix.	Battery Chargers input	:	415 V AC, TPN
x.	UPS System input	:	415 V AC, TPN
xi.	AC Lighting/Power Panels input	:	415 V AC, TPN
xii.	Auxiliary Boards incoming power supply	:	415 V AC, TPN
xiii.	Welding Receptacles	:	415 V AC, TPN
xiv.	Bulk loads like Process Heaters etc.	:	415 V AC
xv.	Normal Lighting/Emergency Lighting	:	240 V AC, Single Phase
xvi.	Convenience outlets	:	240 V AC, SPN
xvii.	LAN UPS	:	230V AC, SPN, UPS

c. **Utilization voltage for critical supplies**

i.	Critical lighting power supply	:	110V +10%/-10%
ii.	Electrical Protection and Control system	:	110V +10%/-10%

1.6 BRIEF DESCRIPTION OF ELECTRICAL SYSTEM

The subject Tender of BPREP Project includes (but not limited) to the following:

1.6.1 POWER SUPPLY DISTRIBUTION SYSTEM

To meet the power requirement of BPREP project in BPCL Bina Refinery, power shall be received at respective substation building as below:

Sl. No.	Process Unit / Utility	Substation No.	Source Power Supply Voltage	Fed From (Source S/S)	Capacity	Estimated Power (MW)
1.	Main Receiving Power substation (MRSS) + Incoming gantry	SS-100	220kV GIS (Indoor) 66kV GIS (Indoor)	GIS + Switchyard 220/66kV, 160/200MVA (3 Nos)	--	--
2.	ECU	SS-101 SS-102	66kV	SS-100	1200 KTPA	77.5
3.	LLDPE/HDPE SWING	SS-103	66kV	SS-100	2 X 575 KTPA	102
4.	PPU	SS-105	66kV	SS-100	550 KTPA	36.6
5.	BUTENE-1	SS-109	6.6kV	SS-100	50 KTPA	1.5
6.	CT-1 (ECU)	SS-106	66kV	SS-100	23+3 CELLS @4000 CUM/HR	23

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Sl. No.	Process Unit / Utility	Substation No.	Source Power Supply Voltage	Fed From (Source S/S)	Capacity	Estimated Power (MW)
7.	TF-21+WS Extn.	SS-106	6.6kV	Part of CT-1 SS-106	-	3
8.	Polymer Warehouse + PropyleneButene-1 unloading gantry	SS-108	6.6kV	SS-100	-	4
9.	CT-2 (POLYMER)	SS-109	66kV	SS-100	15+1 CELLS @4000 CUM/HR	20
10.	N2 / IA / PA	SS-109	6.6kV	Part of CT-2 SS-109	N2 2 x 9000NM^3/HR LP AIR COMP. (4+1) x 25000 NM^3/HR IA Dryer – 4 x 5100 NM^3/HR	15
11.	TF-22, 23, 24 & 26	SS-109	6.6kV	Part of CT-2 SS-109	-	0.5
12.	RWTP + RO-DM + ZLD	SS-110	66kV	SS-100	3600 CUM/HR + 210 CUM/HR + 30 CUM/HR	5
13.	TF-20 + RWPS + Catalyst WH + Flare + Chemical storage	SS-110	6.6kV	SS-100	-	3
14.	ETP	SS-111	6.6kV	SS-100	260 CUM/HR	1.5
15.	CPU	SS-111	415V	Part of ETP SS-111	1 x 90 CUM/HR	0.2
16.	Utility Boiler	SS-112	6.6kV	SS-100	VHP - 1X180 TPH	3
17.	Fire Water Extn.+ Petchem MCR+ Lab + Site office	SS-05A	6.6kV	SS-100	-	3.5
					Total Load	**300 MW**

Emergency power of the new petrochemical complex of BPREP Project units and new substation shall be provided through new 2 nos. DG sets.

66 kV, 33kV and 415V system neutrals shall be solidly earthed, whereas 6.6kV system neutral shall be resistance earthed.

The step-down power at 6.6 kV shall be fed to 6.6 kV switchboard having two incomers & two bus sections interconnected by means of a bus coupler set (one normal bus coupler & one dummy bus coupler). This 6.6kV board shall cater to all 6.6 kV loads. All HV motors rated above 132kW shall be at 6.6 kV fed from 6.6 kV switchboards.

6.6kV power shall be stepped down to 415V using 6.6kV/0.433kV distribution transformers for feeding 415V loads through Power Control Centres (PCCs/PMCs), Motor Control Centres (MCCs), Auxiliary Service Boards (ASBs) and Lighting Distribution Boards (LDBs) in Substations.

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MV motors up to 45kW shall be fed through MCCs/EPMCs, whereas motors rated from 55kW to 132kW shall be fed from PMCs/PCCs/EPMCs. A separate Auxiliary Service Board (ASB) shall be provided in substations to feed miscellaneous loads like Power Panels, welding receptacles etc.

The emergency power generated at 6.6KV is distributed at individual Sub Stations through cable as shown in Overall Key Single Line Diagram.

Lighting system shall consist of Normal/Emergency Lighting Distribution Boards (LDB/ELDB), Lighting Transformers, Lighting Panels (LP) etc. Substations shall have adequately rated 415V/415V dry type Lighting Transformers. Separate Lighting Transformers shall be provided for 'normal' and 'emergency' lighting. Critical lighting at 110V DC shall be catered by separate DC system & DCDB.

20% to 25% of plant lighting will be on emergency. Emergency lighting load will be fed through an emergency lighting distribution board having both incoming supplies fed through 415V/415V Dry type lighting transformers from each bus section of emergency PMC (EPMC).

Dedicated 230V AC UPS system with 2 x 100% battery bank shall be provided in the substation for feeding control supply to thyristor-based heater panels, for process heaters, ECS Panels, LAN, SAS, HMIs, VFDs & Soft starters installed in substation.

110V AC UPS system with 2 x 100% battery bank provided in SRR/Control Room shall be used for all the Un-interrupted power supply requirements of DCS, Telephone, Instrumentation / Electrical loads. Power supply to UPS is fed from EPMC and its bypass is fed from PCC/PMC feeding EPMC.

110V DC system with 2 x 100% battery bank located at substation is provided to cater DC control supply for switchgear control. Further separate 110V SMPS based DC system with 1 x 100% battery bank located at Sub Station is provided for DC critical lighting for plant and non-plant buildings.

All equipment shall be connected to ECS for monitoring and control as per ECS IO list.

Overall key single line diagram (Drawing no. B957-000-16-50-00010) attached with tender depicts the power supply distribution philosophy for BPREP project.

For power distribution to various loads coming up as part of new petrochemical project, the 6.6kV (MV) and 415V (LV) switchboards in respective existing Sub Stations shall be utilised along with new Switchboards. SLDs of other existing Sub Stations as applicable will be given to successful bidder during detail engineering.

All Motors rated above 132 KW shall be fed from 6.6 KV switchboards. Motors rated less than 55 KW shall be fed from MCC's whereas Motors rated 55 KW and up to 132 KW shall be fed through PMCCs in Sub Stations.

1.6.3 CONSTRUCTION POWER REQUIREMENT

Refer elsewhere for details.

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2.0 AREA CLASSIFICATION

All electrical equipment, fixtures and devices supplied as part of this tender shall meet the requirement of area classification as per Hazardous Area Classification Layout. All electrical equipment for hazardous areas shall be tested by CIMFR (Central Institute of Mines and Fuel Research) or equivalent authorized testing agency of the country of origin and approved by PESO/ CCoE for installation and use in the area in which they are located.

3.0 ENGINEERING & JOB SPECIFIC REQUIREMENTS

3.1 Various equipment covered in the tender/ SOR to be supplied by the Contractor/Vendor shall in general be, in accordance with the requirements defined in standard specifications, installation standards, respective equipment data sheets etc. Besides these, the requirements as detailed out in respective clauses for the equipment shall also be considered. In case of any conflict/discrepancy amongst various documents, the order of precedence shall be as follows:

- Statutory regulations
- This specification/ Scope of Work document
- Standard specifications, data sheets, drawings, installation standards etc.

In case of any conflict in requirement specified in various documents having same priority, the more stringent requirement shall govern. Interpretation of EIL/ Engineer-in-charge shall be binding in this regard.

3.2 CONTRACTOR shall ensure that all electrical equipment comply to site and system conditions, rating and other technical requirements as specified.

3.3 CONTRACTOR shall use this specification, datasheets, design basis documents, EIL's standard specifications and installation standards for various equipment. However, for equipment where OWNER/ EIL's standard specifications have not been attached, the CONTRACTOR shall use their own specification developed based on project specific requirement and good engineering practices prevalent in petroleum industry so as to ensure satisfactory operational and maintenance requirements.

3.4 CONTRACTOR shall note that data sheets for some of the equipment are not enclosed separately. Equipment data sheets for all equipment shall be prepared by the CONTRACTOR based on relevant codes and specifications and data sheet shall contain all technical data and information which are essential for review and technical acceptability, detailed engineering, installation, testing, repair and maintenance, replacement etc.

3.5 The equipment shall in general conform to latest revision of statutory regulations, Indian Standards, IEC/ Other international standards applicable for the country of origin of the equipment.

3.6 All equipment shall be subjected to routine and acceptance tests as per applicable specifications. In addition, equipment shall be subjected to type tests if specified elsewhere.

3.7 CONTRACTOR shall clearly specify in their purchase specifications, the requirement of conducting other special tests/ type tests, which are envisaged for various electrical

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equipment, which shall have no impact on cost and time. CONTRACTOR shall restrict the make of switchboards of a particular voltage level to one particular make only. Extension of switchboards shall be restricted to OEM make.

3.8 Contractor shall refer the applicable standard/ specification, before quoting for each SOR item. All sub-items, components, hardware, wiring, accessories etc. as shown in the applicable standard/ specification, shall be deemed to be included in the price quoted for that SOR item.

3.9 Quantities of all such sub-items, components, hardware, wiring, accessories etc. as required shall be decided by contractor in line with tender requirements. No time or cost implication shall be entertained in this regard after award of Contract.

3.10 Only some of the sample drawings are attached with the tender presently. Latest revision of all drawings, covering all the areas/ buildings under the scope of this tender, will be handed over to the successful bidder during detail engineering. Contractor shall follow the same, without any implication to Purchaser.

3.11 Various electrical works covered under this contract like equipment erection, cabling, lighting, earthing and lightning protection works etc, shall be performed in accordance with the following specifications attached with this tender (certain clauses of specifications which are applicable to equipment or systems not covered under this contract shall be omitted).

a) 6-51-0081 Standard specification for electrical equipment installation.
b) 6-51-0082 Standard specification for cable installation.
c) 6-51-0083 Standard specification for lighting installation.
d) 6-51-0084 Standard specification for earthing installation.
e) 6-51-0087 Specification for field inspection, testing and commissioning of electrical installations

3.12 Erection, testing and commissioning of equipment shall be performed in accordance with supplier's instructions and directions of the Engineer-in-Charge.

3.13 The installation shall also conform to specifications and installation standards attached with this tender and referred therein.

3.14 All flameproof (Ex 'd') equipment shall be suitable for gas group IIA, IIB, IIC and temperature class T3 as specified in SOR specifications, area classification drawings & relevant layouts.

3.15 All electrical equipment shall be said to be installed and mechanically complete after circuit testing, primary and secondary injection testing and loop simulation is complete. Due care and consideration shall be given to the installation of all equipment, material and facilities.

3.16 Contractor shall coordinate with manufacturer of other equipment wherever required and shall freely and readily supply all technical information for this purpose as and when called for.

3.17 Suitable miscellaneous accessories like clamps etc., minor modification for bending/dropping of cable for bought out GI cable trays to suit site for requirement shall be carried out by Contractor and no separate payment shall be made to Contractor.

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3.18 Structural Steel works as per site requirement for cables/trays etc. at Offsites pipe rack shall be carried out by Contractor.

3.19 Refer to clause no. 4.4.8 of Specification for cable installation, 6-51-0082 for fire proofing of cables, this clause shall be read as

"Fire proofing of end of power, space heater cables, control cables at least 1 meter at each end as per OISD norms for the refinery and Petroleum industry, shall be carried out as per the recommendation of the paint supplier. Rates for the fire proofing of cables shall be included in the respective cable laying SOR Item, no separate payment shall be paid for fire proofing of cables.

3.20 Contractor is required to install conduit at true ceiling of Building for FA System. Accordingly, miscellaneous site works like removal and reinstallation of false ceiling and its accessories shall be done by Contractor at site for the respective Buildings. No additional payment shall be paid for the removal and reinstallation of false ceiling.

3.21 Chequered plates are provided (by Building Contractor) in floor cut out for panel installation as a safety measure to prevent falling of items / person. Contractor's scope includes cutting/removing of the chequered plates from cut outs/openings in Switchgear Rooms and stack at Owner's designated store/Warehouse before installation of base frames for Electrical Equipment. However, necessary 6 mm thick chequered plates to blind unused openings after Equipment installation works shall be supplied and erected by the Contractor as per SOR Item No. 01EE.6010.60.10. No separate payment shall be paid for cutting/removing of the chequered plates (as provided by Building Contractor) and stacking of the same at Owner's designated Store/Warehouse.

3.22 Trefoil Clamps shall be pressure die cast aluminum (LM-6) or Nylon-6 or fiber glass and shall include neoprene rubber lining wherever the cable touches the clamps and below the clamp base and necessary fixing nonmagnetic nuts, bolts, washer etc. The thickness of neoprene rubber shall not be less than 10 mm inside around the inner surface of the trefoil clamp and minimum 20 mm thick below the base of trefoil clamp. The neoprene shall be tested as per IS 11149-1984.
The contractor shall submit drawings of trefoil clamps and arrangements for Owner/ EIL approval. Trefoil clamps shall be provided at continuous intervals and shall be suitable to withstand fault current for EHV/HV offered cables.

3.23 Contractor shall comply to the requirements as per Ministry of Power (GoI) various orders regarding testing of all equipment, components & parts imported for use in the power supply system for cyber security to check for any kind of embedded malware/Trojans/cyber threat and for adherence to Indian Standards. Necessary testing of their equipment/ components at designated labs & obtaining test certificates in line with MOP orders shall be done by contractor/vendor.

3.24 PA System Equipment for all the areas/buildings/units covered under the scope of this tender shall be hooked up to existing/new PA system at site.

3.25 Contractor's scope shall include installation, termination & connection of all PA equipment as per SOR documents and standard specification and datasheet/ drawings, their integration/interface with existing systems. Final testing and commissioning of entire system shall be in owner's scope. Services of OEM of existing system shall be

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availed by owner for this purpose. Any site assistance to complete the work in all respect shall be provided by contractor for Plant Communication till the completion of work.

3.26 FA System Equipment's for all the areas/buildings/units covered under the scope of this tender shall be hooked up to existing/new FA system at site.

Contractor's scope shall include installation, termination & connection of all FA equipment as per SOR document and standard specification and datasheet/ drawings. Their integration/interface with existing systems and final testing and commissioning of entire system shall be in owner's scope. Services of OEM of existing system shall be availed by Owner for this purpose. Any site assistance to complete the work in all respect shall be provided by contractor for Fire Alarm System till completion of work.

3.27 Rocky area 60 mtr earth pit - GI pipe of dia. 150 mm is to be used for earthing. The earth pipe used should have M16 holes at every 500mm across the length. Earthing connections are to be tapped by tinned copper strip of 50x6 mm size from bottom of the 60-meter pipe length by double run. The connection between two copper strips should be done through brazing.

3.28 The GI sheet covers are to be fixed with M6 SS nut bolts with set of SS washers flat and spring type.

3.29 All type of cable laying by contractor done without damage of cable sheath/wrinkles/loops/dragging. Cable laying is to be done by roller arrangement and cable unwinding drums. Any damage to external sheath will be liable for penalty as deemed fit by EIL/Owner per incident.

3.30 Laying of cables in existing trenches wherever done in existing plant area, contractor to take all precautions to safety of existing cables. No cables should be damaged. If any cable gets damaged during process, then these are to be repaired at contractor's cost by heat shrink sleeve/straight through joint/replacement as per extent of damage and site conditions. All above repairs/replacement cost are to be borne by contractor and immediate action to be taken by contractor in such incidents. Decision of EIL/Owner is binding on contractor for repairs. All the lighting indoor/outdoor, including street lighting shall be LED type.

3.31 Modification works in existing 415V switchboard for bus bar/ panel extension to include new feeders required for Bina refinery expansion project. Supply of vertical panel & other components as required shall be procured through OEM or as per site visit to respective substation buildings.

3.32 The newly added feeders shall be fully equipped Breaker Motor feeder. Extension of bus bar and addition of vertical shall also be under contractor's scope. Procurement of equipment, components shall be through OEM, Services of OEM also to be availed for panel extension, as required. Data Sheet referred in SOR is indicative only, final schematic is to be developed by OEM is to be followed after EIL/Owner review. Relay setting & coordination shall also to be provided by contractor/OEM.

3.33 The newly added feeders shall be fully equipped outgoing power. Extension of bus bar and addition of vertical shall also be under contractor's scope. Procurement of equipment, components shall be through OEM and Services of OEM also to be availed for panel extension, as required. Data Sheet referred here is indicative only, final

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schematic developed by OEM is to be followed after EIL/Owner's review. Relay setting & coordination shall also to be provided by contractor/OEM.

3.34 Supply, Installation, testing & commissioning of outgoing feeders at existing PDB panel to cater new load. Supply of all material required, including supply of wire and wiring upto MCB from Main power bus source available in same PDB and necessary modification in feeder.

3.35 ECS Related Works: Installation of various ECS items under different items available in tender documents, providing assistance during testing & commissioning of ECS system till the completion of works in totality.

3.36 All other Electrical equipment, materials and work not explicitly mentioned but nevertheless required to fulfill the following minimum requirements shall be deemed to be included in the scope of the CONTRACTOR with no additional cost and time implication to OWNER/ EIL:

a) Achieving the plant equipment and personnel safety.
b) To meet the equipment and environment safety.
c) To suit site facilities and environmental conditions.
d) To meet the requirement of statutory approving authority.
e) To co-ordinate with other CONTRACTORS and agencies involved in at site for other activities and site work.

4.0 EQUIPMENT SIZING AND SELECTION CRITERIA

4.1 ELECTRICAL DESIGN BASIS

Standard design philosophy for electrical facilities (6-51-0099) along with details indicated in this specification shall form the basis for basic design and developing detailed design and engineering for electrical facilities including electrical power system, electrical equipment and electrical installation etc.

4.2 EQUIPMENT SIZING

The fault level for various voltage levels of Electrical system for this complex shall be limited and provided as under. Accordingly, the associated electrical equipment shall be selected suitable for same:

i). 40 kA (RMS) (1 Sec)/ 100 kA (Peak) for 66 kV & 33kV System.
ii). 40 kA (RMS) (1sec.) / 100kA (Peak) for 6.6 kV systems.
iii). 65 kA (RMS) (1sec.) / 143kA (Peak) for 415 V System for PMCC /EPMCC /MCC/ ASB
iv). 25kA (RMS) (1 sec.) / 62.5 kA (Peak) for 415V System for LDB/ ELDB.

5.0 EQUIPMENT SPECIFICATIONS

5.1 GENERAL REQUIREMENTS FOR EXTENSION / MODIFICATION IN MV (6.6kV) SWITCHBOARDS

a) A tentative and preliminary feeder list for respective substation switchboards is provided for reference. Feeder ratings and configurations are subject to change and may require modification. The final feeder list, along with changes (if any), shall be confirmed during the drawing review stage.

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b) Selection, sizing and suitability of all components shall be the CONTRACTOR's responsibility. The equipment as required for safe and satisfactory operation shall be considered included in CONTRACTOR's scope even if not specifically mentioned.

c) Only major relays, meters and controls are indicated in the hardware data sheets. Any auxiliary relays, timers, switches, etc, as required while developing the control schematic and felt necessary for safe operation, even if these are not specifically included, shall be supplied by the CONTRACTOR. All logic shall be implemented in the relay itself and not externally. Provision of adequate I/O count in the relays shall be ensured.

d) The CONTRACTORs shall be solely responsible to coordinate the relay characteristics with relay supplier for the proper selection of all CTs with special care to select class PS CTs. The VA burden, knee-point voltage, CT resistance and magnetizing current shall be calculated by the vendor for Owner/ EIL's review before proceeding with manufacturing.

e) Following sizing calculation for Class PS CT's shall be submitted by CONTRACTOR's during drawing review stage.

- Knee point voltage Vk
- Metrosil
- Stabilizing resistor.

f) CT ratios/ details, load details, cable sizes, feeder nos., name plate details etc., for all feeders at switchboards shall be finalized at the time of review of vendor drawings which shall be taken care by the CONTRACTOR without any impact on cost and time to Owner.

g) The size of bus-bar from horizontal bus to breaker and breaker to outgoing shall be designed based on breaker rating and not on CT/feeder rating.

h) Relay Setting:

i. Relay settings for switchboards in CONTRACTOR's scope shall be undertaken by the CONTRACTOR/ Vendor and CONTRACTOR/ Vendor shall furnish the relay setting chart and relay coordination curves. During drawing review stage, vendor shall furnish numerical relay selection chart showing complete model no. of numerical relay and various functionalities offered meeting all requirements specified in tender.

ii. Any other data required for relay setting to be done by the CONTRACTOR's shall be provided during engineering stage.

iii. Design calculations for selection of relay setting and relay parameterization, relay coordination, providing relay-setting table & relay parameterization, etc. for all feeders is included in the CONTRACTOR's scope. Relay parameterization for all relays shall be provided and implemented by vendor.

i) Dummy panels and rear extensions, as required, to avoid fouling with beam/ column, adequacy of space for cable terminations, bus trunking, mounting of relays, meters, control components etc. shall be supplied as required without time & cost implication to owner.

j) Breaker control switches shall be hardwired type. All TNC and Trip Switch shall be lockable type.

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k) Spring charging motors shall be suitable for 110V DC supply.

l) All switchboards shall have provision for positive LOTO implementation. Photographs of LOTO provision in each type of panels shall be submitted during drawing review for approval.

m) All transformer incipient faults signals shall be wired through interposing contactors in the panel to avoid nuisance tripping.

n) Suitable rating stabilizing resistance to be provided in earth fault protection of motor to prevent mal-operation on account of spill currents.

o) Transformer SEF should go to 86 of downstream and direct trip of upstream.

p) Load shedding scheme based on under frequency shall be finalised during detail engineering.

q) 4-Pole MCB shall be considered in all the PT panels. 4th pole contact of the MCB shall be used for blocking under voltage protection function. Bi-stable relays shall be considered in PT panels for multiplication of the contact for under voltage blocking function in each feeder.

r) In Control logics / schemes, contacts of vacuum/ SF6 circuit breaker shall be utilized. In case, same is not available, then Bi-stable relays shall be considered for multiplication of Circuit breaker contacts.

s) Wherever failsafe contact concept is used, it shall use mechanical contacts. In case mechanical contacts cannot be provided, failsafe concept shall not be used.

t) The details of all Instrument transformers comprising their full name plate and connection diagram shall be displayed with stickers at an easily accessible location (In addition to Instrument transformer itself), during normal operation.

u) All the CT & PT connection should be through ring type reliable connection/terminations only.

v) Terminal connectors of all other control terminals shall be screwed type only. Separate terminal block shall be provided for further wiring to ECS/ upstream breaker/ Transformer, etc. for tripping/ interlock/ annunciation, etc.

w) All the NO, NC contacts of breaker, Relay DI/DO, RTD inputs, etc. shall be wired up to terminal block, even if the contacts are not used in the scheme.

x) Terminal multiplication to be done, wherever double control cable termination is done, i.e. only one control cable wire shall be connected to one terminal.

y) Additional 2 set of spare CT and PT terminals shall be provided for tapping CT and PT supply for future purpose in Incomers/ bus couplers/ Line PT and Bus PT of all switchboards.

z) It is required to interface HV and MV switchgears with the ECS Panel for control, monitoring and annunciation purpose. For ECS Interface, typical ECS IO list is attached.

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aa) In addition to above, terminals as required for interface with upstream and downstream switchgear needs to be provided to fulfil the operational requirements.

bb) Hardware, as required, including selector switches, auxiliary relays, etc. during detail engineering to meet the operation requirement shall be supplied by vendor without any time and cost implication.

cc) Vendor to note that the control cables used shall be 2.5 sq. mm. twisted pair shielded cables.

dd) All signals as per ECS IO List shall be provided for interface with the Electrical control system.

ee) DC and AC control supply scheme for switchboards shall be in line with hardware data sheet attached for switchboards.

ff) For the DC Control supply to the various breaker panels in HV & MV Switchboards, there shall be one common control switch for all control supply to a particular breaker panel. Separate fuses for following branch circuit shall be provided:

a) Spring charging circuit
b) Closing circuit
c) Tripping, contact multiplier & digital input circuit
d) Indication circuit
e) Each Numerical relay supply (incoming of numerical relay supply fuse shall be tapped before the control supply switch)

gg) Separate control supply switch shall be provided for differential protection relays.

hh) Bus differential scheme shall have dedicated supply from the same bus section.

ii) CT Bypassing relay shall be latched type.

jj) Bus differential multiplier relay shall be VAJH type only.

kk) Common lock key shall be provided for breakers in place of individual lock key for each breaker.

ll) LOTO-Lock out Tag out provision shall be done as a standard feature in all the switchgear (AC & DC) feeders including all power distribution boxes. Also refer Electrical design basis.

mm) Feeder differential relay (87F) of same make/ model as installed in the Upstream & downstream Switchboard shall be free-issued to CONTRACTOR for installation and wiring. Testing and commissioning of loose supply relay is included in scope of CONTRACTOR. Optical fibre cable along with HDPE duct (Green conduit with white strip) shall be provided by Contactors, including end termination of OFC including all accessories for sending & receiving end shall be in the scope of this tender.

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nn) Only major relays, meters and controls are indicated in the hardware data sheets. Any auxiliary relays, timers, switches, etc, as required while developing the control schematic and felt necessary for safe operation, even if these are not specifically included, shall be supplied by the CONTRACTOR. All logic shall be implemented in the relay itself and not externally. Provision of adequate I/O count in the relays shall be ensured.

oo) All relays, metering and control components shall be mounted on the panel front only. Dummy panel and rear extension, as required, for bus trunking / cable terminations shall be provided.

pp) CT and PT burden mentioned in data sheets are indicative. CONTRACTOR shall provide the same as required including the burden for transducers provided at transducer panel. CONTRACTOR may consider 1.5 VA per phase per transducer for CT burden and 1.5 VA per phase per transducer for PT burden for analogue input for ECS interface.

qq) All HV motor feeder schematics shall have provision for auto start and auto re-acceleration with feature to inhibit irrespective of process/licensor's requirement.

rr) All requirements as specified above including ECS interface, shall be applicable for switchboard. Line PT and protection & metering requirements shall be as per Design data sheets and hardware data sheets as applicable.

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

tt) Current rating for interface contacts shall be 2A, 110V DC.

uu) All the signals available in Numerical relays shall be made available in Laptop & HMI through serial communication.

vv) Number of analogue / digital IOs shall be worked out by the CONTRACTOR as per the existing system ECS I/Os list.

ww) All trip contact should be preferably "NO" contact. Separate NO contact of each such trip should be routed to relay also for event logging or redundant tripping.

xx) Control supply of each BUS PT of HV switchboard shall have independent control supply switch and sets of fuses tapped from Main DC bus.

yy) Installation of surge arrestors to be done after the CTs towards cable termination side.

zz) Critical contacts used for providing process interlocks should be direct hard contacts and these shall not be taken from the multiplying contactors / auxiliary relays, if feasible.

aaa) Wherever two NO contacts available in Emergency push button & LCS STOP PB of all breaker fed HV Motors, one NO contact shall be wired to trip breaker directly & other shall be wired to binary input of numerical motor protection relay.

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bbb) All rear panel doors of HV panels shall have handle for ease of maintenance.

ccc) The validity requirements for the type test reports for HV switchboards, breakers etc. shall be as below:-

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

ddd) Hardwired signals (with minimum requirement specified below) from various feeders of a bus section required for DCS interface shall be wired and terminated at terminal strips.

i) Breaker/Contactor 'ON' indication

ii) Breaker/Contactor 'OFF' indication

iii) Local/Remote selection indication

iv) Process Trip indication

v) Process Start command

vi) Process Stop command

vii) Process Start permissive command

viii) Ammeter (0-1A/4-20mA)

ix) Ready to Start signal from feeder

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

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

ggg) Critical contacts used for providing process interlocks should be direct hard contacts and these shall not be taken from the multiplying contactors / auxiliary relays, if feasible.

hhh) Wherever two NO contacts available in Emergency push button & LCS STOP PB of all breaker fed MV Motors, one NO contact shall be wired to trip breaker directly & other shall be wired to binary input of numeric motor protection relay.

iii) All rear panel doors of MV panels shall have handle for ease of maintenance

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jjj) Rear cable chamber provided for the switchboard shall be of height similar to other vertical panels and shall have handle for ease of maintenance.

kkk) Contractor shall carry out supply, installation, testing and commissioning of 415V feeders as specified in SOR. For FVNR feeder exact rating of motors and details of existing switchboards like make, model, bus bar material/size, bus bar rating and numerical relays/IMPRs etc. shall be informed during detailed Engineering. Testing, pre commissioning & commissioning of all numerical relays, IMPRs, Relay metering LAN and miscellaneous works related to Sub Station Automation System including inter panel cabling etc. at Site shall be by Original Equipment Manufacturer (OEM). Also, details such as substation numbers and switchboards numbers shall be provided to successful bidder post order.

5.2 INTELLIGENT MOTOR PROTECTION RELAY(IMPR) FOR MOTOR UPTO 45KW

a. All intelligent motor protection relays shall be of latest advanced version.

b. Intelligent motor protection relay shall provide current based protection only. However, provision shall be provided to add on voltage & frequency-based protection in the IMPR. Further, display unit either as part of IMPR or additional module shall be provide for each IMPR

c. It shall suitably distinguish between starting and running condition and provides appropriate protection at the right time.

d. All relays shall be communicable type.

e. Display unit is not part of IMPR shall be provided additionally for each intelligent motor protection relay. Minimum following shall be provided in display unit:

i. ON Indication,

ii. OFF Indication,

iii. TRIP Indications &

iv. 3-Phase Current Display.

f. All disturbances/events in numerical relay shall be displayed with time stamp.

~~g.~~ Vendor to furnish Intelligent Motor protection datasheet doc. no. B957-000-16-50-DS-5512 attached with tender during drawing review stage~~.~~

h. Intelligent communicable type motor protection relay shall offer a wide range of selectable protective functions. Enhanced capabilities shall be available in the intelligent motor protection relay allow following facilities to the user:

- Get warnings of developing problems before a trip occurs
- Gather dynamic load information
- Select the response of the protective device
- Know why the device tripped

~~i.~~ Intelligent relay shall have following minimum benefits for maintenance purpose~~:~~

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- Provides real time, dynamic motor and load data to facilitate Predictive motor and load maintenance.
- Includes enhanced monitoring and protective functions
- Allows selected responses to monitored motor or load conditions
- Alert the user to an impending problem and prevent unwanted shutdowns
- Alerts the user as to the cause of a trip or warning, simplifying maintenance
-

j. All relays shall have conformal coating as per as per IEC-60271-3-3 class 3C2 & type test certificates of IMPR batch supplied for the project shall be furnished during detail engineering.

k. Intelligent Protection relay shall have following minimum protection elements:

S.No.	Protective Function	√- Required X – Not Required	Operating time/Range/Setting (To be filled by Vendor Post order)
1.	Overcurrent / Overload	√	
2.	Current Imbalance	√	
3.	Under Current	√	
4.	Over Current	√	
5.	Earth leakage Protection	√	
6.	Time Delayed Phase Overcurrent	√	
7.	Time Delayed Neutral Overcurrent	X	
8.	Ground Fault-51G	√	
9.	Stalled rotor-48	√	
10.	Jam	√	
11.	Loss of Load	√	
12.	Starts/Hour Limit	√	
13.	Under Voltage	X	
14.	Over Voltage	X	
15.	Voltage Unbalance	X	
16.	Under Frequency	X	
17.	Over Frequency	X	
18.	Warnings	√	
19.	Power Factor	√	
20.	Voltage Monitoring	√	
21.	kW monitoring	√	
22.	Phase Fail/Phase unbalance-47P	√	
23.	Reverse Phase	√	
24.	Negative Phase sequence	√	

l. Vendor to furnish operation & setting manual for the relay.

m. Minimum 6DI & 4DO shall be provided in Intelligent motor protection relay. However, additional DIs & DOs if required shall be provided to fulfil control scheme requirements as specified in tender.

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n. Intelligent relays shall be used only for Protection and Monitoring. It shall not be used for control logic.

o. All intelligent motor protection relay shall be of same make.

5.3 NUMERICAL RELAYS AND SUBSTATION AUTOMATION SYSTEM

a. All numerical relays shall be digital (microprocessor based) & communicable type as per EIL Standard Specification 6-51-0055 and datasheet for Numerical relay attached with tender.

b. All relays to the extent possible shall be sourced from same make. All the numerical relays of each switchboard shall be suitable for communication on IEC-61850 protocol and shall be connected serially/LAN topology to Ethernet Switches.

c. All protective relays and meters shall be provided with test terminal blocks for secondary injection testing.

d. Hardwired lockout relay (86) shall be provided. Differential relays (87), restricted E/F (64R) relay as asked for in the data sheet shall be separate relay and shall not be combined with the main protection relay.

e. The requirement of numerical relays and integration shall be in compliance with the requirement given in attached data sheet, and specification. Even though data sheets define the requirement in terms of discreet relays (electromechanical type) but numerical relay comprising all required functions shall be provided. Under voltage and Overvoltage relay along with associated timers shall be part of the numerical relay.

f. Numerical relays provided for motor feeders shall use in-built under voltage relay and timer for delayed tripping on bus under voltage.

g. Minimum 4 nos. inputs (DI) and 4 nos. outputs (DO) as spare shall be provided in each numerical relay.

h. Provision of manual bypass of 87B shall be provided in Numerical relays

i. Relay logic shall be ensured to not provide trip in case of DC failure & restoration

j. Scheme of switchboard shall be engineered to achieve the control logic, as required, through relay logic.

k. All relays shall be integrated to ECS for monitoring and control. Provision shall be provided for monitoring & control at HMI also. The relays shall be integrated based on basic system architecture attached with the tender.

l. Conformal coating shall be done for all PCB, electronic equipment as per min. class 3C2 (Harsh environment) of IEC 60721-3-3. Alternatively, it shall comply with ANSI/ ISA S71.04 class G3 or IEC 60068-2-60 for mixed flow gas test or ASTM B845. Certification for batch of supplied items shall be submitted by vendor for the same.

m. All relays shall have communication port for direct access of data through laptop. One laptop common for all relays shall be provided for the following purposes:

f) Retrieving data from numerical relays.

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g) Uploading settings & I/O configuration.

h) Retrieving & viewing disturbance recorder data

n. The Numerical relays shall be provided with suitable hardware, software and communication ports for communication with minimum two different client sources simultaneously.

o. The redundancy in communication hardware shall be provided as per the data sheet attached. In ring topology, the communication shall have no disruption due to loop open circuit or failure of communication port. Also, the switch off of DC supply to any or more relay should not affect the communication to rest of the relay. Moreover, the ring should not be shared between the switchboards. For LAN where star couplers are used, the communication from star coupler to Ethernet switches shall be dual redundant. Relays of different switchboard should not be connected to the same star coupler. Similar to ring architecture, the failure of one star coupler or failure of communication port or processor should not affect the communication of other star coupler to Ethernet switches.

p. Refer Specification for Numerical Relays (Doc no. 6-51-0055). 30% spare ports shall be provided in each Ethernet switch provided in switchboard and in SAS.

q. All the data as available in the relay including the status of DI should be considered to be communicated to HMI. The data required for final configuration shall be finalized during engineering. Similarly, whether specified or not, serial interface shall have no limitation for data transfer to ECS. However, data as required for ECS interface shall be decided during engineering.

r. Supply, laying and termination of all interconnecting cables from switch boards to Ethernet switches including cable termination kits and accessories in each substation is in CONTRACTOR's scope. FO cable for connection between switchgear and Ethernet switch shall be supplied and laid in HDPE duct which is also to be supplied and installed by CONTRACTOR.

s. Thyristor control panels of Electric heaters shall be integrated to ECS/ Substation automation system.

t. VFD, Soft starter, DC System, UPS etc. shall be interfaced with SAS (Substation Automation System) on MODBUS TCP/IP.

5.4 DRY TYPE LIGHTING TRANSFORMER

a) Dry Type Lighting Transformer shall be in compliance with EIL specification no. 6-51-0042 and Data sheet B957-999-16-50-DS-4201. Contractor to note that No deviation shall be acceptable against the requirements specified EIL specification no. 6-51-0042 and Data sheet no. B957-999-16-50-DS-4201.

b) These transformers shall be supplied along with single compression nickel plated brass cable glands and long barrel circular/sector shaped crimping type tinned copper lugs/ aluminum lugs / bimetallic lugs for incoming and outgoing cables.

5.5 JUNCTION BOXES

a) Junction boxes shall be minimum IP 55 degree of protection suitable for installation in classified areas, hazardous areas or safe area as specified. It shall be suitable for terminating or looping armored/ unarmoured signal/ power cables, as specified. JBs

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shall be provided with earthing stud. It shall be suitable for wall/ column/ structure/ ceiling mounting.

b) Junction boxes installed in classified hazardous area shall be explosion proof Ex'd' only irrespective of area classification.

5.6 CABLE TRAYS

Prefabricated GI Cable trays along with bends, Tee, accessories like clamps shall be provided for substations cellar, SRR and outdoor areas. Offered ladder type GI Cable Trays shall be in compliance with EIL installation standard 7-51-0333.

5.7 LOCAL CONTROL STATION

Flameproof and Industrial weatherproof local control stations (IP-65) shall meet the requirements of enclosed specification nos. 6-51-0006 & 6-51-0014 respectively. Exact no. of terminals for local control stations shall be decided during detail engineering and there shall be no price implication on account of this.

Each motor shall have a separate push button station for motor start/stop in addition to local/remote, Auto/OFF/manual selector switch as per operation requirements. Field ammeters are to be provided for all motors.

Each pushbutton provided in LCS shall have two elements / contacts. However local control stations stop push button for transformer shall have 3 NO + 3 NC contacts instead of 2 NO + 2NC specified in EIL standard specification 6-51-0006

Local control stations installed in outdoor area shall have FRP canopy for additional weather protection

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

Pushbutton to be provided in the transformer bay shall be wired in series and connected to the trip circuit of the upstream breaker such that pressing of button shall trip the transformer circuit breaker. All contact of these push buttons shall be used as close permissive for the transformer circuit breaker. Additionally push buttons shall also be provided with covers

5.8 CABLING SYSTEM

a) All Power cables shall comply with the EIL standard specification 6-51-0051 and datasheet attached with tender.

b) All MV control cables, plant communication cables, telephone system cables and fire alarm cables shall comply with the EIL standard specification 6-51-0052 and datasheet attached with tender. Control cables shall be 2.5 mm^2, multistranded copper conductor, twisted pair and overall shielded, XLPE insulated type. Note that type of core insulation for these cables shall be Type A as per IS 5831 and material of Inner sheath shall be ST1.

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c) All cable trays as required as per CONTRACTOR scope, shall be GI type with SS hardware and shall be provided by CONTRACTOR. Coupling and connection hardware of cable trays shall be of stainless-steel grade SS 304

d) Non-magnetic clamps with non-magnetic metallic hardware for laying single core cables in trefoil arrangement shall be supplied by the contractor and same shall be included in the cost of laying of cables and no additional charges shall be paid for these clamps.

e) GI Sheet covers shall be provided for top most cable tray and vertical extent of cable trays. GI Sheet covers shall be provided at the bottom of the bottom most cable trays, if trays are laid on pipe rack with hydrocarbon piping below the cable trays.

f) Tinned copper lugs having sector shaped / circular barrel shall be used for making connections for cables having sector shaped / circular geometry of conductor respectively.

5.9 LIGHTING SYSTEM

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

b) All hardware for installation of lighting fixtures like nuts, bolts, mounting brackets for ceiling & column mounting and adaptors for installation on poles shall be with MOC of SS304.

c) All lighting poles shall be hot dipped galvanized type with SS hardware.

5.10 TECHNICAL PARTICULARS FOR ILLUMINATED SLD FOR SUB-STATIONS

a) Size – 8 x 6 feet for each SLD.

b) Construction – SLD shall be provided mounted on powder coated aluminum or GI box. Depth of the box shall be as required sufficient to mount backlite lamps.

c) Material – SLD shall be screen printed or itched on the acrylic board.

d) Illumination – Backlite illuminated by adequate quantity of LED lamps.

e) Details/description – SLD shall have complete details of voltage, current, fault level, bus no., component rating, motor KW rating etc. as per approved and final As-built SLD.

- Each feeder of 6.6KV SLD shall be shown separately on the SLD.
- If possible, each feeder of 415V PCC/PMCC/EPMC shall be shown separately. If the same is not feasible due to space constraint, outgoing feeders shall be included in tabular form.
- Typical SLD shall be shown for each 415V PMCC, PCC, MCC, ASB & LDB separately and outgoing feeders of each PMCC/PCC//EPMC/MCC/ASB/LDB shall be included in the tabular form along with respective switchboard typical SLD.

f) Colour scheme for different voltage levels – The colour code for various voltages in the SLDs shall be as per IS: 11954 which is detailed below:

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Sl. No.	Voltage level	SLD Colour	Shade No. as per IS: 5
1	66 KV	Golden Brown	414
2	6.6 KV	Aircraft Blue	108
3	415V /240V	Dark violet	796
4	110V DC	Black	-

5.11 TECHNICAL PARTICULAR OF OPTIC FIBRE CABLE (OFC) AND FR-HDPE DUCT

a) The optical fiber shall be 9/125µ, Single Mode OS2, Gel filled, Zero water peak, metallic armoured cable as per ISO/IEC-11801.

b) The fiber shall be able to meet Gigabit & 10 Gigabit Ethernet performance requirement specified by IEEE 802.3z (1000 Base-X) & IEEE 802.3ae (10G Base-X).

c) The fiber cable shall be RoHS & IEC 60332-3 (Flame Retardant) compliant and shall be Low-Smoke & Zero-Halogen as per IEC 61034-2, IEC 60754-2 respectively.

d) The fibre-optic cable shall be with no. of fibres as mentioned in the SOR. Procedure of data transmission, error control and recovery shall be as per acceptable standards.

e) All lengths shall be joint free single continuous lengths. Outer sheath shall be flame retardant low smoke (FRLS) type.

f) Fibre-optic data highway cable shall be suitable for water-submergence duty and high temperature withstand as per the routing requirements in the plant.

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

h) The coatings shall be in various colours in order to facilitate fibre identification. Fibre colours shall correspond to latest revision of IEC publication 60793-2 and 60304. The colours shall correspond reasonably with standard colours and shall readily be identifiable and shall be durable. The colours should have good colour fast properties also in the presence of other materials during the lifetime of cable. The coating and the colour shall not react with the surrounding jelly.

i) The fibre optic cable shall be protected against damages from termite, rodent, fire, chemicals (such as oil & natural gas, LPG and other petroleum products), moisture and water over the life time of the cable.

j) The optical fibre cable construction shall be of loose tube type with multitube / unitube construction. The cable shall have central strength member, inner and outer sheaths and moisture barrier layers.

k) The main cable core containing fibres and core wrappings shall be provided with moisture barrier protection by means of flooding compound (jelly) having properties of non-hygroscopic dielectric material and / or by water swellable type. The core wrapping shall not adhere to the secondary fibre coating.

l) The armoring of the optical fibre cable shall be of corrugated steel (electrolytically chrome plated low carbon steel) tape both sides coated with ethylene acrylic copolymer, applied longitudinally with minimum overlap of 6mm. The thickness of the steel tape shall be 0.15 mm minimum. The thickness of each polymer layer shall be minimum 0.04 mm minimum.

m) The cable shall have sufficient strength to withstand a load of value T = 9.81×W newtons, where W = mass of 1 km in kg. The load shall not produce total strain

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exceeding 0.25% in the fibre.

n) The termination enclosures of the optical fibre cable should be dust tight (No dust ingress) and protected against immersion in water (suitable for continuous immersion in water) and should be complete with all accessories including splice cassettes splice protection and all other accessories including accessories for electrical continuity of metallic layers of optical fibre cable and OFC preparation kit along with instruction sheet.

o) All fibres (including spare fibers) of a cable shall be terminated in the termination enclosure by pigtails. Subsequent connection shall be by patch chords. Erection of termination enclosure, LIU, splices, pigtail, patch chord connection etc. is in contractor's scope. OTDR analysis/report shall form part of the testing activities of the OFC network.

p) Vendor shall furnish past track record for the selected make of the fiber optic cable, preferably for the past EIL projects during drawing review stage.

q) FR-HDPE duct of shall be supplied for fibre optic cable routing, shall be permanently solid lubricated/ with spiral groove, UV-protected, fire retardant (Class V2 as per UL-94 and with limited oxygen index of 21 or higher as per ASTM D2863), of 40 mm outer diameter (+5.0/-0.0 mm) minimum thickness 3.7 mm, suitable to withstand load of 6 kg/m2. FR-HDPE ducts shall be supplied in drum length of 500m. Color of FR-HDPE duct shall be informed to contractor during post order.

r) All FR-HDPE ducts shall be supplied along with accessories such as push fit coupler, bend and elbow, end plug, simple plug, sonic head, etc. required for blowing cable into FR-HDPE duct by compressed air technology.

s) Contractor shall furnish past track record for the selected make of the FR-HDPE duct preferably for the past EIL projects during drawing review stage. Make of FR-HDPE duct shall be approved by Owner/EIL during drawing approval stage.

t) Moisture barrier – Polymer coated aluminium tape placed longitudinally over the cable core. The tape shall form a close fit around the cable core with a sealed overlap of 6mm minimum. The thickness of each polymer layer shall be 0.04 mm minimum. The thickness of fully annealed aluminium foil shall be 0.15 mm minimum.

1.1.1 HDPE ducts of two different colours shall be supplied to distinguish between the two redundant data highway cables. For routing information highway cables, HDPE ducts of third (and fourth) different colours shall be supplied as required as per the direction of EIL/Owner engineer-in-charge.

1.1.2 For the purpose of identification, HDPE duct shall be supplied as per the colour code specified below:

HDPE conduit description.	Colour
HDPE conduit for Telephone line OFC	YELLOW conduit with RED strip
HDPE conduit for LAN line OFC	YELLOW conduit with BLACK strip
HDPE conduit for Fire Alarm System	RED conduit with WHITE strip
HDPE conduit for Feeder differential protection	GREEN conduit with WHITE strip
HDPE conduit for ECS OFC	BLACK conduit with BLUE stripe
HDPE conduit for Plant Communication System	BLUE conduit

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5.12 TECHNICAL SPECIFICATION FOR FIXED TYPE SPACE HEATER PDB

a) PDB shall be installed in safe area and shall be suitable for safe area. Ingress protection shall be IP-41.

b) PDB shall be single front, and fixed type, free standing floor mounted type. PDB shall be 415V, 200 Amp, 50Hz, TPN, 50 kA (1 sec.) with two number MCCB incomers mechanically interlocked with each other. MCCB shall be provided with shunt trip and short circuit release.

c) The switchboard shall be non-compartmentalized type instead of compartmentalized specified in 6-51-0012. However, other requirements of 6-51-0012 shall be complied with.

d) The number of outgoing 240V AC, SPN feeders in the PDB shall be as per SOR item.

e) Incomer feeder shall be provided with voltmeter and ammeter. All indicating lamps shall be LED type.

f) Equipment earthing shall be done using green colored PVC insulated aluminum cable.

g) Terminals for outgoing feeder's up to 16A shall be suitable for 2.5 Sq.mm. cable. Terminals for up to 32A and 63A feeders shall be suitable for 6 mm^2 cable. Incoming terminals shall be suitable for max. 3.5C x 300 Sq.mm. cable.

h) Supply of lugs and nickel-plated brass cable glands for all cabling & termination in the scope of vendor inclusive of cable glands for incoming cable to PDB. The cable glands shall be single compression type.

5.13 6.6kV HV termination kits and straight through jointing kits shall be Heat shrinkable type.

5.14 All outdoor as well as indoor equipment and structural steel shall be painted with epoxy-based powder coated paint. Colour of paint shall be RAL-7032 for indoor equipment and RAL-7031 for outdoor equipment.

5.15 All hardware shall be of SS-304, unless otherwise specified.

5.16 All outdoor equipment shall be provided with FRP canopy except transformers, capacitor banks.

5.17 Street lighting poles shall not to be used for Access Way illumination. Floor mounted poles as per standard with hazardous area lighting shall be used.

5.18 For taking out the oil from the waste oil pit, a portable pump of suitable rating shall be provided as per OISD-173.

5.19 SAFETY EQUIPMENTS

Switchgear room shall be provided with following minimum (but not limited to) equipment:

(a) Epoxy based insulation coating with breakdown voltage as per IS, suitable for system voltage as marked and shall be suitable for installation on concrete flooring of substation having smooth finish.-

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(b) Electrically tested rubber gloves kept in dust free MS box with chalk powder.

(c) Framed shock treatment instruction card in English and local language. Name and address together with telephone no. of nearest doctor should be entered in it.

(d) First aid box easily accessible containing full compliments of ointments and medicines for treatment of electrical burns.

(e) Round bottom fire buckets filled with clean dry sand.

(f) Illuminated framed single line diagrams.

(g) Electrical protection suit shall be of reputed make and certified by approving authority.

5.20 PLANT COMMUNICATION SYSTEM

a) Installation of all Plant Communication System, PAJB and cabling including supply of PAJB and supply & laying of cables up to PAJB for all field equipment in line with approved layouts shall be done by respective contractor as defined in respective SOR. Installation shall be carried out as per installation details/ instruction details/ precautions provided by Plant Communication system manufacturer, approved layouts, specification attached, approved sizing calculations and block diagram.

b) Testing and commissioning of the Plant Communication system will be done by Plant Communication Vendor. However, contractor shall extend all necessary help and manpower to Plant communication vendor for executing works such as cable connection, disconnection and reconnection required during testing and commissioning of the system.

c) Plant Communication cabling from Existing Central exchange onwards to the PAJB, OCS, FCS, loudspeaker, beacon lamp, etc. shall be done by CONTRACTOR. Cabling inside building shall be done in concealed conduits using un-armored cables. Tinned copper cable lugs shall be considered for termination of multi stranded cables in all equipment. Cable glands with PVC shrouds for all equipment shall also be considered by the CONTRACTOR

d) All hardware used for installation and cable tags shall be of SS 304 grade.

e) Where distance between exchange and field call stations is longer, multiple cores shall be used in parallel for power supply cables, wherever required.

f) Basis for deciding spare cores shall be as under:

i).	Cable with up to 7 pairs	1 spare pair required
ii).	Cable with > 7 pairs up to 10 pairs	2 spare pairs required
iii).	Cable with >10 pairs up to 40 pairs	4 spare pairs required
iv).	Cable with >40 pairs up to 100 pairs	5 spare pairs required

5.22 SPECIAL REQUIREMENTS FOR LED FIXTURES.

MISCELLANEOUS REQUIREMENTS

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

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

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

d) LED type lighting fixtures shall fulfill the following requirements:

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

5.23 EARTHING & LIGHTNING PROTECTION

5.23.1 Earthing system of the entire package shall be designed to meet the statutory requirements and shall be included in contractor's scope including interconnection with owner's earth grid and earthing of all equipment.

5.23.2 Equipment earthing shall be done as per 7-51-0116.

5.23.3 Lightning protection for high mast shall comply with the requirements of IS/ IEC 62305.

5.23.4 Earth pits shall be painted as per following standard:

Earth pit for equipment earthing, body earthing etc.	Green
Earth pit for transformer neutral earthing	Black

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Earth pit for lightning arrestors	Blue

5.23.5 The disconnection facility shall be provided for each individual earth electrode to check its earth resistance periodically.

5.23.6 Individual Earth Pit resistance shall be in the range of 2 to 5 ohms or less.

5.23.7 Location of earth electrodes shall be marked by permanent markers for easy identification. Letter writing including earth pit no., earth pit resistance, maintenance date and due date shall be written on chamber with white or black paint of required letter size as decided by BPCL SIC/EIC.

5.23.8 All earth pits shall be interconnected. After connecting the earth strips to the earth electrodes, the earth pit entry point shall be sealed with bitumen compound.

5.23.9 All Earth Pits shall be provided with suitable Earth Pit Chamber and Earth Pit Covers. Earth Pit Cover shall be of Cast Iron material. Earth Pit Chamber/Cover shall be installed in such a way that they are not protruded from the ground level. They shall be in the same level as ground. Moreover, they shall give aesthetic look and shall not pose any kind of unsafe condition like tripping hazard, falling hazard etc. Earth Pit Number and Earth Pit Resistance shall be clearly written on Earth Pit Cover using suitable paint.

5.23.10 Earth pit cover size shall be min 650 X 650 mm.

5.23.11 Earth pit chamber covers shall be flushed with FFL for paved area. For unpaved area, it should be elevated.

5.23.12 All Earth electrodes shall be Maintenance free chemical earth electrode. Requirement of Maintenance Free Earth Pit is as below:

i) The job includes excavation of hard/ soft/ rock soil for making augured hole for laying the earth electrode. Where machine drilling is not allowed as per site conditions, excavation shall be done manually. Augured hole shall be of minimum 125-150 mm dia. The augured hole is to be filled up completely with Earth enhancement compound. 3-metre-long Copper Bonded Steel Earth Electrode of minimum diameter 14mm (solid round) and minimum cross-sectional area 150 sq. mm. shall be driven into the pit. Copper shall be intrinsically bonded to steel. There should be minimum 250 µm radial copper coating with 99.9% copper content in line with IEC 62561-2. Earth pit Inspection chamber is to be constructed in such a way that it provides easy access for resistance measurement and connection/disconnection facility. The earth pit is to be connected with earth termination conductor i.e. GI earth strip through Stainless Steel Strip and Stainless-Steel Nuts/Bolts only. It shall meet all the specifications of IEC 62305, IEC 62561-2 & IEC 62561-7.

ii) Earth Enhancement Compounds shall fulfill all the specifications as mentioned in IS 3043:2018 & IEC 62561-7.

a) The material of the earthing enhancing compound shall be chemically inert to subsoil. It shall Not pollute the environment. It shall provide a stable environment in terms of physical and chemical properties and exhibit low resistivity. The earthing enhancing compound shall not be corrosive to the earth electrodes being used.

b) Resistivity of earthing enhancing compound shall be equal to or less than 0.12 Ω m.

c) Earth enhancement compound shall be supplied in sealed moisture proof bags. The packaging unit of earthing enhancing compound shall clearly have the manufacturer's name or trademark, resistivity value and identifying symbol.

d) It shall be a carbon-based material and shall be free from bentonite and other such hazardous substances.

e) It shall not leach out any chemicals into the ground and shall be suitable for installation in dry form or slurry form.

f) It shall not depend on continuous presence of water to maintain its conductivity.

g) It shall have high conductivity, improves earth's absorbing power and humidity reaction capability.

h) It shall have a long life and shall be permanent and maintenance free in its set form and

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maintains constant earth resistance with time.

i) It shall not pollute the soil or local water table. It shall not be explosive and shall not cause burns, irritation to eyes, skin etc. In this regards 'Safety Data Sheet' shall be submitted.

j) It shall not require periodic charging or any kind of treatment or maintenance.

k) It shall be thermally stable for temperature range -10 deg C to +60 deg C ambient temperature.

iii) Earth enhancing compounds shall be tested as per IEC 62561-7 and certified test reports shall be submitted.

iv) The disconnection facility shall be provided for each individual earth electrode to check its earth resistance periodically.

v) Individual Earth Pit resistance shall be in the range of 2 to 5 ohms or less.

vi) Location of earth electrodes shall be marked by permanent markers for easy identification. Letter writing including earth pit no., earth pit resistance, maintenance date and due date shall be written on chamber with white or black paint of required letter size as decided by BPCL SIC/EIC.

vii) All earth pits shall be interconnected. After connecting the earth strips to the earth electrodes, the earth pit entry point shall be sealed with bitumen compound.

viii) All Earth Pits shall be provided with suitable Earth Pit Chamber and Earth Pit Covers. Earth Pit Cover shall be of Cast Iron material. Earth Pit Chamber/Cover shall be installed in such a way that they are not protruded from the ground level. They shall be in the same level as ground. Moreover, they shall give aesthetic look and shall not pose any kind of unsafe condition like tripping hazard, falling hazard etc. Earth Pit Number and Earth Pit Resistance shall be clearly written on Earth Pit Cover using suitable paint.

ix) Refer Sketch B857-000-16-50-SK-0102 for typical earth electrode in test pit

6.0 INSPECTION, TESTING AND COMMISSIONING

6.1 Site inspection, testing and commissioning of electrical installation shall be carried out as per enclosed Specification no. 6-51-0087 and Inspection and Test Plans included or referred in this Tender.

6.2 All the equipment installed by the contractor shall be tested and commissioned, as required and no separate payments shall be made unless otherwise specified in the Schedule of Rates. Contractor shall carefully inspect all equipment before receiving them from owner/EIL for installation purposes. Any damage or defect noticed shall be brought to the notice of the engineer-in-charge at that time.

6.3 Any work not conforming to the execution drawings, specifications or codes shall be rejected forthwith and the contractor shall carry out the rectification at his own cost.

6.4 The contractor shall carry out all the tests as enumerated in the tender and technical specifications and technical documents which may be furnished to him during performance of the work.

6.5 Before the electrical system is made live, the electrical contractor shall carry out suitable tests to establish to the satisfaction of Engineer-in-Charge / Owner / EIL that the installation of equipment, cabling / wiring and connections have been correctly done and are in good working condition and that the system / equipment will operate as intended.

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6.6 All tests shall be conducted in the presence of Owner/ EIL/ Engineer-in-Charge or his authorized representative unless he waives this requirement in writing. Contractor shall arrange testing equipment, as required to carry out the tests. Test results shall be recorded on approved Performa and certified records of the tests shall be submitted to Owner/ EIL/ Engineer-in-Charge.

6.7 After the completion of all tests and rectification of all defects pointed out during final inspection, plant start-up trials shall commence. During the start-up trials, contractor shall provide skilled/ unskilled personnel and supervision round the clock at his own cost. The Engineer-in-Charge/ Owner will decide the number and the category of workmen and their duration. Any defects noticed during the start-up trials relating to the equipment supplied and work carried out by the contractor, shall be rectified by the contractor at his own cost.

6.8 Owner/ EIL/ Engineer-in-Charge shall have the right to get the defects rectified at the risk and cost of the contractor if he fails to attend to the defects immediately as desired.

6.9 The following equipment/ items, as included in Contractor's scope of supply, shall be tested and **inspected by EIL/owner or his representative before dispatch** at the manufacturer's works. Test certificates duly signed by EIL/ Owner/ Owner's authorized representative shall be submitted by the contractor as part of the final document:

a) All equipment for installation in classified hazardous areas
b) Dry Type Lighting Transformers
c) 6.6kV MV, 415 LV Power and Control cables
d) Optical Fibre cables
e) HV⁄MV Panels/Feeders
f) Extension and modification work in 33kV, 6.6kV and 415V switchboard.
g) Floor Mounted Marshalling Panel
h) Space Heater PDBs
i) 30 M smart high Mast Lighting System
j) Smart lighting control network

In addition, equipment shall be subjected to type test if specified in the tender. Type test certificates for all equipment shall be submitted from authorized testing lab (e.g., CIMFR) as a minimum.
For other equipment not mentioned above, Contractor shall ensure that any shop inspection/ testing, as required and mentioned elsewhere in the Tender, to ensure delivery of equipment meeting the contract requirement is suitably arranged by Contractor.

6.10 Contractor shall also inform Owner / Engineer-in-charge, well in advance in case, services of any OEM (Equipment manufacturer) are required, for testing and commissioning of equipment. Contractor shall do necessary coordination for mobilization of OEM specialist after obtaining permission of Owner / Engineer-in-charge. No separate payment shall be paid for the same.

6.11 Contractor shall furnish site acceptance test (SAT) procedures from the equipment supplier and get it approved from OWNER / EIL before carrying out the same at site.

6.12 Contractor shall prepare detailed testing, pre-commissioning and commissioning procedures for the entire installation. These shall include Performa for defining activities and recording of test results.

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7.0 SYSTEM TESTS & START-UP

7.1 Complete testing of power distribution system in the plant would be carried out under the supervision of the owner/ EIL/ Engineer-in-Charge. The contractor shall provide as part of the works and within his quoted rates, on round the clock basis, skilled personnel and supervisors to carry out the plant testing. The number and category of skilled personnel to be deployed by the contractor shall be decided by the Engineer-in-Charge and the contractor shall abide by his decision.

7.2 During start-up of the plant, the Contractor's responsibilities would be limited to attending to the defects attributable to him in the plant as and when they are brought to his notice. Defects shall be rectified at the risk and cost of the contractor if he fails to attend to these defects immediately.

7.3 After the operating conditions are fully achieved in all the plants and the requirement as stated in General Conditions of Contract are fulfilled, the contractor would be eligible for applying for a completion certificate.

7.4 Where the works are carried out at the cost of the contractor, the engineer-in-charge would recover the actual cost incurred towards, labor, supervision and materials, consumables or otherwise, plus 10% towards overheads, from any pending bill of the contract or the security deposit.

7.5 Contractor shall include painting and marking of all buses by low light glowing fluorescent stickers and letters as per plant marking stencil are used for individual incomers, all outgoing feeders etc. with detail such as Tag no., feeder rating, sending end source reference etc. for all switchboards. Fuse rating on all 415 V switchboards for outgoing feeders etc. shall also be marked. All lighting poles shall also be painted/marked with tag Numbers.

8.0 DRAWINGS & DOCUMENTS

8.1 The drawings accompanying the tender document are indicative of the nature of work and issued for tendering purpose only. The purpose of these drawings is to enable the tenderer to make an offer in line with the requirements of the owner. However, no extra claim, whatsoever, shall be entertained for any variation between the 'Approved for Construction (AFC)' and 'Tender Drawings' regarding any changes.

8.2 Construction shall be carried out as per drawings / specifications issued / approved by the engineer-in-charge during the course of execution of work. Detailed construction drawings on the basis of which actual execution of work is to proceed will be furnished to the contractor progressively based on the detailed construction program evolved after the award of work and also based on construction progress achieved by the contractor.

8.3 Prospective bidder shall be deemed to have studied the drawings enclosed with tender or displayed for scrutiny and fully understood the nature and magnitude of the work before submitting the bids.

8.4 Where the contractor has to prepare drawings, e.g., for fabrication of lighting and power panels, contractor shall submit the drawings to engineer-in-charge and the approval in writing of the engineer-in-charge shall be obtained before commencing fabrication.

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8.5 After the job completion, contractor shall prepare 'As-Built' drawings. Final certified 'As-Built' drawings shall be submitted by the contractor to owner in bound volumes and in soft files/CDs.

8.6 Contractor shall submit equipment manufacturer's drawing as applicable for the review of EIL Engineer-in-Charge in five sets of prints and the approval in writing of the EIL Engineer-in-Charge shall be obtained before commencing manufacture. However, it is to be understood that the review of drawings shall not absolve the basic responsibility of contractor to check total compliance to specifications included in tender document. Final drawings in bound volumes with one set of reproducible original sepia plus six sets of prints shall be submitted by contractor along with supply of materials at site.

8.7 Test certificates, catalogues, Contractor drawings, installation, operation and maintenance manuals for all equipment/materials shall be submitted by Contractor.

9.0 SPARES

9.1 COMMISSIONING SPARES

All commissioning spares are included in Contractor's scope of supply. Contractor shall consider the same while quoting for the applicable items.

9.2 TWO YEARS OPERATION & MAINTENANCE SPARES

Contractor/Vendor shall provide list of spares required for two years of normal operation and maintenance for all electrical equipment in their scope of supply, as applicable, along with unit prices.

10. MAKES OF EQUIPMENT AND COMPONENTS

Makes of Electrical equipment shall be as per vendor list attached with the Tender (Doc. No. B957-999-16-50-VL-9501).

11. LIST OF ATTACHEMENTS

For the list of attachments, refer Master Index attached elsewhere in the Tender.

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फोर्ज्ड, सीमलेस एंड वैल्डेड फिटिंगों के लिये निरीक्षण व परीक्षण योजना

INSPECTION AND TEST PLAN FOR FORGED, SEAMLESS & WELDED FITTINGS

Owner : BPCL
Project : ECU AND UTILITIES & OFFSITES
Job No : B957

Rev. No.	Date	Purpose	Prepared By	Checked By	Approved By
0	19.08.2025	ISSUED FOR IMPLEMENTATION	SG	BD	GS

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Abbreviations:

CEIL	:	Certification Engineers International Limited	MRT	:	Mechanical Run Test
CIMFR	:	Central Institute of Mining & Fuel Research	NDT	:	Non Destructive Testing
CE	:	Carbon Equivalent	NPSH	:	Net Positive Suction Head
DFT	:	Dry Film Thickness	PO	:	Purchase Order
DPT	:	Dye Penetrant Testing	PESO	:	Petroleum Explosive Safety Organization
DHT	:	De-hydrogen Heat Treatment	PQR	:	Procedure Qualification Record
ERTL	:	Electronics Regional Test Laboratory	PR	:	Purchase Requisition
FCRI	:	Fluid Control Research Institute	PMI	:	Positive Material Identification
HT	:	Heat Treatment	RT	:	Radiography Testing
HIC	:	Hydrogen Induced Cracking	SSCC	:	Sulphide Stress Corrosion Cracking
ITP	:	Inspection and Test Plan	TC	:	Test Certificate
IP	:	Ingress Protection	TPI or TPIA	:	Third Party Inspection Agency
IHT	:	Intermediate Heat Treatment	UT	:	Ultrasonic Testing
IC	:	Inspection Certificate	VDR	:	Vendor Data Requirement
IGC	:	Inter Granular Corrosion	WPS	:	Welding Procedure Specification
MPT/MT	:	Magnetic Particle Testing	WPQ	:	Welders Performance Qualification
MTC	:	Material Test Certificate			

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1.0 SCOPE

This Inspection and Test Plan covers the minimum testing requirements of Forged, Seamless & Welded Fittings.

2.0 REFERENCE DOCUMENTS

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

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	**Procedure**						
1.1	Heat Treatment / NDT / Design Proof test (as applicable)	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS, PQR & WPQ	Welding Parameters & Qualification	100%	WPS,PQR &WPQ	-	H	W- New R- Existing
1.3	NDE operator qualification records & Calibration records of measuring instruments & testing equipment	NDE Operator qualification certificates & calibration certificates	100%	NDE & Calibration Summary	-	H	R
2.0	**Material Inspection**						

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
2.1	Raw Material Identification (Billets, Rounds, Pipes, Coil, Plates, etc.) (*For pipes, coils & plates of alloy steels and Special services like NACE, H2, HIC, Wet H2S, LTCS, UOP, AXEN, etc.)	Chemical and Mechanical Properties, Size & Steel making practice, etc.	100%	Mill test certificate, Supplier's Inspection Report	-	H	W* / R
3.0	**In Process Inspection**						
3.1	Forming & Welding	Forming & Welding Parameters	100%	Supplier's records	-	H	-
3.2	Ferrite Check of SS Welds (If Applicable)	% Ferrite Check	100%	Inspection Report	-	H	R
3.3	Heat Treatment	Stress Reliving, Normalizing, Tempering, Solution Annealing, Stabilization Heat Treatment, etc. as applicable	100%	HT chart / Report	-	H	R
3.4	NDT-RT As Applicable	Surface & Internal Imperfections	As per PR/Purchase Specification	RT Films & Reports	-	H	R (Films Review)
3.5	NDT – UT (as applicable)	Surface & Internal Imperfections	As per PR/Purchase Specification	UT Report	-	H	R

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
3.6	NDT – DPT/MPT on Bevel Ends (as applicable)	Surface & Internal Imperfections	100%	Test Report	-	H	RW
3.7	Identification of Test Samples	Product Chemical, Mechanical, Impact, IGC and Other test as applicable	Per heat, per heat treatment lot (Note-4)	Test Reports	-	H	H
3.8	Product Analysis	Chemical Composition	As per PR/Purchase Specification	Test Reports	-	H	R
3.9	Destructive Testing	Mechanical, Impact, IGC, Hardness and Other test as applicable	100%	Test Reports	-	H	H
3.10	Galvanizing (If Applicable)	Integrity Of Galvanized Coating	100%	Inspection Report	-	H	R
4.0	**Final Inspection**						
4.1	Visual and Dimension	Size, Thickness / Schedule, Dimensions, Surface quality, Marking, etc.	100%	Inspection Report	-	H	RW
4.2	Hardness testing on finished fittings of Alloy steels and Special services (like NACE, H2, HIC, Wet H2S, LTCS, UOP, AXEN, etc.) & any other services as applicable	Hardness value of Base metal & Welds/HAZ as applicable	Random 10%	Test Report	-	H	RW

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
4.3	PMI Check	Chemical Check	As Per EIL Spec. B957-6-81-0001	Inspection report	-	H	RW
4.4	Design Proof test qualification under witness by reputed TPIA (To be arranged by supplier)	Proof load test as per ASME B16.9, MSS-SP75, MSS-SP95 & MSS-SP97 (As applicable)	Minimum one per Type, Rating and Material Group covering the specified size and thickness to diameter ratio	Test Records	-	W	W- New R- Existing W-TPIA R-EIL
4.5	Final Stamping	Stamping of Accepted Fittings	Stamping of Fittings which are witnessed by EIL/TPIA	Inspection Report	-	H	H
5.0	**Painting**						
5.1	Rust Preventive Coating & Color Coding	Visual & Color Coding as applicable	100%	Inspection Report	-	W	-
6.0	**Documentation & IC**						
6.1	Documentation & Inspection Certificate(IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Supplier TC & IC	-	H	H

Legend: H- Hold (Do not proceed without approval), P-Perform, RW - Random Witness (As specified or 10% (min.1 no. of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

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NOTES (As applicable):

1. 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).
2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in /Job Specification /Approved Documents.
3. For orders placed on stockiest, items shall be accepted based on manufacturer's TC with EN10204 type 3.2 certification from EIL approved suppliers.
4. Test piece marking shall be carried out from the product for each heat of raw material and for each heat treatment batch at shop floor.

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विक्रेता कार्यशाला में सकारात्मक सामग्री पहचान के लिए मानक विनिर्देश

STANDARD SPECIFICATION FOR POSITIVE MATERIAL IDENTIFICATION (PMI) AT SUPPLIER'S WORKS

Owner : BPCL

Project : ECU AND UTILITIES & OFFISTES

Job No : B957

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
0	31.03.2025	ISSUED FOR IMPLEMENTATION	BD	GS	RK

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Abbreviations:

API	:	American Petroleum Institute
AS	:	Alloy Steel
HIC	:	Hydrogen Induced Cracking
LSTK	:	Lump Sum Turn Key
NACE	:	National Association of Corrosion Engineers
PMI	:	Positive Material Identification
RTJ	:	Ring Type Joint
Sch	:	Schedule
SS	:	Stainless Steel
TPI or TPIA	:	Third Party Inspection Agency

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1.0 SCOPE

1.1 This specification applies to the requirements for Positive Material Identification (PMI) to be performed at the Supplier's works on Metallic Materials procured either directly by the Owner/EIL/ LSTK contractor or indirectly through the sub-Suppliers.

1.2 This specification covers the procedures and methodology to be adopted to assure that the chemical composition of the material is consistent with the material specifications as specified in purchase documents using 'Alloy Analyzer' at the time of final inspection before dispatch.

1.3 The scope of this specification shall include but shall not be limited to Positive Material Identification (PMI) to be performed on Materials listed below:

1.3.1 For alloy Steel materials as below:

- Alloy Steel Pipes including Clad Pipes
- Alloy Steel Flanges & Forgings
- Alloy Steel Fittings including Clad Fittings
- Alloy Steel Fasteners
- Alloy Cast & Forged steel valves
- Alloy Steel Instrumentation Items (Control Valves, Safety Valves etc.)
- Longitudinal Pipe & Fittings Welds.
- Gaskets (for Ring Type Joints)

1.3.2 For Carbon Steel materials as below:

- All Carbon Steel Piping items under NACE or HIC or H2 or Wet Hydrogen Sulfide (H_2S), Hydrofluoric acid (HF), Sulfuric acid (H_2SO_4) services, etc.
- LTCS items

1.3.3 PMI shall be done for all equipments and piping (Carbon Steel above 300#, AS, SS).

Following items shall be excluded from scope of PMI examination.

- Gaskets other than for Ring Type Joints
- Internal Components of Valves if not accessible

1.4 All grades of material supplies including Stainless Steels shall be liable for PMI test at site. In case of any defective materials being found at site, the Supplier shall be responsible to effect replacement of such defective materials at project site without any delays to the satisfaction of EIL site RCM (Resident Construction Manager).

2.0 REFERENCE DOCUMENTS

2.1 API Recommended Practice 578 (Third Edition, Feb 2018) - Material Verification Program for New and Existing Alloy Piping Systems.

3.0 DEFINITIONS

3.1 **Supplier:** Any Supplier or Manufacturer on whom an order is placed for the supply of referred items. This definition shall also include any sub-Supplier or manufacturer on whom a sub-order is placed by the Supplier.

3.2 **Inspection Lot:** A group of items offered for inspection covered under same size, Heat and Heat treatment lot.

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3.3 **Alloy Material:** Any metallic material (including welding filler materials) that contains alloying elements such as Chromium, Nickel, Molybdenum or Vanadium, which are intentionally added to enhance mechanical or physical properties and/or corrosion resistance.

4.0 PMI EXAMINATION

4.1 The Supplier shall submit a procedure of PMI to comply with the requirements of this Specification. Approval of PMI Procedure shall be obtained from Owner / EIL / TPIA prior to commencing manufacture / inspection of product.

4.2 PMI examination of materials is independent of any certification, markings or colour coding that may exist and is aimed at verifying that the alloy used are as per specified grades.

4.3 The Supplier shall identify all incoming alloy materials and maintain full traceability of all alloy materials, including all off-cuts. Transfer of identification marks shall be undertaken prior to cutting to ensure maintenance of identification on off-cuts.

4.4 The Supplier shall ensure that all alloy materials are segregated and stored in separately identified locations to prevent the mix up of materials of different alloy specifications or alloy material with carbon steel. Non ferro-magnetic materials shall be segregated at all times from ferro-magnetic materials.

4.5 PMI examination is subject to surveillance inspection by Owner / EIL / TPIA.

5.0 ACCEPTABLE METHODS FOR PMI

5.1 The method used for PMI examination shall provide a quantitative determination of the alloying elements like Chromium, Nickel, Molybdenum or Vanadium in Alloy Steel items.

5.2 Instruments or methods used for PMI examination shall be able to provide quantitative, recordable, elemental composition results for positive identification of alloying elements present.

5.3 The acceptable instruments for alloy analyzer shall be either “Portable X-Ray fluorescence” or “Optical Emission” type each capable of verifying the percentage of alloy elements within specified range.

5.4 Chemical spot testing, magnets, alloy sorters and other methods using eddy current or tribo-electric testing methods are not acceptable for PMI examination.

5.5 The PMI instrument used shall have the sensitivity to detect the alloying elements in the specified range.

5.6 All PMI instruments shall have been serviced within a 6 month period of the time of use to verify the suitability of batteries, sources etc., and the data of the last service shall be stated on the PMI Report Form (Sample enclosed).

5.7 Each analyzer must be calibrated according to the manufacturer’s specification at the beginning and end of each shift. Instrument must be checked against known standard for each alloy type to be inspected during the shift.

5.8 Certified samples, with full traceability, of a known alloy materials shall be available for use as a random spot check on the instrument calibration.

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5.9 The surfaces to be examined shall be prepared by light grinding or abrasive paper and solvent cleaner. Evidence of Arc burn resulting from examination shall be removed by light grinding or abrasive paper. No permanent marks, which are injurious to the usage of product in service, are acceptable.

5.10 Alloy Steel ring type joint Gaskets shall be inspected by using portable X-Ray fluorescence instrument.

5.11 Testing shall be done as per the procedures outlined by the manufactures of alloy analyzer being used. Modification of these procedures if any must be approved by Owner/EIL.

5.12 The persons performing PMI shall demonstrate their capabilities to the satisfaction of Owner/EIL/TPIA visiting engineer. If the Supplier has qualified operator on their rolls, he may perform the examination. Otherwise PMI examination shall be sub-contracted to an independent testing agency approved by EIL.

5.13 Whenever material is identified as not meeting requirements by the visiting engineer a rejection note shall be issued.

6.0 EXTENT OF PMI EXAMINATION

Following sampling plans shall be applicable for PMI examination of various items.

A.	Flanges, Fittings Valves, RTJ Gaskets	-	100% by Supplier and 10% @ random witness by EIL/TPIA
B.	Pipes	-	100% (for pipes procured from traders) 2 random samples drawn from each Size/Heat/Lot (for pipes procured directly from mills)
C.	Fasteners	-	

Lot Size	**Sample Size for** EIL/TPIA	Sample size for Supplier
Upto 100	2% (Min 2)	Min 10%
101 to 500	1% (Min 3)	Min 10%
501 and above	0.5% (Min 5)	Min 10%

Note:

a. For Welded Pipes and Fittings and flanges like Fig 8, Spacer and blinds etc. PMI shall be performed on Base Metal as well as weldments.

7.0 ACCEPTANCE CRITERIA

7.1 Base Metal

PMI test results showing presence of characteristic elements upto 10% less than the minimum specified value in the material specification and upto 10% more than the maximum specified value in the material specification shall be acceptable.

7.2 Deposited Weld Metal

For deposited weld metal using welding consumables matching with base metals, the recorded presence of characteristic elements upto 12.5% less than the minimum specified value in the

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welding consumable specification and upto 12.5% more than the maximum specified value in the welding consumable specification shall be acceptable.

8.0 REJECTION CRITERIA

8.1 If PMI test results fall outside the acceptable range as specified in 7.0 above, the supplier shall obtain a quantitative check analysis performed by a laboratory acceptable to Owner / EIL / TPIA for a complete chemical analysis. Alternatively, the item can be tested with a spark analyser for verification. Results of this analysis shall be submitted to Owner / EIL / TPIA for final decision.

Decision of Owner / EIL / TPIA shall be final in this regard.

8.2 If any sample drawn to PMI test on the basis of percentage selection as per 6.0 above, fails to meet specification requirements, 100% of items of lot shall be tested for PMI by supplier. Any failure thereafter during sample check shall mean rejection of whole lot.

9.0 RECORDING AND DOCUMENTATION

The results of PMI examination shall be recorded in a Report Format as enclosed with this specification.

10.0 MARKING

10.1 All alloy materials tested by PMI shall be identified using either of the following methods by indicating “PMI OK”

a) Bar Code/Hologram Sticker
b) A low stress stamp marking

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	POSITIVE MATERIAL IDENTIFICATION REPORT							Page of
Project:		Client						Job No.
PMI Report No.		Supplier/Sub-Supplier						
Purchase Order No.		Testing Agency						
Purchase Requisition No:		PMI Location						
Item Type (as per Requisition)								
Material Specification/Grade Number of items in Lot								
Requisition Item No./ Description		Major content, Weight Percent						Remarks Accept/Reject
Element	Cr	Ni	Mo	V	Ti *	Cb/ Nb **	Mn ***	
Specified Range								
Actual observations 1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
Instrument Type / ID Last Service Date		Inspection Agency						Witnessed By

* To be additionally reported in case of SS321 Material
** To be additionally reported in case of SS347 Material
*** To be additionally reported in case of CS & LTCS Material

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LIST OF ATTACHMENTS
(INSTRUMENTATION)

PROJECT : **EPCM SERVICES FOR ETHYLENE CRACKER UNIT AND U&O FOR BINA PETCHEM & REFINERY EXPANSION PROJECT, BPREP**

OWNER : **M/s BHARAT PETROLEUM CORPORATION LIMITED**

UNIT : **UTILITIES AND OFFSITES**

JOB NO. : **B957**

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
A	17.03.2026	ISSUED FOR TENDER	AS	JJ	AR

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S. No.	Document Title	Document No.	Rev No	No of Sheets
SPECIFICATIONS				
1.	Special Instructions to Vendor	B957-999-16-51-SI-9501	A	17
2.	Standard Specifications of Junction Boxes and Cable Glands	6-52-0048	5	8
3.	Standard Specifications for Erection Tender	6-52-0060	4	29
4.	Standard specification for instrument tube fittings (Including Annexures)	6-52-0067	7	7
5.	Standard specification for instrument tubing (Including Annexures)	6-52-0068	5	7
6.	Standard specification for instrument valves and manifolds (Including Annexures)	6-52-0069	6	8
7.	Specification for Quality Management System requirements from Bidders	6-78-0001	3	7
8.	Specification for documentation requirements from contractors	6-78-0002	3	11
9.	Specification for documentation requirements from suppliers	6-78-0003	3	11
10.	Standard Specifications for Health, Safety & Environment (HSE) at construction sites	6-82-0001	2	105
11.	Inspection & Test Plan (ITP) for instrument tube fittings	6-81-2067	5	5
12.	Inspection and test plan (ITP) for instrument tubing	6-81-2068	4	4
13.	Inspection & Test Plan (ITP) for Field Instrumentation Works	6-82-3400	2	79
INSTALLATION STANDARDS / DRAWINGS				
14.	Instrument Cable Duct/Trench Layout - BPREP	B957-999-16-51-00801	1	2
15.	Instrument Cable Duct/Trench Layout - BDT	B957-999-16-51-00812	0	1
16.	Instrument Support Single Instrument	7-52-0101	4	3
17.	Support details for junction boxes	7-52-0104	4	2
18.	Fabricated Canopy for Instruments	7-52-0105	4	7
19.	Free Standing Support Details for Junction Box (Bottom Entry)	7-52-0106	0	5
20.	Perforated tray supports and cables clamping details	7-52-0107	4	1
21.	GI Duct Fabrication Details - Bolted Construction	7-52-0254	2	31
22.	Instrument Installation Standards along with Index	B957-999-16-51-IS-00	0	23
23.	Fabrication Details - Canopy for Junction Box	B933-003-16-51-IS-008	0	1

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24.	Installation of RCC Pedestal for Cable Tray Support Detail	B933-003-16-51-IS-011	0	1
25.	Support Details of Junction Boxes	B933-003-16-51-IS-014	0	1

NOTE-1: All the drawings attached with the tender are only for reference. Latest revision of drawings shall be provided to successful bidder after award of contract.

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DOCUMENT INDEX SHEET

TITLE:- INSTALLATION STANDARD

ATTACHMENTS :

TITLE	NUMBER	REVISIONS / DATE				
		0	1	2	3	4
INDEX OF INSTALLATION STANDARD	B957-999-16-51-IS-00	17.03.26				

REVISED SHEETS ONLY ISSUED ☐

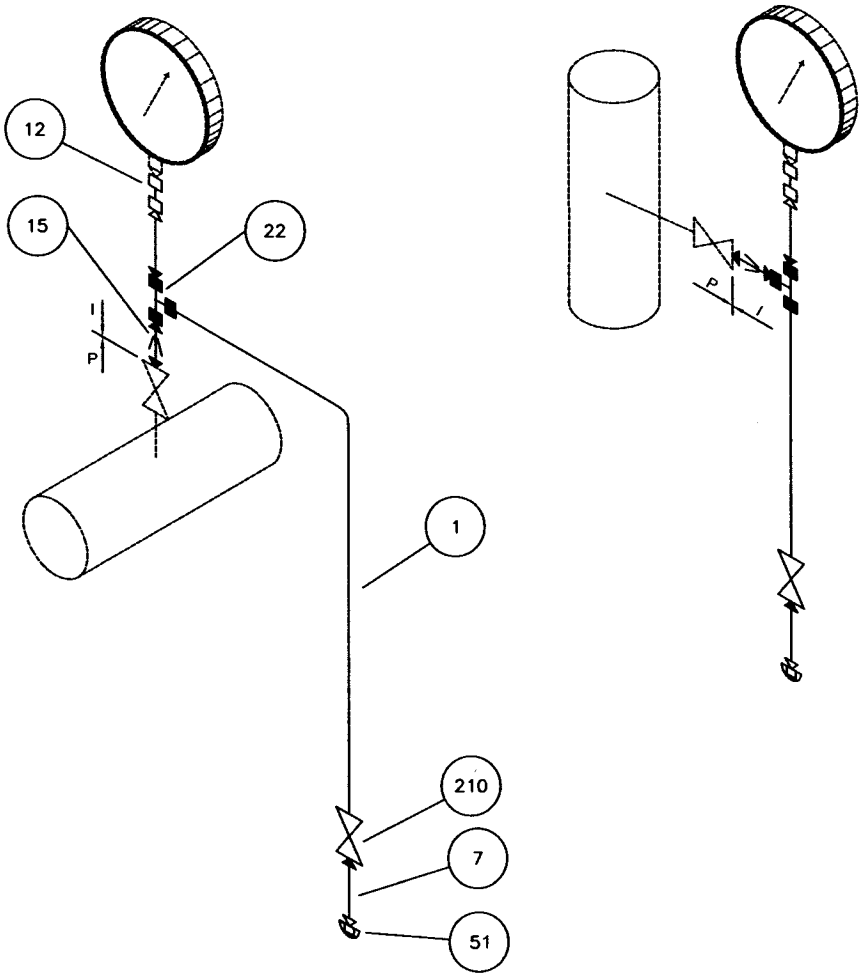
ENTIRE DOCUMENT RE - ISSUED ☐

REV.	DATE	BY	CHK	APP	DESCRIPTION	TOTAL SHEETS
0	17.03.2026	AS	JJ	AR	ISSUED FOR TENDER	23 (Including Index with cover sheets)

EIL	ENGINEERS INDIA LIMITED NEW DELHI	Project: BPREP Location: BINA, MP Client: BPCL	COVER SHEET: B957-999-16-51-IS-00 / REV: 0

SL. NO.	STD NO.	DESCRIPTION	REV NO.
1	7-52-1112	Pressure gauge liquid / gas service on pipe	0
2	7-52-1113	Pressure gauge steam service on pipe	0
3	7-52-1202	Pressure instrument liquid & cond. vapour meter below (high pressure)	0
4	7-52-1210	Pressure gauge liquid / gas service on vessel	0
5	7-52-1211	Pressure instrument liquid & cond. vapour service meter below - SW	0
6	7-52-2126	Pressure gauge high temperature remote mounted - SW	0
7	7-52-1221	Pressure instrument / gauge diaphragm seal type on side of vessel	1
8	7-52-2111	Pressure instrumentation / gauge diaphragm seal type line mounted high temperature	0
9	7-52-1143	Pressure instrument 3 way 2 valve manifold pre-fabricated	0
10	7-52-2110	Pressure instrument liquid and cond. vap service meter below (on vessel)	0
11	7-52-1171	Differential pressure instrument DP - type meter below	0
12	7-52-1605	Level / diff. press. instrument DP type on vessel meter below - SW	0
13	7-52-1520	Level gauge magnetic type on vessel / standpipe	1
14	7-52-1562	Level gauge magnetic type (WN) on vessel / standpipe 3/4 inch vent & drain to ABD / CBD	0
15	7-52-1305	Flow instrument DP type prefabricated hookups direct	0
16	7-52-1385	Flow nozzle steam service high pressure meter below	0
17	7-52-1413	Flow instrument DP type liquid and cond. vap. service intg. manifold meter below	0
18	7-52-1902	Tubing Hook up Control valve with Solenoid valve 1/2" OD	0
19	7-52-1904	Schemtaic for Instrument Air supply distribution with manifold (12 way with 1/2" OD tube)	0
20	7-52-1905	Schemtaic for Instrument Air supply distribution with manifold (6 way with 1/2" OD tube)	0
21	7-52-1906	Tubing hook - up control valve with smart / FF positioner - 1/2 inch O.D.	0

STANDARD NO. 7-52-0432 REV-5 RENUMBERED



P - BY PIPING
I - BY INSTRUMENTATION

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
1	PIPE	1/2"	PL	A/R	m						
7	NIPPLE	1/2"	TH X PL	2	Nø						
12	COUPLING	1/2"	TH	1	Nø						
15	SWAGE NIPPLE	3/4" X 1/2"	PL X PL	1	Nø						
22	EQUAL TEE	1/2"	SW	1	Nø						
51	CAP	1/2"	TH	1	Nø						
210	GATE VALVE	1/2"	SW	1	Nø						

Rev. No	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
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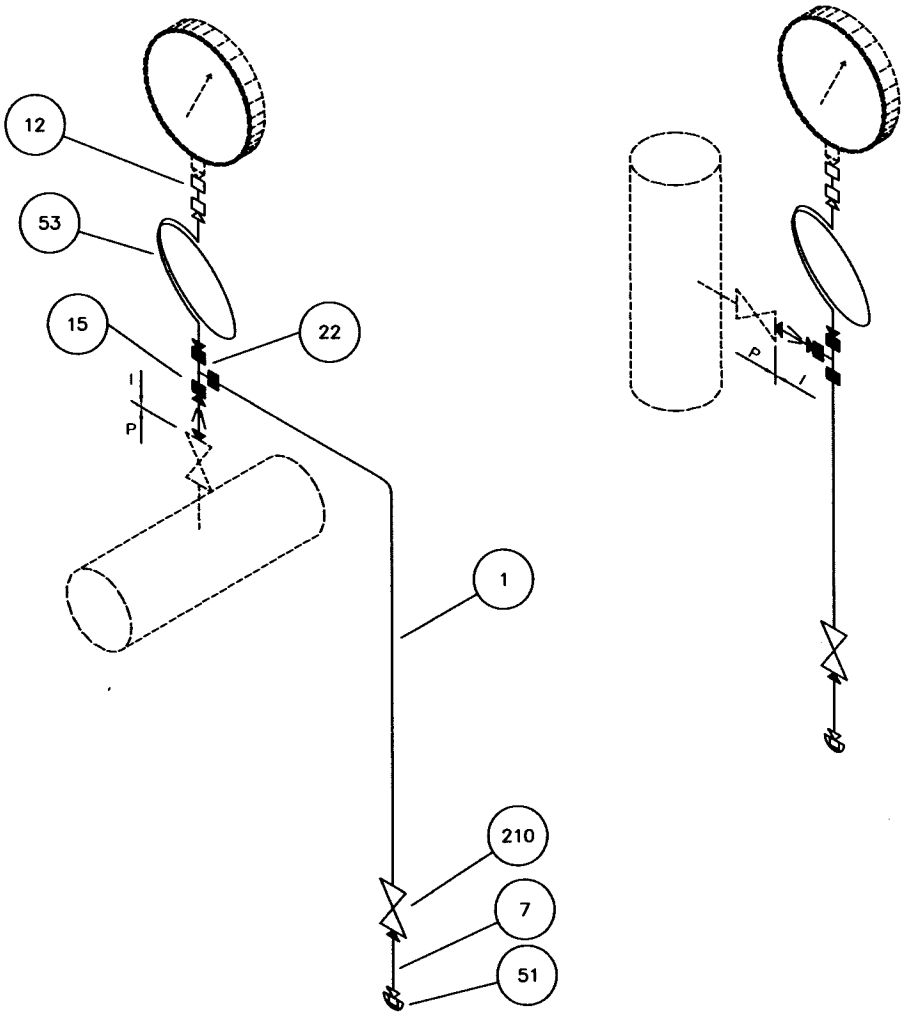
STANDARD NO. 7-52-0433 REV-5 RENUMBERED



P - BY PIPING
I - BY INSTRUMENTATION

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
1	PIPE	1/2"	PL	A/R	m						
7	NIPPLE	1/2"	TH X PL	1	Nø						
12	COUPLING	1/2"	TH	1	Nø						
15	SWAGE NIPPLE	3/4" X 1/2"	PL X PL	1	Nø						
22	EQUAL TEE	1/2"	SW	1	Nø						
51	CAP	1/2"	TH	1	Nø						
53	SYPHON C-TYPE	1/2" X 1/2"	TH(Ext) X PL	1	Nø						
210	GATE VALVE	1/2"	SW	1	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
0	01.07.2021	Issued As Standard	Manoj	AJS	MN	SM

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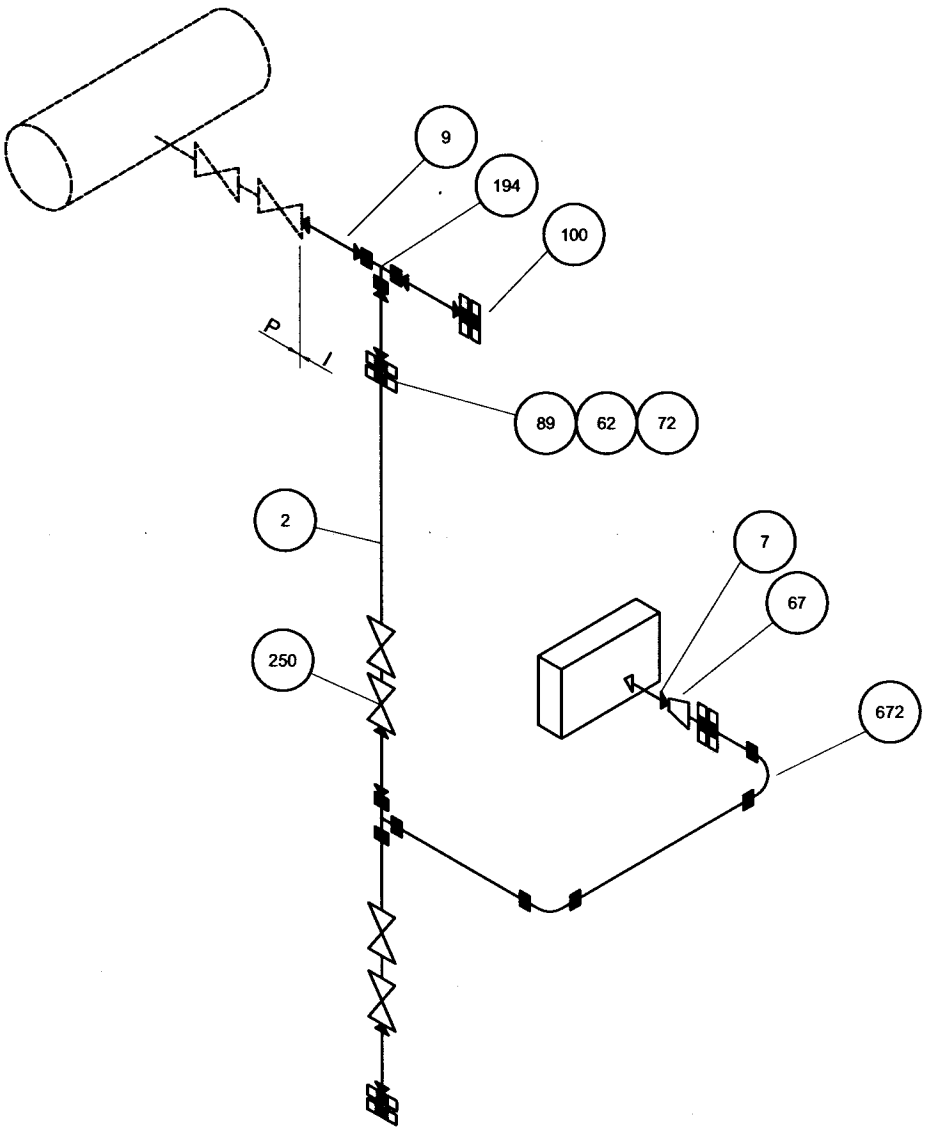

P - BY PIPING
I - BY INSTRUMENTATION

* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
2	PIPE	3/4"	PL	A/R	m						
7	NIPPLE	1/2"	TH X PL	1	Nø						
9	NIPPLE *	3/4"	PL X PL	5	Nø						
62	GASKET	FOR 3/4" FL		4	Nø						
67	REDUCER	3/4" x 1/2"	BW	1	Nø						
72	STUDS & NUTS	FOR 3/4" FL		4	Set						
89	FLANGE	3/4"	WN	6	Nø						
100	BLIND FLANGE	3/4"		2	Nø						
194	EQUAL TEE	3/4"	BW	2	Nø						
250	GATE VALVE	3/4"	BW	4	Nø						
672	ELBOW	3/4"	BW	2	Nø						

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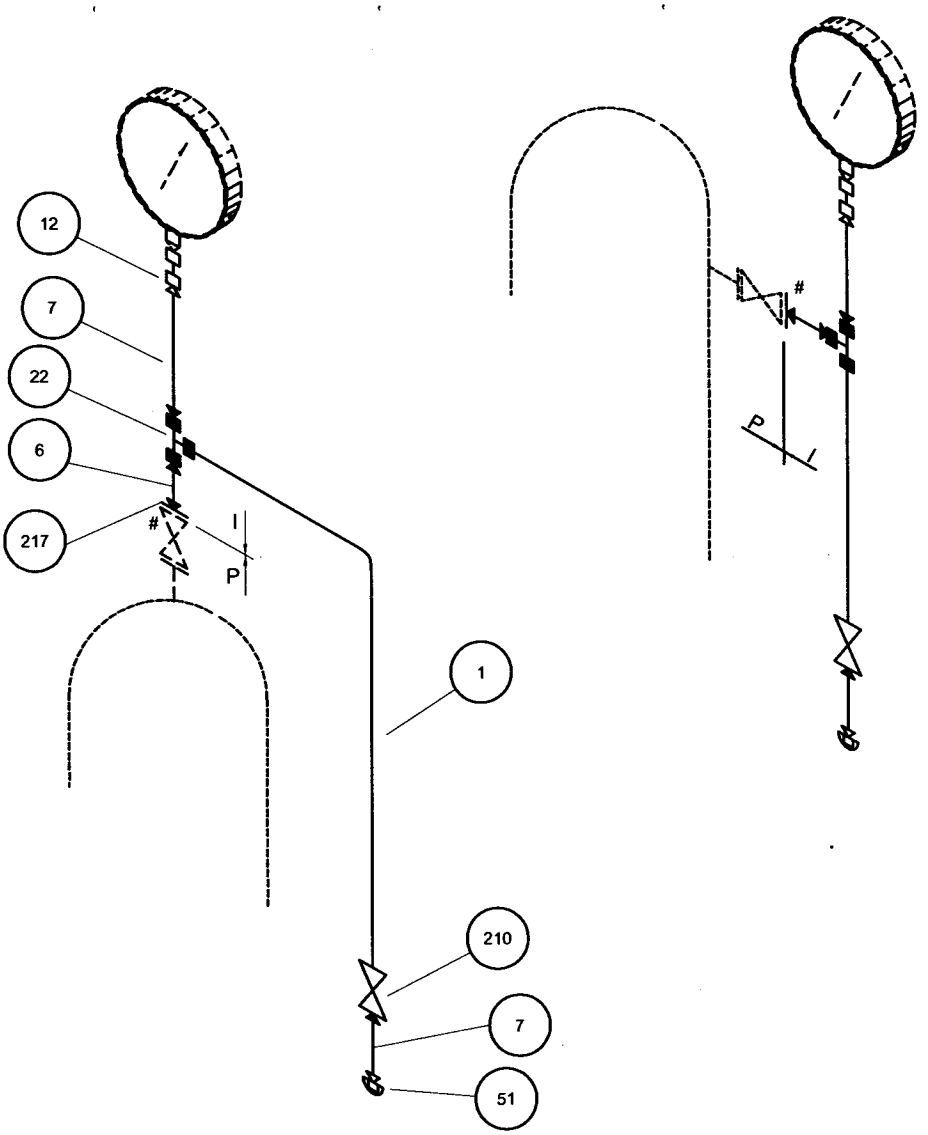

P - BY PIPING
I - BY INSTRUMENTATION

- STUD NUTS & GASKET BY PIPING
* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
1	PIPE	1/2"	PL	A/R	m						
6	NIPPLE *	1/2"	PL X PL	1	Nø						
7	NIPPLE	1/2"	TH X PL	2	Nø						
12	COUPLING	1/2"	TH	1	Nø						
22	EQUAL TEE	1/2"	SW	1	Nø						
51	CAP	1/2"	TH	1	Nø						
210	GATE VALVE	1/2"	SW	1	Nø						
217	FLANGE	2" X 1/2"	FLG x SW (Red)	1	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
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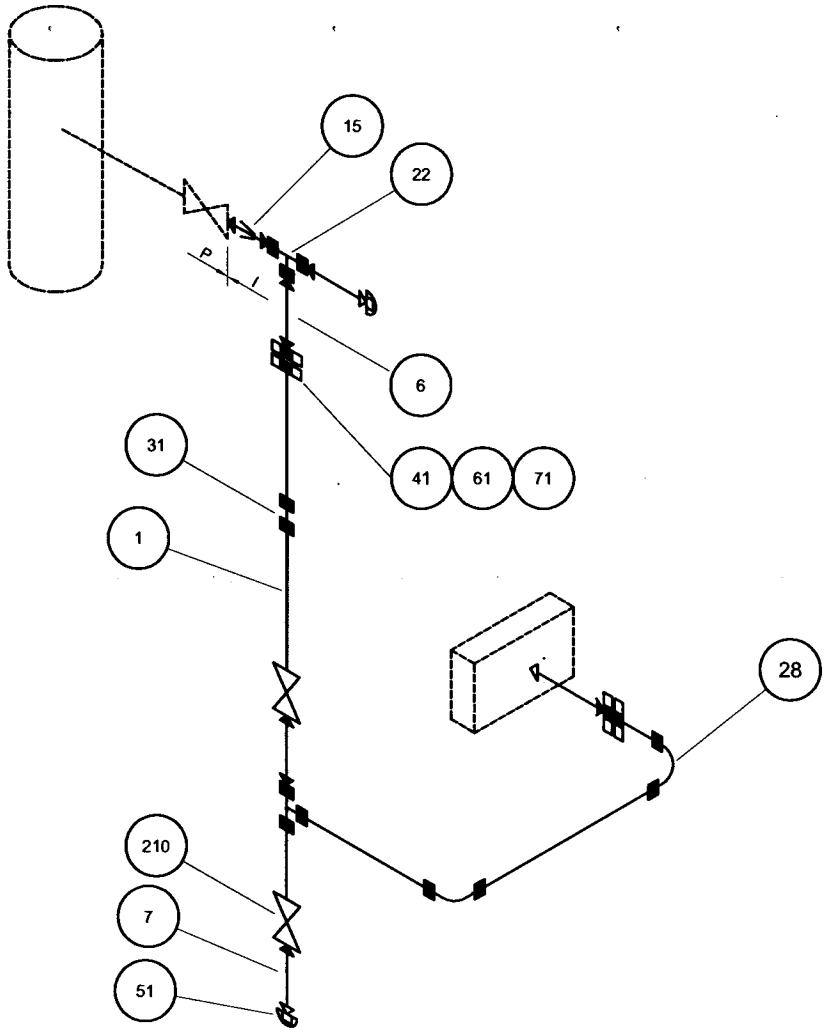

P - BY PIPING
I - BY INSTRUMENTATION

* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
1	PIPE	1/2"	PL	A/R	m						
6	NIPPLE *	1/2"	PL X PL	2	Nø						
7	NIPPLE	1/2"	TH X PL	3	Nø						
15	SWAGE NIPPLE	3/4" X 1/2"	PL X PL	1	Nø						
22	EQUAL TEE	1/2"	SW	2	Nø						
28	ELBOW	1/2"	SW	2	Nø						
31	COUPLING	1/2"	SW	1	Nø						
41	FLANGE	1/2"	SW	4	Nø						
51	CAP	1/2"	TH	2	Nø						
61	GASKET	FOR 1/2" FLG.		2	Nø						
71	STUDS & NUTS	FOR 1/2" FLG.		2	Set						
210	GATE VALVE	1/2"	SW	2	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
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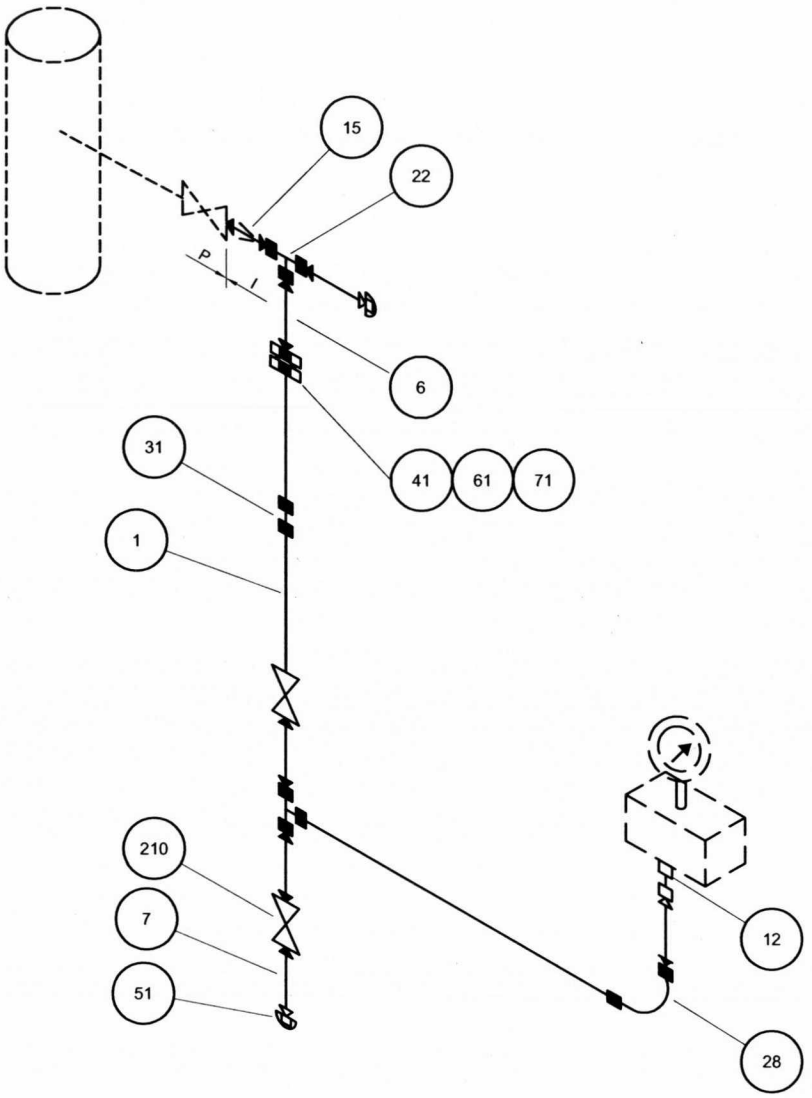

P - BY PIPING
I - BY INSTRUMENTATION

* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
1	PIPE	1/2"	PL	A/R	m	210	GATE VALVE	1/2"	SW	2	Nø
6	NIPPLE *	1/2"	PL X PL	3	Nø						
7	NIPPLE	1/2"	TH X PL	3	Nø						
12	COUPLING	1/2"	TH	1	Nø						
15	SWAGE NIPPLE	3/4" X 1/2"	PL X PL	1	Nø						
22	EQUAL TEE	1/2"	SW	2	Nø						
28	ELBOW	1/2"	SW	1	Nø						
31	COUPLING	1/2"	SW	1	Nø						
41	FLANGE	1/2"	SW	2	Nø						
51	CAP	1/2"	TH	2	Nø						
61	GASKET	FOR 1/2" FLG.		1	Nø						
71	STUDS & NUTS	FOR 1/2" FLG.		1	Set						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
0	01.07.2022	Issued As Standard	Manoj/AB	GG/AR	MN	SM

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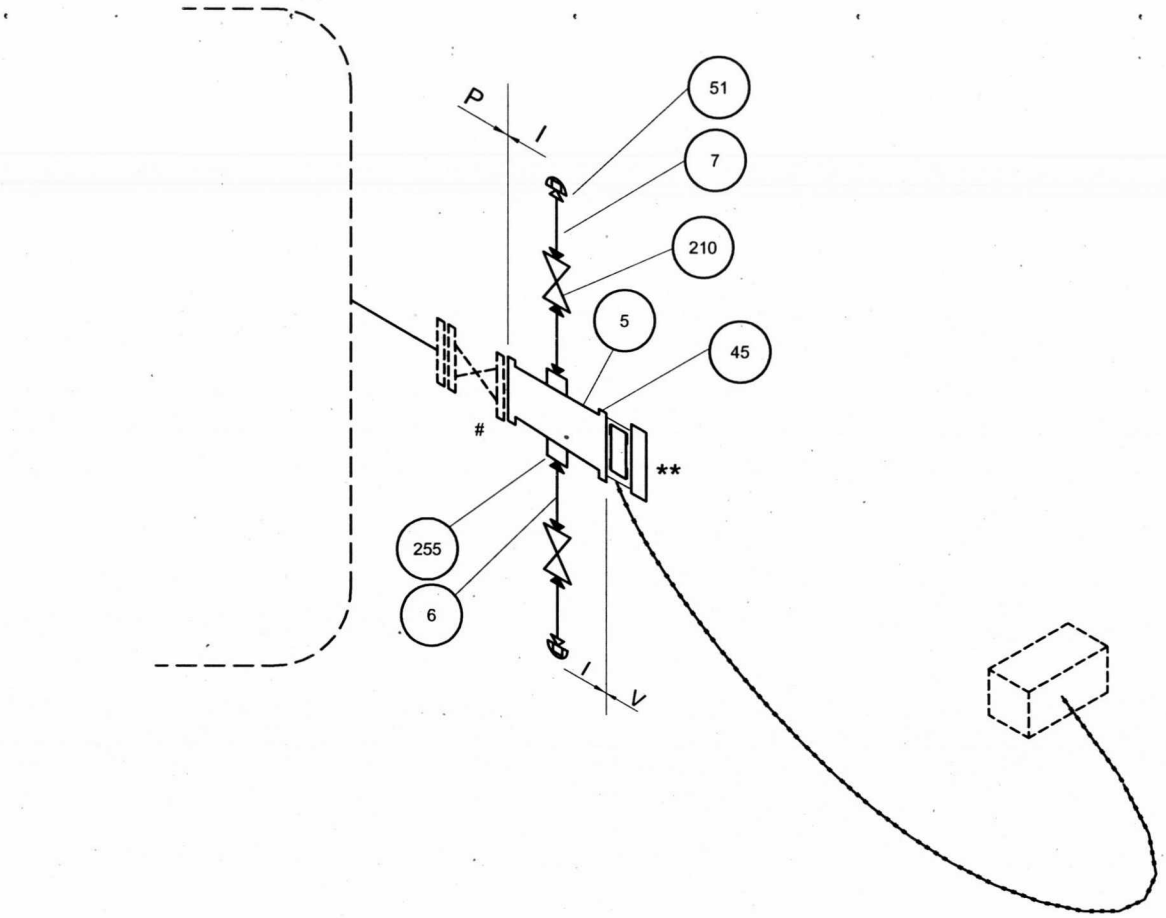

** GASKET, STUDS & NUTS (EXTRA LONG) BY VENDOR.

V - BY VENDOR
P - BY PIPING
I - BY INSTRUMENTATION

STUD NUTS & GASKET BY PIPING
* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
5	PIPE	2"	PL	A/R	m						
6	NIPPLE *	1/2"	PL X PL	2	Nø						
7	NIPPLE	1/2"	TH X PL	2	Nø						
45	FLANGE	2"	WN	2	Nø						
51	CAP	1/2"	TH	2	Nø						
210	GATE VALVE	1/2"	SW	2	Nø						
255	HALF COUPLING	1/2"		2	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
1	18.11.2022	Revised & reissued	Manoj	GG/AR	MN	SM
0	11.02.2022	Issued As Standard	Manoj/AB	GG/AR	MN	SM

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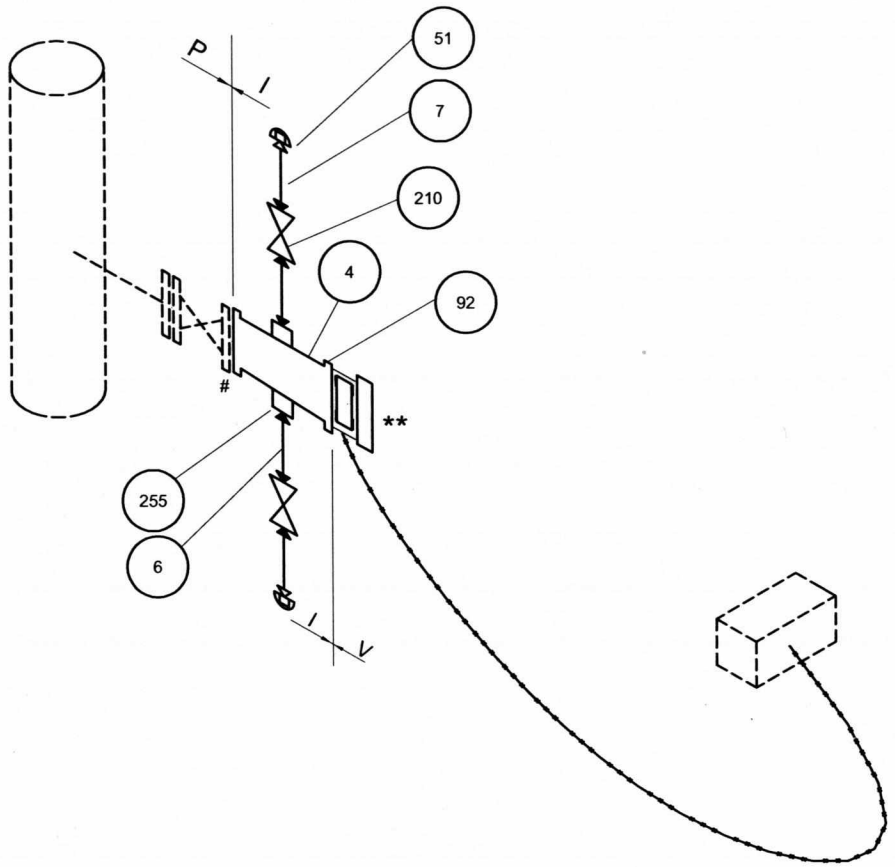

** GASKET, STUDS & NUTS (EXTRA LONG) BY VENDOR.
PRESSURE INST. TYPE WITH OR WITHOUT CAPILLARY SHALL BE AS PER INST. DATA SHEET.

V - BY VENDOR
P - BY PIPING
I - BY INSTRUMENTATION

STUD NUTS & GASKET BY PIPING
* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
4	PIPE	1 1/2"	PL	A/R	m						
6	NIPPLE *	1/2"	PL X PL	2	Nø						
7	NIPPLE	1/2"	TH X PL	2	Nø						
51	CAP	1/2"	TH	2	Nø						
92	FLANGE	1 1/2"	SW	2	Nø						
210	GATE VALVE	1/2"	SW	2	Nø						
255	HALF COUPLING	1/2"		2	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
0	01.07.2022	Issued As Standard	Manoj/AB	GG/AR	MN	SM

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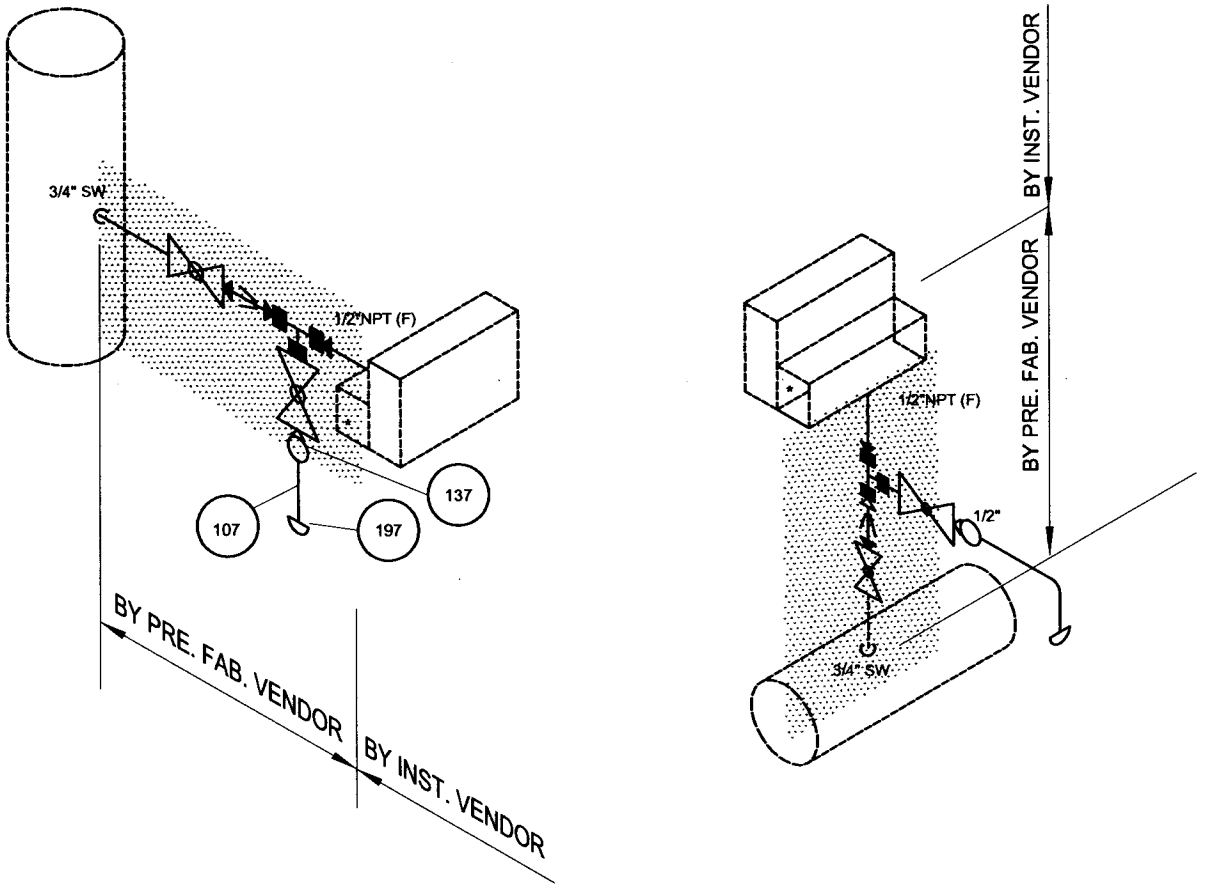

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
						107	TUBE	1/2"	OD	A/R	m
						137	MALE CONNECTOR	1/2" X 1/2"	TH X OD	1	Nø
						197	TUBING CAP	1/2"	OD	1	Nø

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
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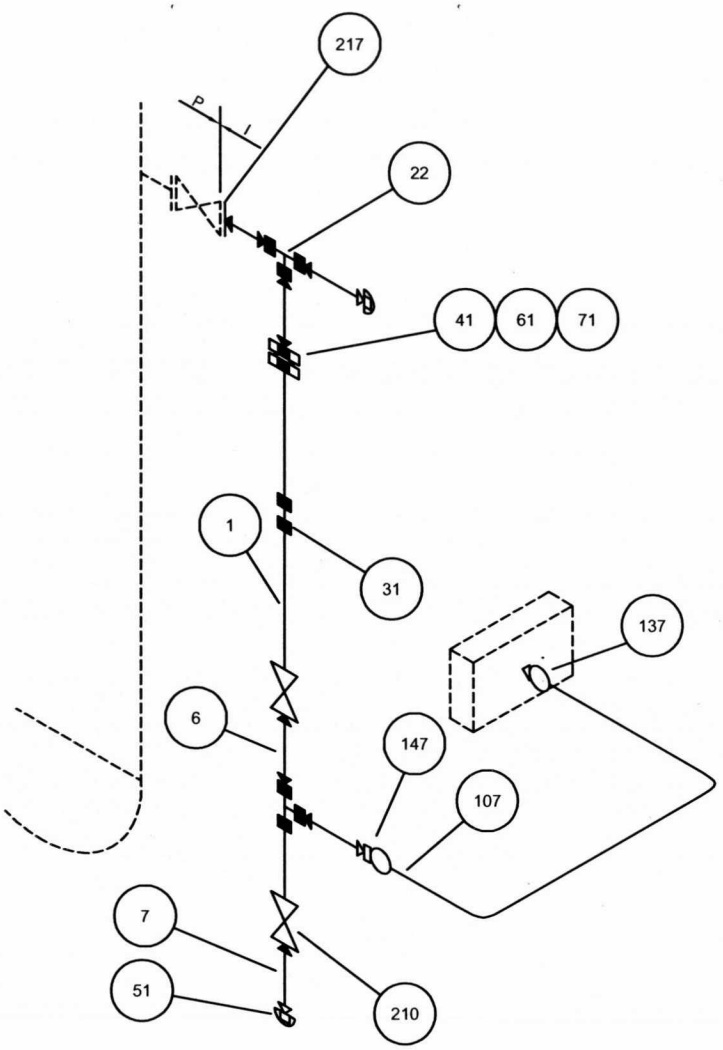

P - BY PIPING
I - BY INSTRUMENTATION

* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
1	PIPE	1/2"	PL	A/R	m	107	TUBE	1/2"	OD	A/R	m
6	NIPPLE *	1/2"	PL X PL	3	Nø	137	MALE CONNECTOR	1/2" X 1/2"	TH X OD	1	Nø
7	NIPPLE	1/2"	TH X PL	3	Nø	147	FEMALE CONNECTOR	1/2" X 1/2"	TH X OD	1	Nø
22	EQUAL TEE	1/2"	SW	2	Nø						
31	COUPLING	1/2"	SW	1	Nø						
41	FLANGE	1/2"	SW	2	Nø						
217	FLANGE	2" X 1/2"	FL X SW (Red)	1	Nø						
51	CAP	1/2"	TH	2	Nø						
61	GASKET	FOR 1/2" FLG.		1	Nø						
71	STUDS & NUTS	FOR 1/2" FLG.		1	Set						
210	GATE VALVE	1/2"	SW	2	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
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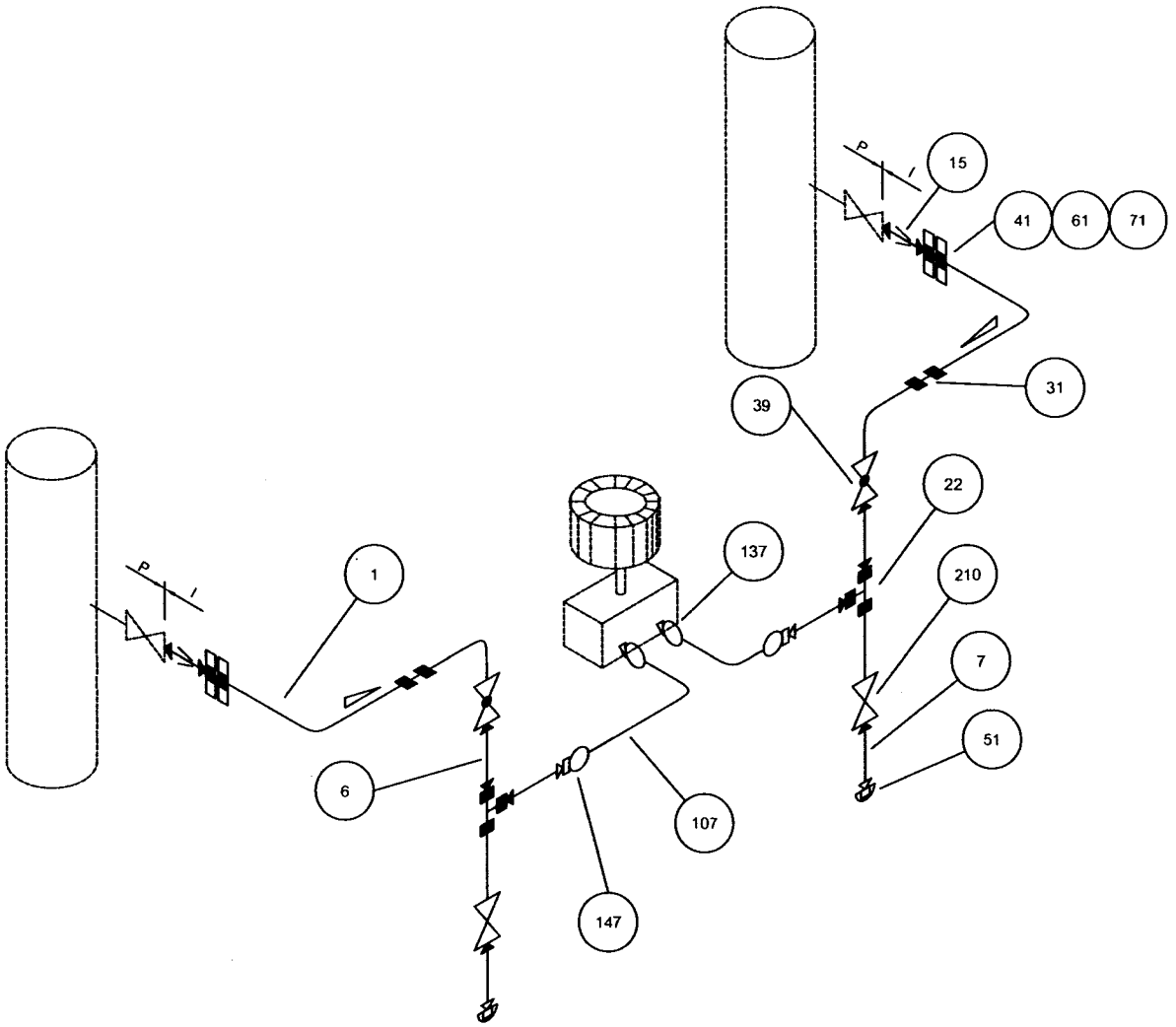
STANDARD NO. 7-52-0452 REV-5 RENUMBERED



P - BY PIPING
I - BY INSTRUMENTATION

* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
1	PIPE	1/2"	PL	A/R	m	107	TUBE	1/2"	OD	A/R	m
6	NIPPLE *	1/2"	PL X PL	2	Nø	137	MALE CONNECTOR	1/2" X 1/2"	TH X OD	2	Nø
7	NIPPLE	1/2"	TH X PL	4	Nø	147	FEMALE CONNECTOR	1/2" X 1/2"	TH X OD	2	Nø
15	SWAGE NIPPLE	3/4" X 1/2"	PL X PL	2	Nø						
22	EQUAL TEE	1/2"	SW	2	Nø						
31	COUPLING	1/2"	SW	2	Nø						
39	GLOBE VALVE	1/2"	SW	2	Nø						
41	FLANGE	1/2"	SW	4	Nø						
51	CAP	1/2"	TH	2	Nø						
61	GASKET	FOR 1/2" FLG.		2	Nø						
71	STUDS & NUTS	FOR 1/2" FLG		2	Set						
210	GATE VALVE	1/2"	SW	2	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
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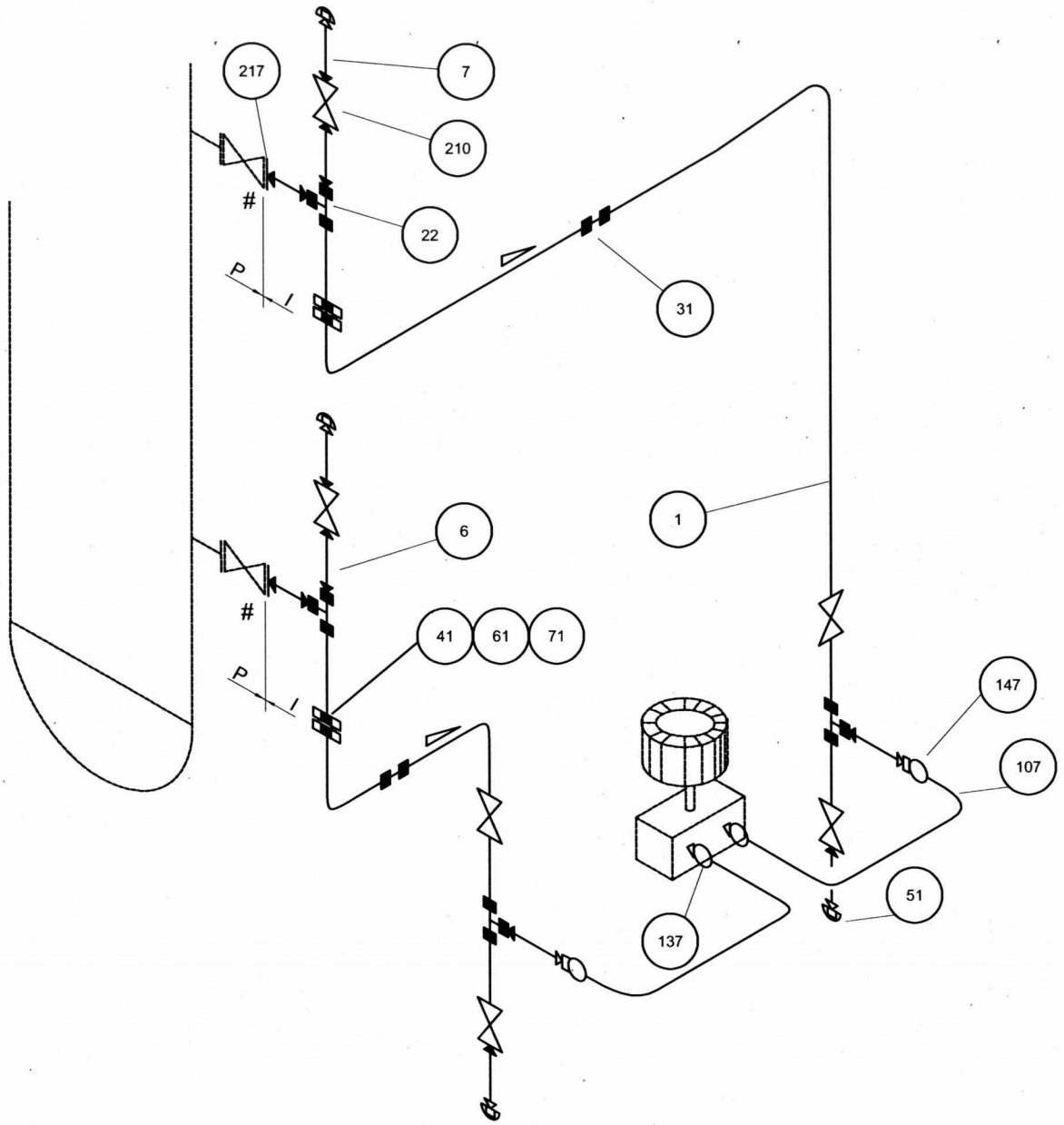

P - BY PIPING
I - BY INSTRUMENTATION
V - BY INSTR. VENDOR

- STUD NUTS & GASKET BY PIPING
* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
1	PIPE	1/2"	PL	A/R	m	107	TUBE	1/2"	OD	A/R	m
6	NIPPLE *	1/2"	PL X PL	4	Nø	137	MALE CONNECTOR	1/2" X 1/2"	TH X OD	2	Nø
7	NIPPLE	1/2"	TH X PL	6	Nø	147	FEMALE CONNECTOR	1/2" X 1/2"	TH X OD	2	Nø
22	EQUAL TEE	1/2"	SW	4	Nø						
31	COUPLING	1/2"	SW	2	Nø						
41	FLANGE	1/2"	SW	4	Nø						
51	CAP	1/2"	TH	4	Nø						
61	GASKET	FOR 1/2" FL		2	Nø						
71	STUDS & NUTS	FOR 1/2" FL		2	Set						
210	GATE VALVE	1/2"	SW	6	Nø						
217	FLANGE	2" X 1/2"	FL X SW (Red)	2	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
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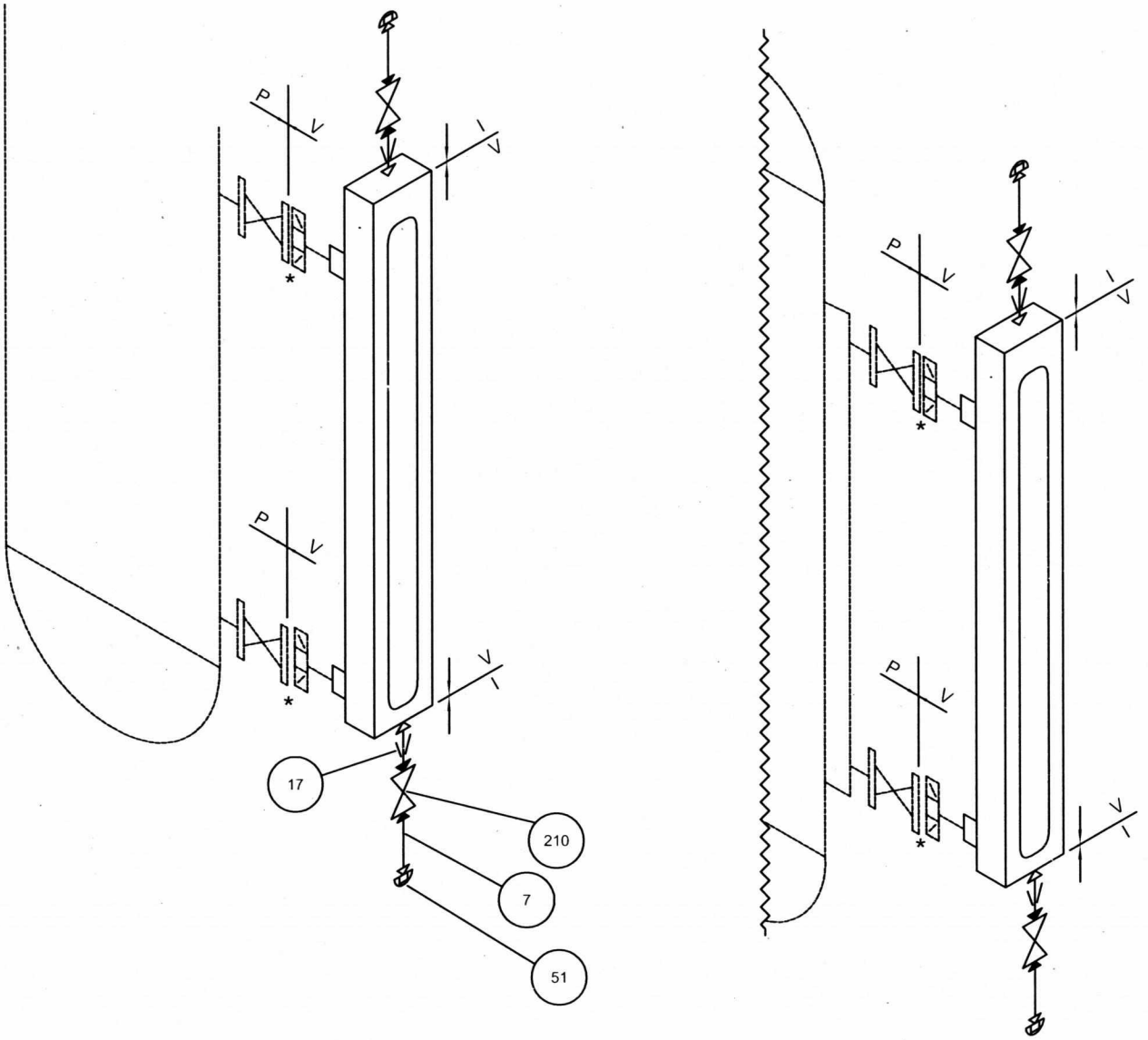
STANDARD NO. 7-52-0484 REV-0 RENUMBERED



P - BY PIPING
I - BY INSTRUMENTATION
V - BY INST. VENDOR

* - STUD NUTS & GASKET BY PIPING

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
7	NIPPLE	1/2"	PL X TH	2	Nø						
17	SWAGE NIPPLE	3/4" x 1/2"	TH X PL	2	Nø						
51	CAP	1/2"	TH	2	Nø						
210	GATE VALVE	1/2"	SW	2	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
1	01.05.2023	Revised & Reissued As Standard	Manoj	SG/AR	MN	SM
0	09.06.2021	Issued As Standard	Manoj	AJS	RG	RKT

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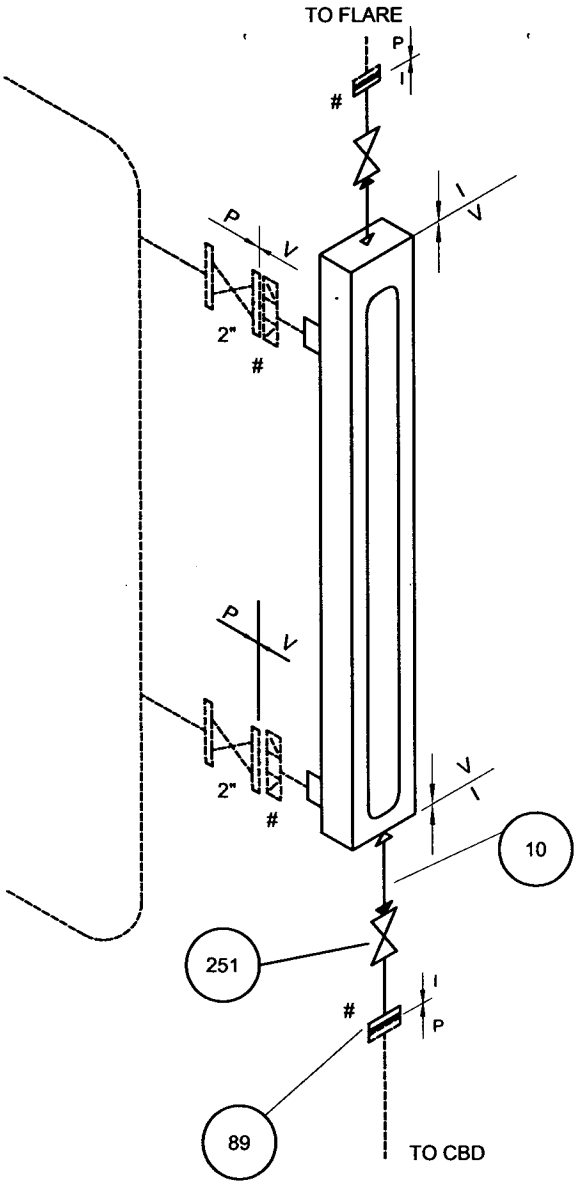

V - BY INSTR. VENDOR
P - BY PIPING
I - BY INSTRUMENTATION

STUD NUTS & GASKET BY PIPING

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
10	NIPPLE	3/4"	TH X PL	2	Nø						
89	FLANGE	3/4"	WN	2	Nø						
251	GATE VAVE	3/4"	SW	2	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
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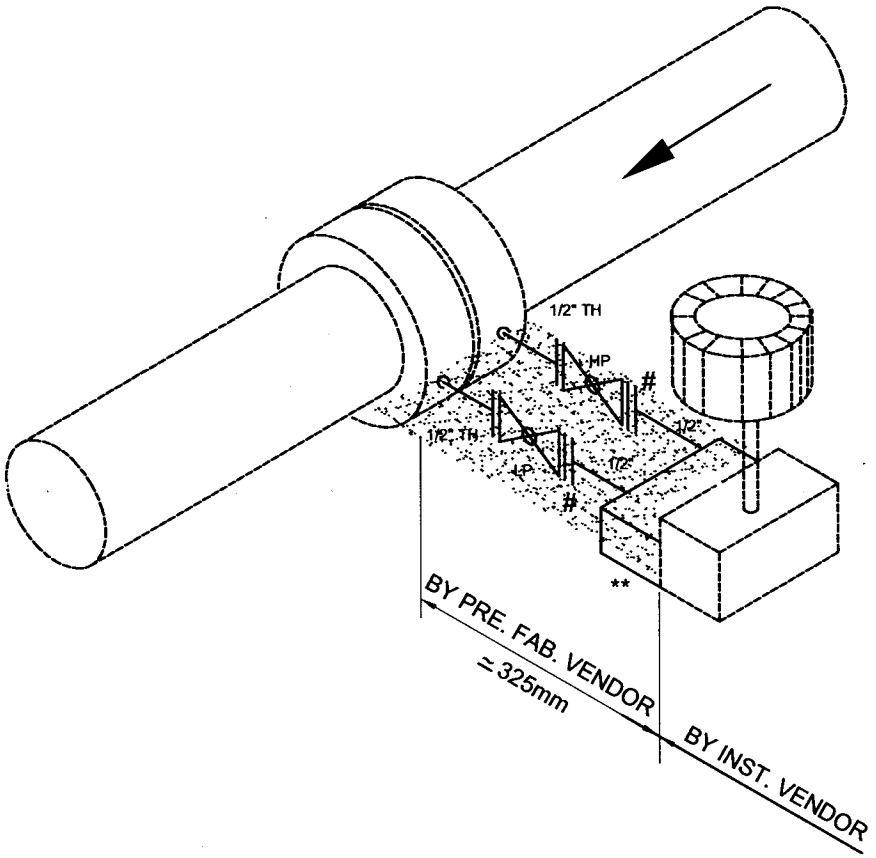

ONE FLANGE SHALL BE PART OF ISOLATION VALVE AND OTHER SHALL BE PART OF 5 WAY MANIFOLD.

** 5 WAY MANIFOLD

THIS DRAWING SHALL NOT BE REFERRED FOR TAPPING ORIENTATION.

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Chairman
0	11.02.2022	Issued As Standard	Manoj/AB	GG/AR	MN	SM

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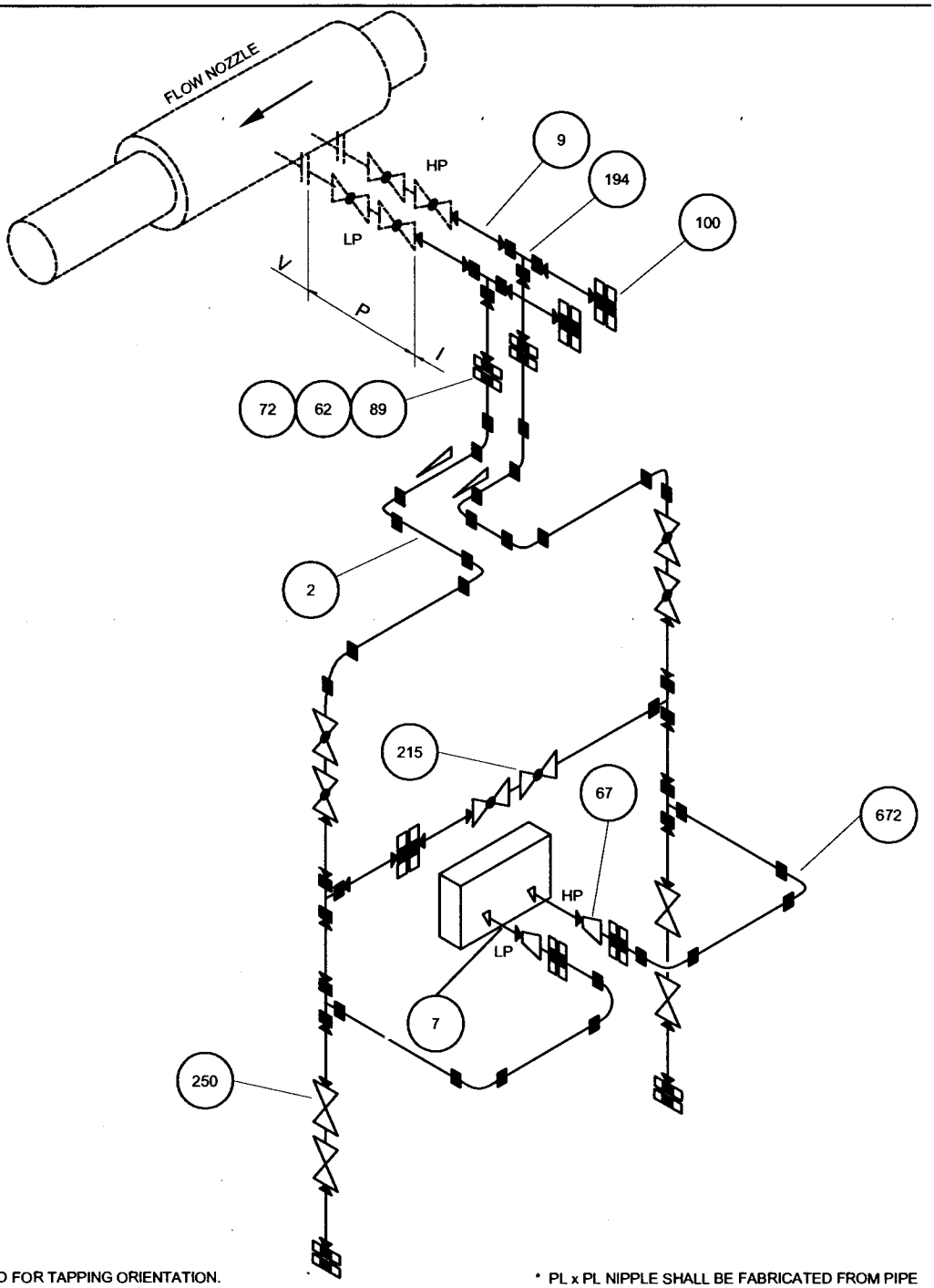

V - BY VENDOR
P - BY PIPING
I - BY INSTRUMENTATION
THIS DRAWING SHALL NOT BE REFERRED FOR TAPPING ORIENTATION.

* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
2	PIPE	3/4"	PL	A/R	m						
7	NIPPLE	1/2"	TH X PL	2	Nø						
9	NIPPLE *	3/4"	PL X PL	16	Nø						
62	GASKET	FOR 3/4" FL		9	Nø						
67	REDUCER	3/4" x 1/2"	BW	2	Nø						
72	STUDS & NUTS	FOR 3/4" FL		9	Set						
89	FLANGE	3/4"	WN	14	Nø						
100	BLIND FLANGE	3/4"		4	Nø						
194	EQUAL TEE	3/4"	BW	6	Nø						
215	GLOBE VALVE	3/4"	BW	6	Nø						
250	GATE VALVE	3/4"	BW	4	Nø						
672	ELBOW	3/4"	BW	12	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
0	11.02.2022	Issued As Standard	Manoj/AB	GG/AR	MN	SM

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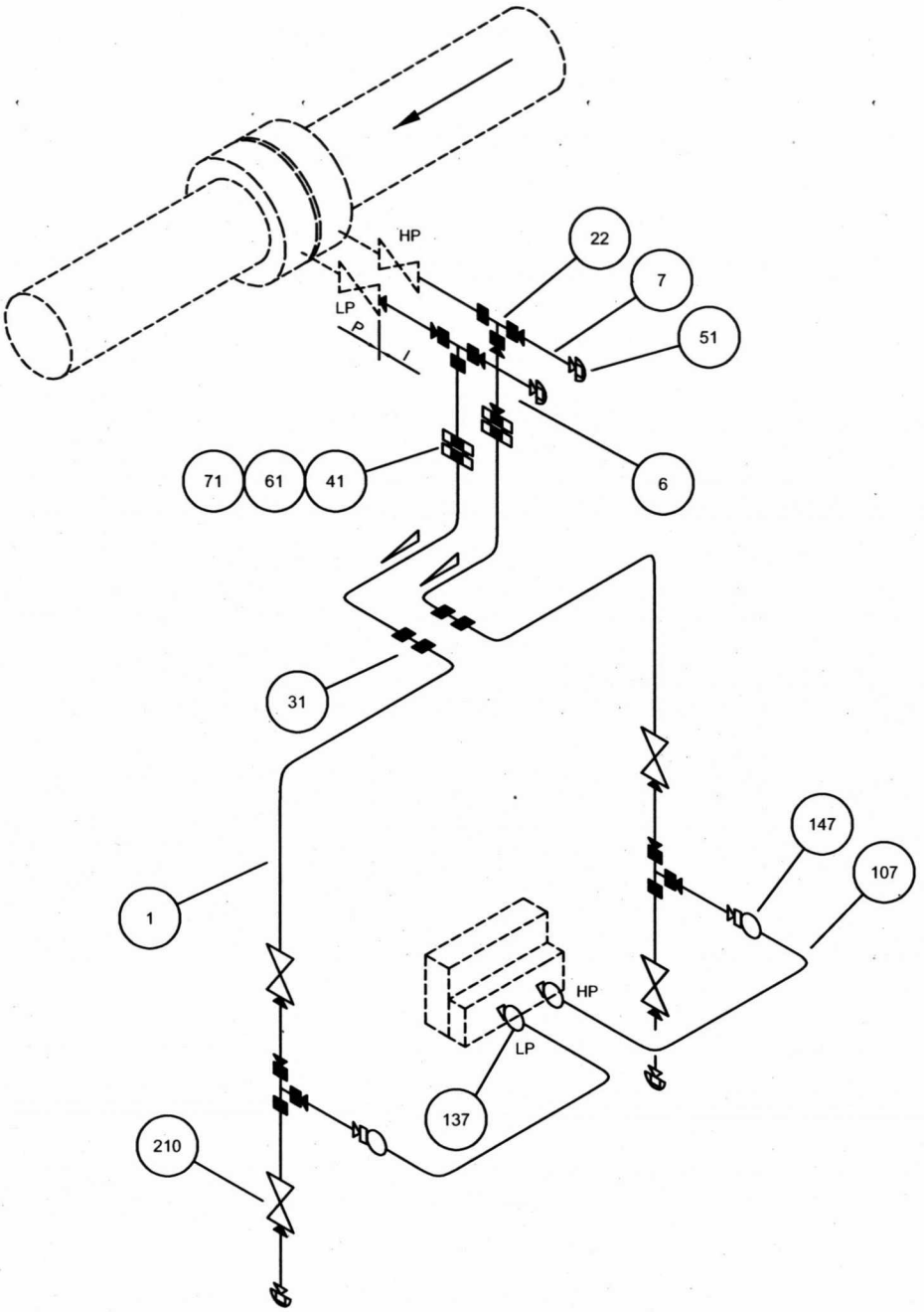

P - BY PIPING
I - BY INSTRUMENTATION
THIS DRAWING SHALL NOT BE REFERRED FOR TAPPING ORIENTATION.

* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
1	PIPE	1/2"	PL	A/R	m	107	TUBE	1/2"	OD	A/R	m
6	NIPPLE *	1/2"	PL X PL	4	Nø	137	MALE CONNECTOR	1/2" X 1/2"	TH X OD	2	Nø
7	NIPPLE	1/2"	TH X PL	6	Nø	147	FEMALE CONNECTOR	1/2" X 1/2"	TH X OD	2	Nø
22	EQUAL TEE	1/2"	SW	4	Nø						
31	COUPLING	1/2"	SW	2	Nø						
41	FLANGE	1/2"	SW	4	Nø						
51	CAP	1/2"	TH	4	Nø						
61	GASKET	FOR 1/2" FLG.		2	Nø						
71	STUDS & NUTS	FOR 1/2" FLG.		2	Set						
210	GATE VALVE	1/2"	SW	4	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
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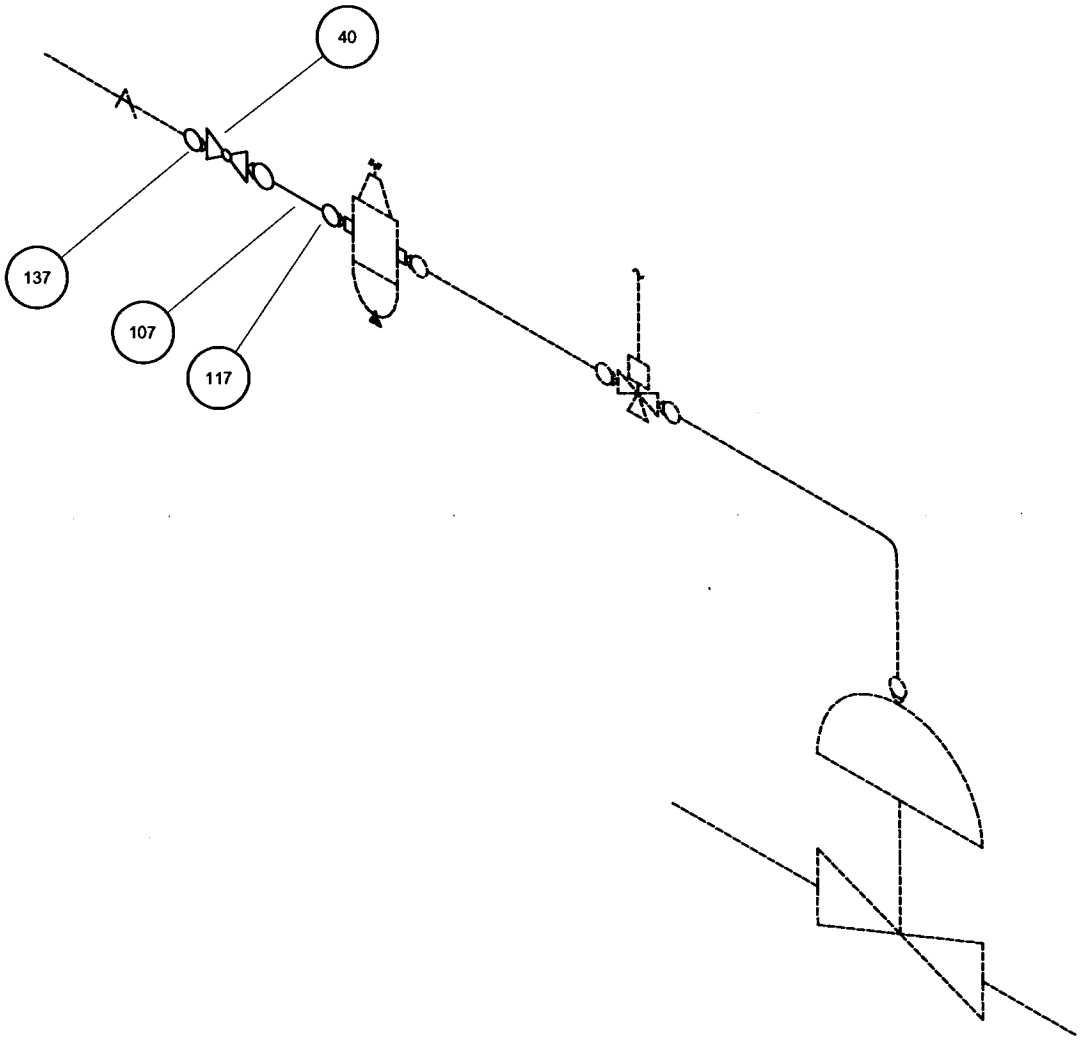

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
40	BALL VALVE	1/2"	TH	1	Nø	107	TUBE	1/2"	OD	A/R	m
						117	MALE CONNECTOR	1/4" X 1/2"	TH X OD	1	Nø
						137	MALE CONNECTOR	1/2" X 1/2"	TH X OD	2	Nø

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
0	11.02.2022	Issued As Standard	Manoj/AB	GG/AR	MN	SM

Approved by

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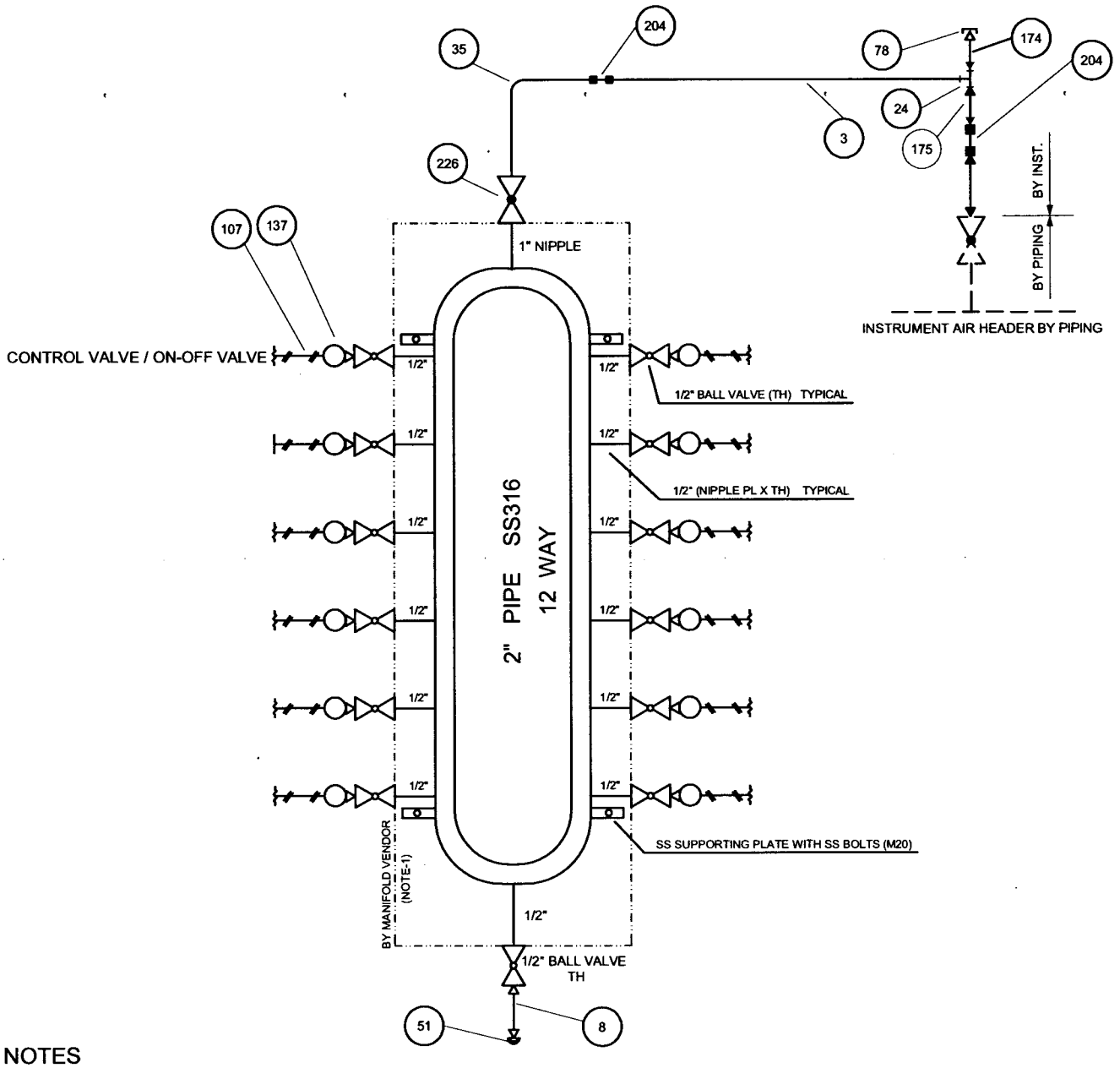

NOTES

1 - PRE-FABRICATED INSTRUMENT AIR MANIFOLD OF SS316 MATERIAL SHALL BE CONSIDERED WITH 2" PIPE.

2 - TUBING PLUG SHALL BE USED AFTER MALE CONNECTOR FOR SPARE TAPPINGS.

P - BY PIPING

I - BY INSTRUMENTATION

* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
3	PIPE	1"	PL	A/R	m	40	BALL VALVE	1/2"	TH	13	Nø
8	NIPPLE	1/2"	TH X TH	1	Nø	107	TUBE	1/2"	OD	A/R	m
24	EQUAL TEE	1"	SW	1	Nø	137	MALE CONNECTOR	1/2" X 1/2"	TH X OD	12	Nø
35	ELBOW	1"	SW	4	Nø	167	TUBE UNION	1/2"	OD	24	Nø
51	CAP	1/2"	TH	1	Nø	160	TUBING PLUG	1/2"	OD	6	Nø
78	CAP	1"	TH	1	Nø						
174	NIPPLE	1"	TH X PL	1	Nø						
175	NIPPLE *	1"	PL X PL	2	Nø						
204	COUPLING	1"	SW	3	Nø						
226	GLOBE VALVE	1"	SW	1	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
0	11.02.2022	Issued As Standard	Manoj/AB	GC/AR	MN	SM

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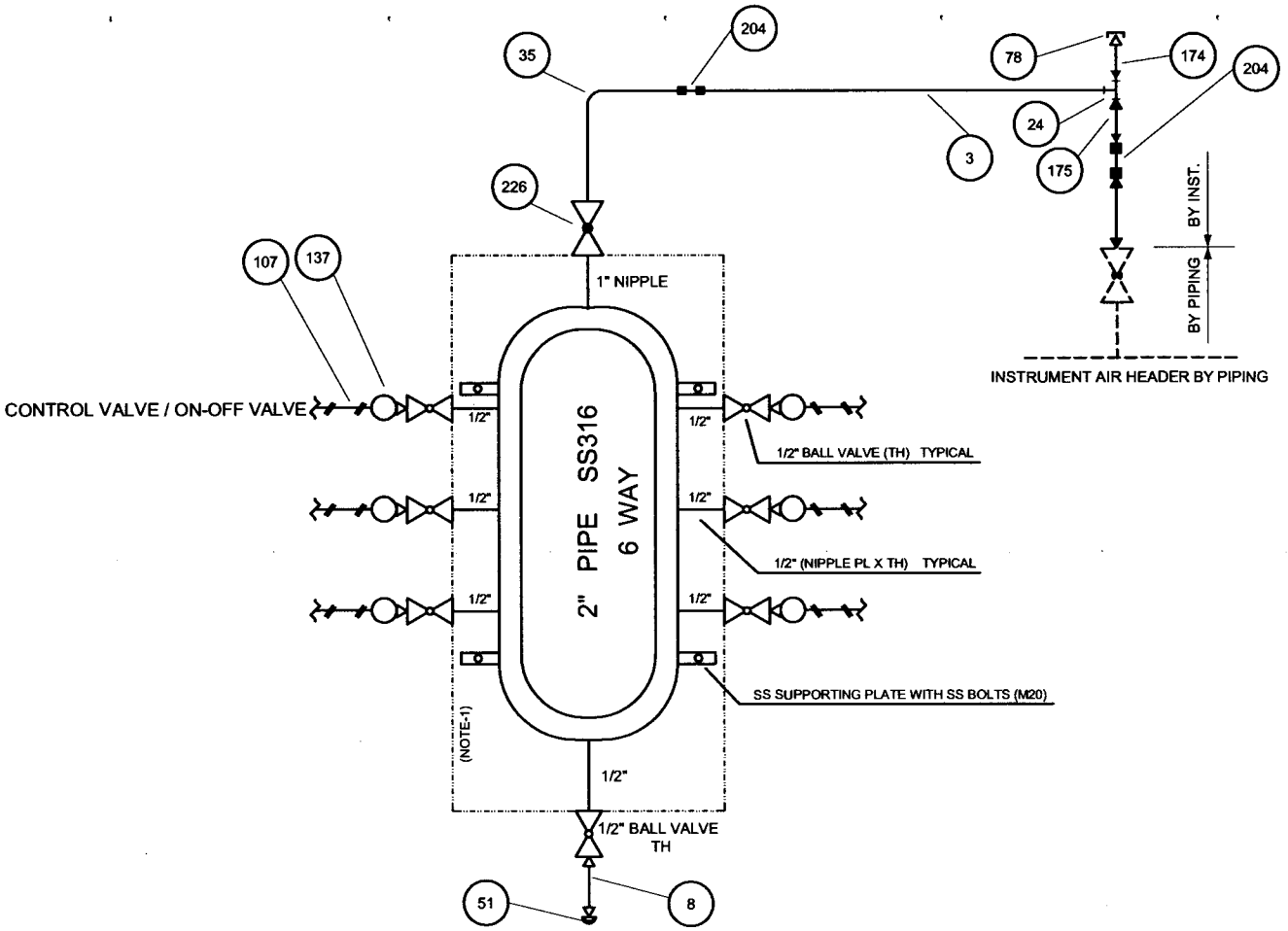

NOTES

1 - PRE-FABRICATED INSTRUMENT AIR MANIFOLD OF SS316 MATERIAL SHALL BE CONSIDERED WITH 2" PIPE.
2 - TUBING PLUG SHALL BE USED AFTER MALE CONNECTOR FOR SPARE TAPPINGS.

P - BY PIPING
I - BY INSTRUMENTATION
* PL x PL NIPPLE SHALL BE FABRICATED FROM PIPE

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
3	PIPE	1"	PL	A/R	m	40	BALL VALVE	1/2"	TH	7	Nø
8	NIPPLE	1/2"	TH X TH	1	Nø	107	TUBE	1/2"	OD	A/R	m
24	EQUAL TEE	1"	SW	1	Nø	137	MALE CONNECTOR	1/2" X 1/2"	TH X OD	6	Nø
35	ELBOW	1"	SW	4	Nø	167	TUBE UNION	1/2"	OD	12	Nø
51	CAP	1/2"	TH	1	Nø	160	TUBING PLUG	1/2"	OD	3	Nø
78	CAP	1"	TH	1	Nø						
174	NIPPLE	1"	TH X PL	1	Nø						
175	NIPPLE *	1"	PL X PL	2	Nø						
204	COUPLING	1"	SW	3	Nø						
226	GLOBE VALVE	1"	SW	1	Nø						

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
0	11.02.2022	Issued As Standard	Manoj/AB	GG/AR	MN	SM

Approved by

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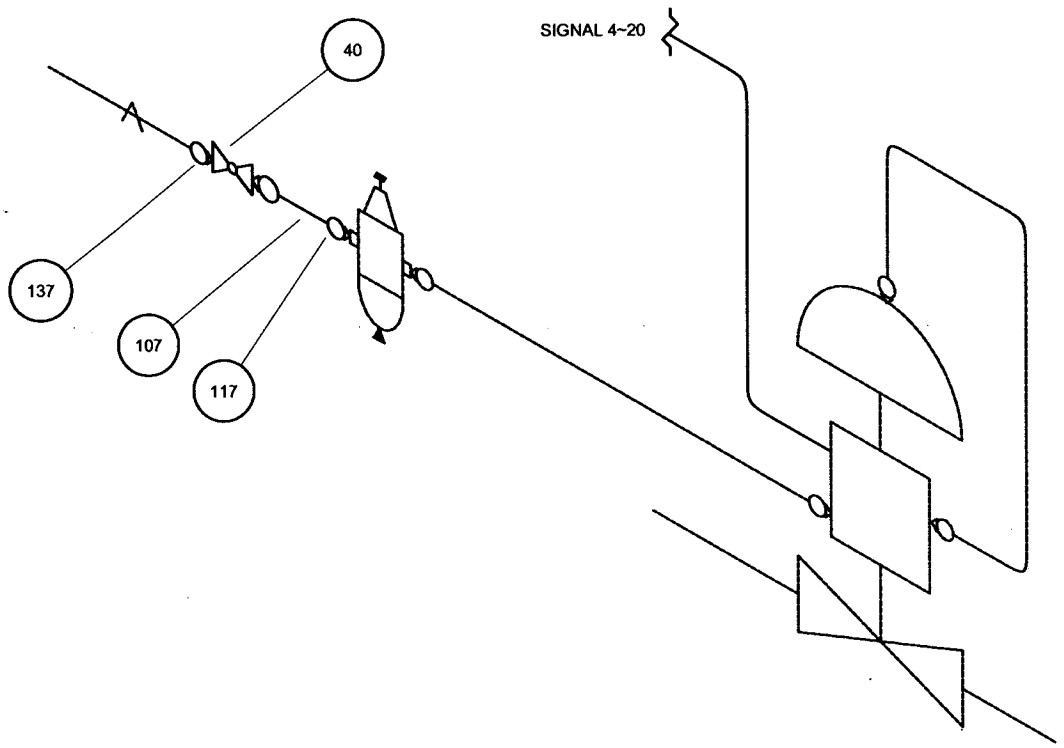

LIST OF ITEMS

CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT	CODE	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
40	BALL VALVE	1/2"	TH	1	Nø	107	TUBE	1/2" mm	OD	A/R	m
						117	MALE CONNECTOR	1/4" X 1/2"	TH X OD	1	Nø
						137	MALE CONNECTOR	1/2" X 1/2"	TH X OD	2	Nø

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
0	11.02.2022	Issued As Standard	Manoj/AB	GG/AR	MN	SM

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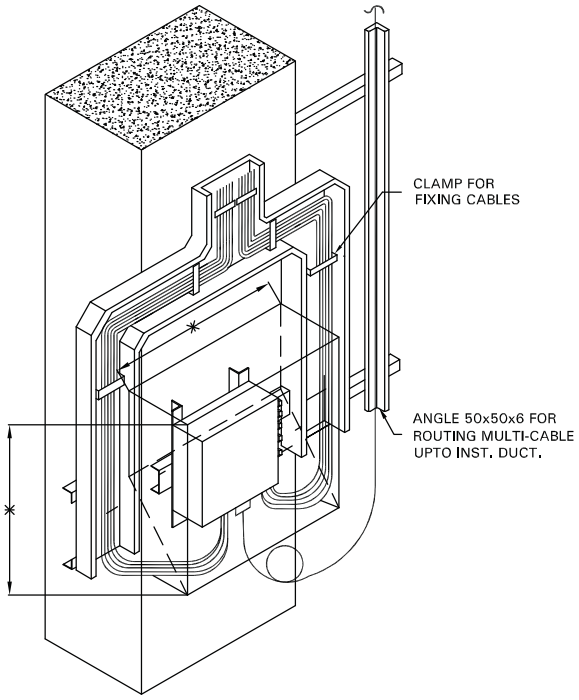
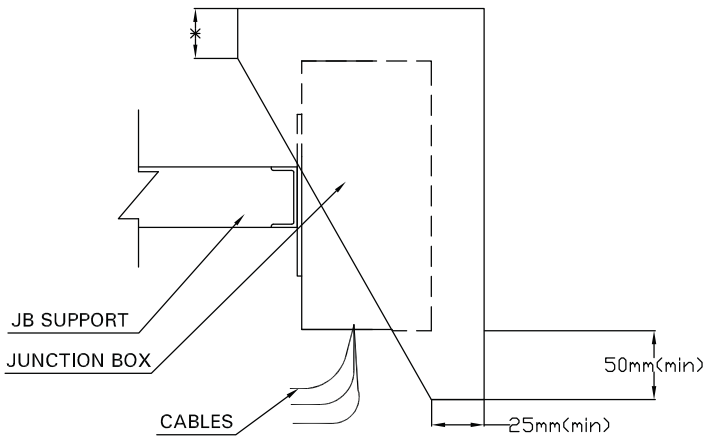
INSTRUMENTATION	FABRICATION DETAIL OF CANOPY FOR JUNCTION BOXES	REV.	DATE	REVISION	BY	CHKD	APPRD	
		0	03.04.25	ISSUED WITH TENDER	AS	JJ	AR	





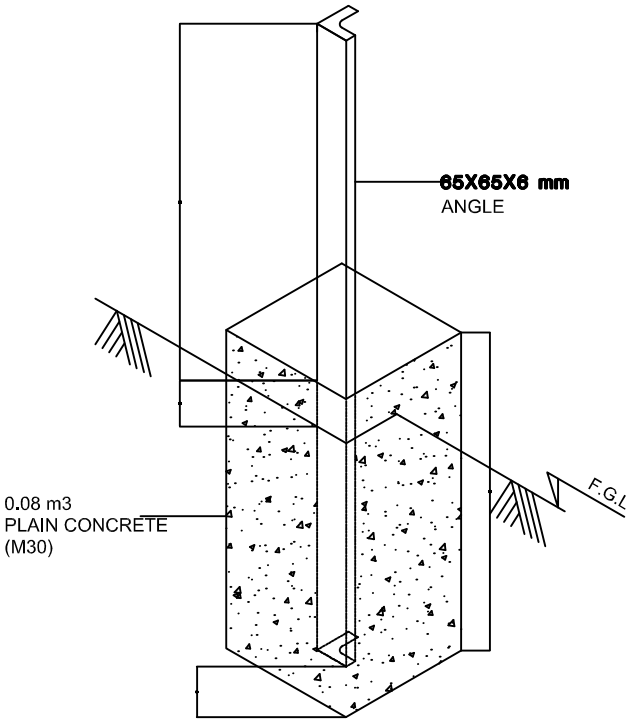
SIDE VIEW

NOTE:

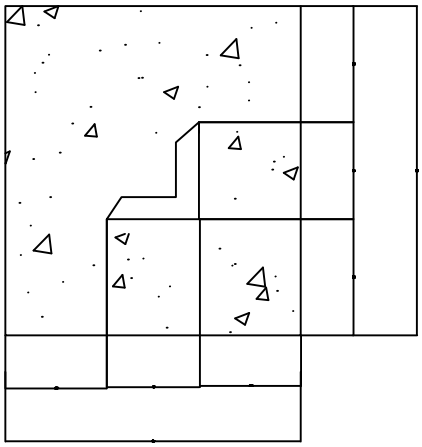
1. * SHALL BE AS PER JUNCTION BOX/SUIT TO SITE
2. PROPER FIXING ARRANGEMENT SHALL BE MADE BY THE CONTRACTOR.

ENGINEERS INDIA LIMITED NEW DELHI	CLIENT: M/s BPCL	INSTALLATION STANDARD	REV.
		B933-003-16-51-IS-008	0
		SHEET 1 OF 1	

INSTRUMENTATION	REV.	DATE	REVISION	BY	CHECKED	APPD.	APPD.
	0	03.04.25	ISSUED WITH TENDER	AS	JJ	AR	



RCC PEDESTAL FOR CABLE TRAY SUPPORT



PLAN VIEW

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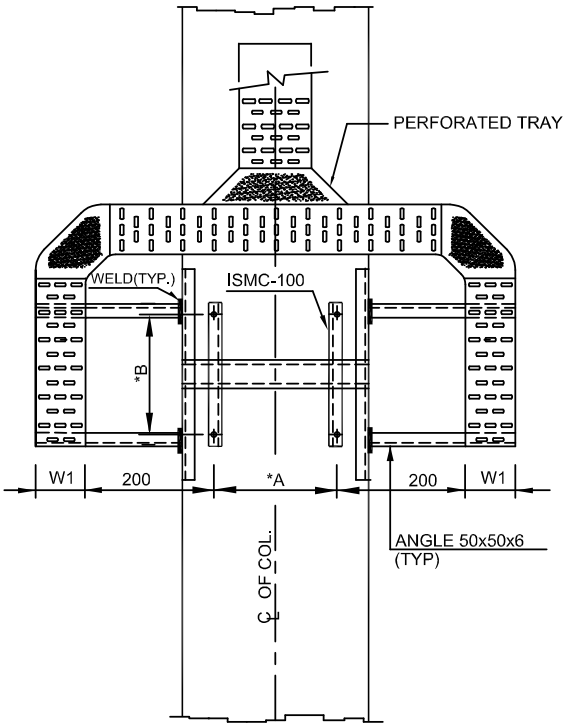
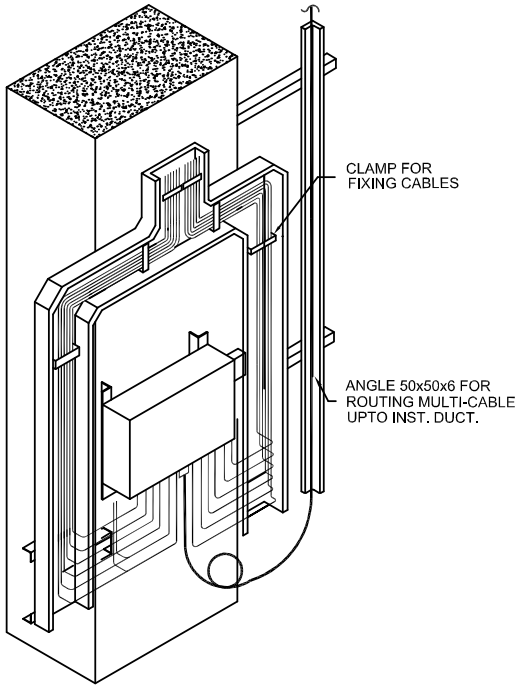
ENGINEERS INDIA LIMITED NEW DELHI	RCC PEDESTAL FOR CABLE TRAY SUPPORT DETAILS	DRAWING NO.	REV.
		B933-003-16-51-IS-011	0
		SHEET 1 OF 1	

INSTRUMENTATION	REV.	DATE	REVISION	BY	CHECKED	APPD.	APPD.
	0	03.04.25	ISSUED WITH TENDER	AS	JJ	AR	

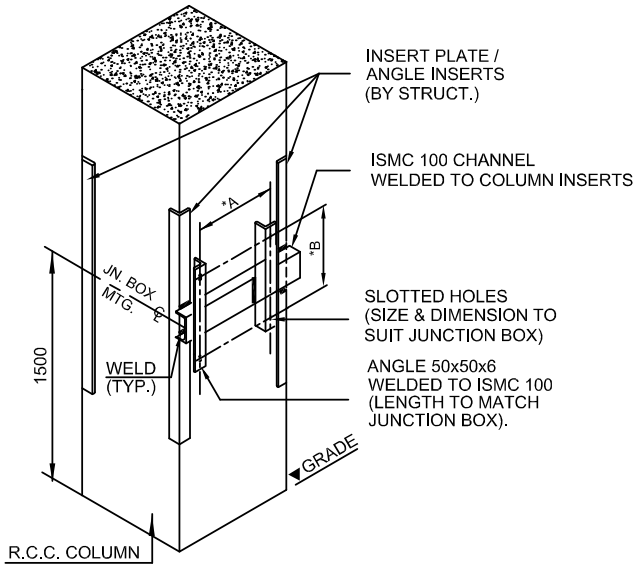
TRAY ARRANGEMENT FOR JUNCTION BOXES



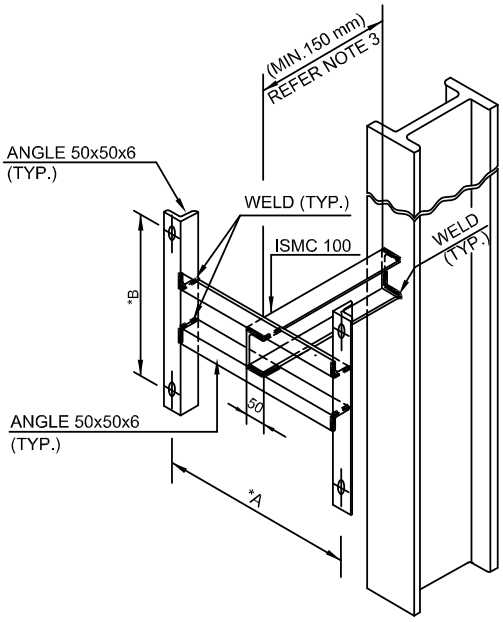
CABLE ROUTING FOR JUNCTION BOXES.



JN. BOX MOUNTING FRAME (R.C.C. COLUMN)



JN. BOX MOUNTING FRAME (STEEL COLUMN)



* DIMENSION `A and B' TO SUIT JUNCTION BOX.

NOTE:
1. ALL DIMENSIONS ARE IN mm.
2. CLAMP MULTICABLE ON ANGLE WITH 25mm WIDE PVC COVERED ALLUMINIUM STRIP.
3. ADD 50 mm WHERE-EVER FIRE INSULATION IS PROVIDED.

TRAY WIDTH

JN. BOX	W	W1
12 PAIR	300	150
8 TRIAD	300	150
6 PAIR	150	100
6 TRIAD	150	100

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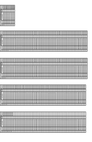
NEW DELHI

SUPPORT DETAILS FOR JUNCTION BOXES

DRAWING NO.	REV.
B933-003-16-51-IS-014	0

SHEET 1 OF 1



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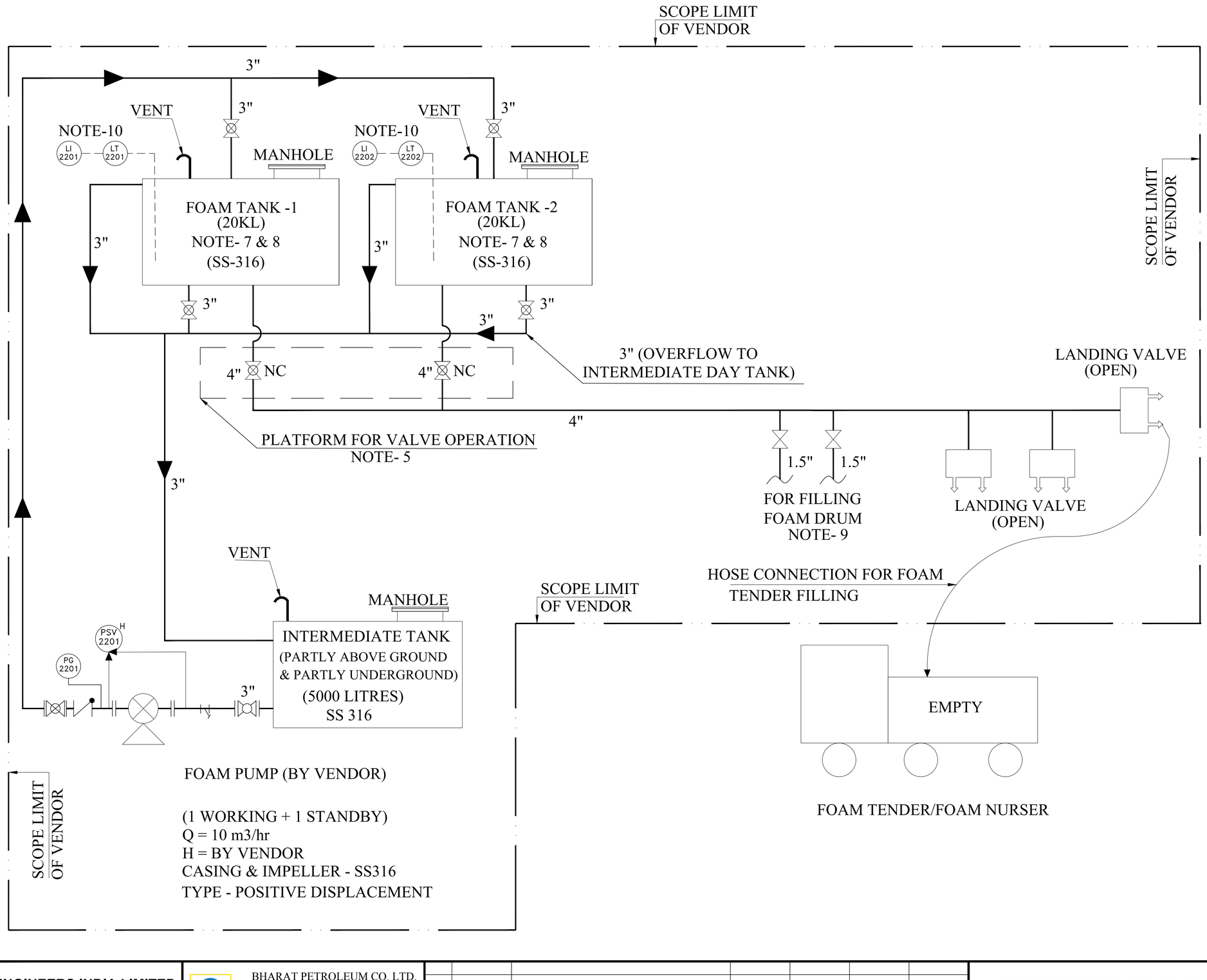
B957-17-43-999-1122



NOTES-

1. ALL FIXED PIPES & FITTINGS FOR FOAM SHALL BE AS PER PMS A1N.
2. FLEXIBLE HOSE PIPES (TYPE 3 AS PER IS 636) (MIN. 7.5M LENGTH) TO BE SUPPLIED BY PACKAGE VENDOR AS PER FINAL SCHEME AND GET THE SAME REVIEWED FROM CLIENT BEFORE IMPLEMENTATION.
3. THE SCHEME SHOWN IS INDICATIVE ONLY. THE VENDOR SHALL DEVELOP THE COMPLETE SCHEME AND P&ID INCLUDING OPERATIONAL PHILOSOPHY.
4. THE FOAM TANK SHALL BE INSTALLED ON ROOF OF SATELLITE FIRE STATION. THE EXACT LOCATION OF TANK SHALL BE AS PER ARCHITECTURAL DRAWING.
5. THE VALVE OPERATING PLATFORM SHALL BE PROVIDED BY VENDOR.
6. HOSE STAND SHALL BE PROVIDED BY THE VENDOR FOR HOSE STORAGE IN ALL THE PLATFORM FOR VALVE OPERATION. HOSE DIAMETER SHALL BE MINIMUM 2.5".
7. LADDER SHALL BE PROVIDED FOR FOAM STORAGE TANK BY THE VENDOR.
8. PACKAGE VENDOR SHALL PROVIDE SHED/ WEATHER SHELTER OVER THE STRUCTURE (INCLUDING FOAM TANKS).
9. FOAM BARREL HANDLING PLATFORM, RAMP SHALL BE PROVIDED BY VENDOR NEAR INTERMEDIATE TANK.
10. LEVEL TRANSMITTERS (LT) TO BE INSTALLED AT TOP OF THE TANK. THE LOOP POWERED INDICATOR SHALL BE PROVIDED AT THE GRADE LEVEL FOR LEVEL INDICATION.
11. SYSTEM TO BE DESIGNED FOR SIMULTANEOUS FILLING OF 4 NUMBERS OF FOAM TENDER/ NURSER FROM MAIN FOAM TANK AT A TIME, TO BE FILLED WITHIN 10 MINUTES. THE STORAGE IN ONE FOAM NURSER IS 10 KL FOAM.

THIS P&ID IS ONLY INDICATIVE. PACKAGE VENDOR SHALL DEVELOP THE DETAILED WORKING SCHEMATIC & P&ID INCORPORATING ALL OPERATIONAL, SAFETY REQUIREMENTS IN LINE WITH NFPA, IS CODES & OTHER RELEVANT CODES.

LEGEND:–

- BALL VALVE
- STRAINER
- LI — LEVEL INDICATOR
- PG — PRESSURE GAUGE
- CHECK VALVE
- FOAM PUMP
- NC — NORMALLY CLOSED

ENGINEERS INDIA LIMITED
NEW DELHI

BHARAT PETROLEUM CO. LTD.
भारत पेट्रोलियम कॉर्पोरेशन लिमिटेड
BINA PETCHEM AND REFINERY EXPANSION PROJECT,
BINA REFINERY

REV.	DATE	REVISION	BY	CHKD	APPROVED	PEM/PC
0	15.12.2025	ISSUED WITH TENDER	BR	RR	AMP	
A	18.09.2025	ISSUED FOR COMMENTS/BIDS	AB	RR	AMP	

INDICATIVE P&ID FOR FOAM COMPOUND STORAGE (SATELLITE FIRE STATION)

DRAWING NO.	REV.
B957-17-43-999-1122	0

1-1641-0503 REV.0 A3-420x297

Page 2815 of 5448 : B957-TENDER DOC-B957-999-08-41-PK-T-9501 : Rev. A

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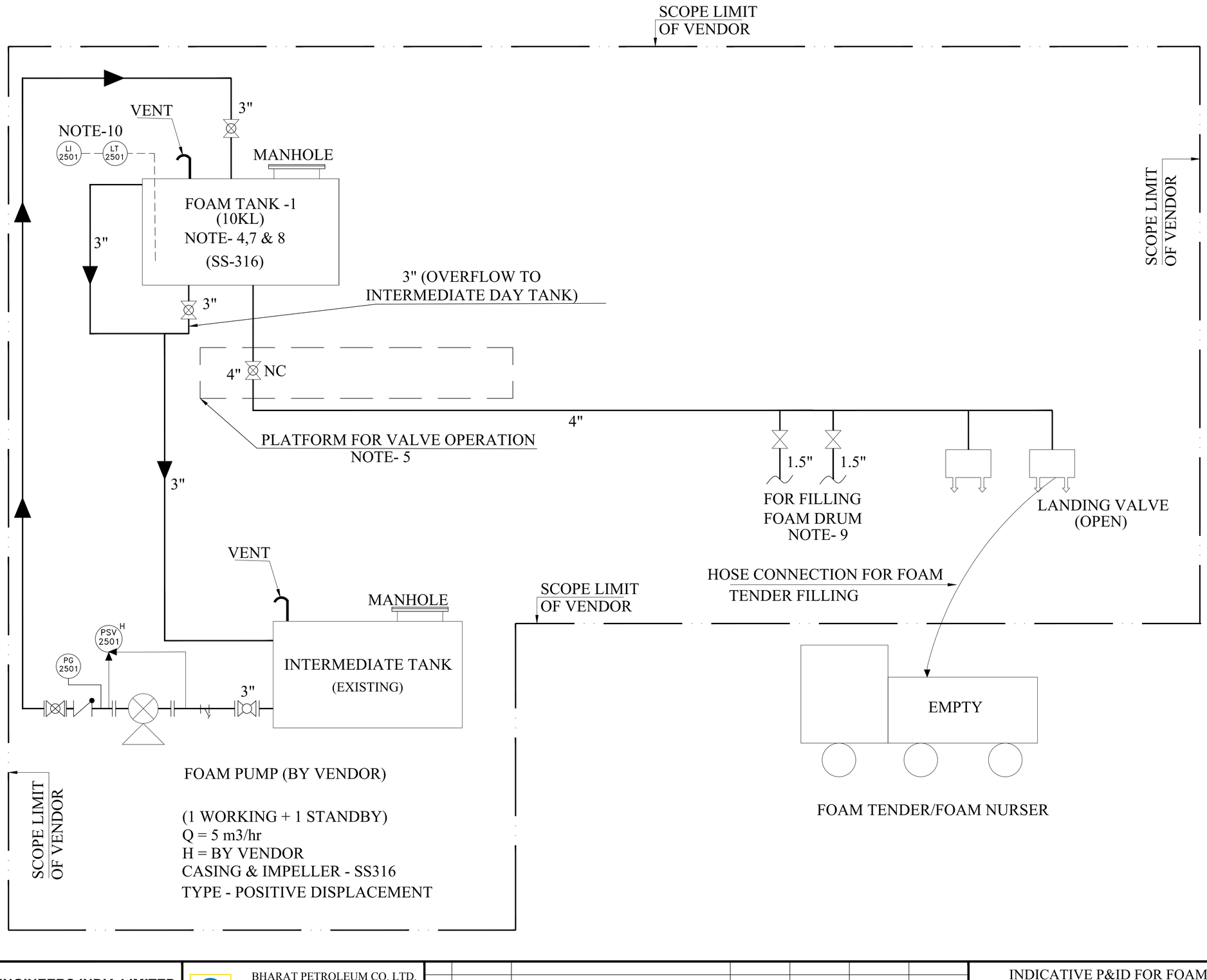
B957-17-43-600-1125



NOTES-

1. ALL FIXED PIPES & FITTINGS FOR FOAM SHALL BE AS PER PMS A1N.
2. FLEXIBLE HOSE PIPES (TYPE 3 AS PER IS 636) (MIN. 7.5M LENGTH) TO BE SUPPLIED BY PACKAGE VENDOR AS PER FINAL SCHEME AND GET THE SAME REVIEWED FROM CLIENT BEFORE IMPLEMENTATION.
3. THE SCHEME SHOWN IS INDICATIVE ONLY. THE VENDOR SHALL DEVELOP THE COMPLETE SCHEME AND P&ID INCLUDING OPERATIONAL PHILOSOPHY. (IN CASE IT IS NOT FEASIBLE TO USE EXISTING INTERMEDIATE TANK, NEW INTERMEDIATE TANK HAVING CAPACITY 2000 LITER & SS316 MATERIAL TO BE PROVIDED).
4. THE FOAM TANK SHALL BE INSTALLED ON INDEPENDENT STRUCTURE (STRUCTURE BY VENDOR) NEAR EXISTING STRUCTURE OF 20KL FOAM TANK. THE EXACT LOCATION OF TANK SHALL BE AS PER CIVIL DRAWINGS.
5. THE VALVE OPERATING PLATFORM SHALL BE PROVIDED BY VENDOR.
6. HOSE STAND SHALL BE PROVIDED BY THE VENDOR FOR HOSE STORAGE IN ALL THE PLATFORM FOR VALVE OPERATION. HOSE DIAMETER SHALL BE MINIMUM 2.5".
7. STAIR SHALL BE PROVIDED FOR FOAM STORAGE TANK BY THE VENDOR.
8. PACKAGE VENDOR SHALL PROVIDE SHED/ WEATHER SHELTER OVER THE STRUCTURE (INCLUDING FOAM TANKS).
9. FOAM BARREL HANDLING PLATFORM, RAMP SHALL BE PROVIDED BY VENDOR NEAR INTERMEDIATE TANK.
10. LEVEL TRANSMITTERS (LT) TO BE INSTALLED AT TOP OF THE TANK. THE LOOP POWERED INDICATOR SHALL BE PROVIDED AT THE GRADE LEVEL FOR LEVEL INDICATION.
11. SYSTEM TO BE DESIGNED FOR SIMULTANEOUS FILLING OF 2 NUMBERS OF FOAM TENDER/ NURSER FROM MAIN FOAM TANK AT A TIME, TO BE FILLED WITHIN 10 MINUTES. THE STORAGE IN ONE FOAM NURSER IS 10 KL FOAM.

THIS P&ID IS ONLY INDICATIVE. PACKAGE VENDOR SHALL DEVELOP THE DETAILED WORKING SCHEMATIC & P&ID INCORPORATING ALL OPERATIONAL, SAFETY REQUIREMENTS IN LINE WITH NFPA, IS CODES & OTHER RELEVANT CODES.

LEGEND:–

- BALL VALVE
- STRAINER
- LI — LEVEL INDICATOR
- PG — PRESSURE GAUGE
- CHECK VALVE
- FOAM PUMP
- NC — NORMALLY CLOSED

ENGINEERS INDIA LIMITED
NEW DELHI

BHARAT PETROLEUM CO. LTD.
भारत पेट्रोलियम कॉर्पोरेशन लिमिटेड
BINA PETCHEM AND REFINERY EXPANSION PROJECT,
BINA REFINERY

REV.	DATE	REVISION	BY	CHKD	APPROVED	PEM/PC
0	17.03.2026	ISSUED WITH TENDER	RR	RR	AMP	
A	17.03.2026	ISSUED FOR COMMENTS/BIDS	RR	RR	AMP	

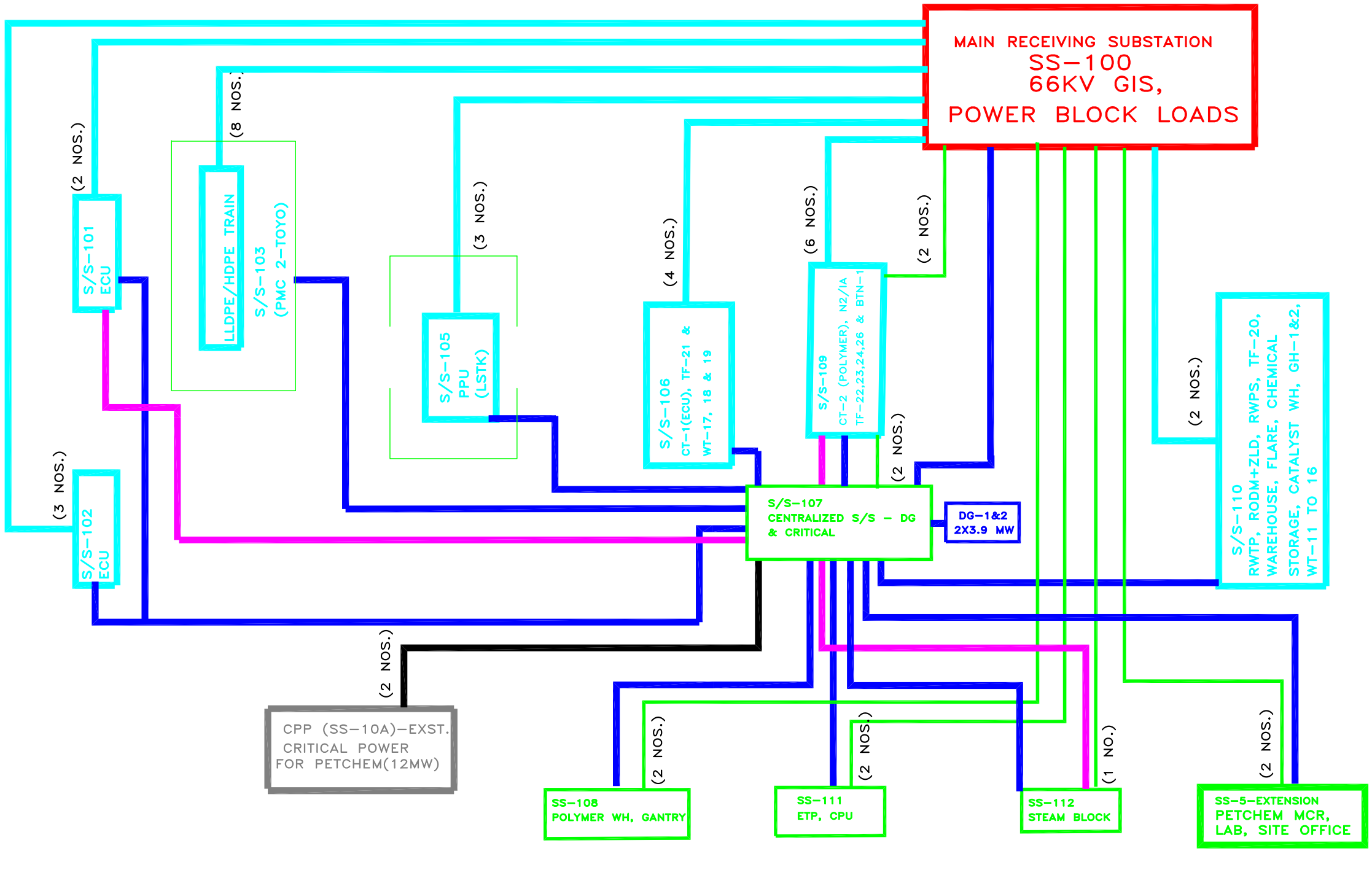
INDICATIVE P&ID FOR FOAM COMPOUND STORAGE
(EXISTING SATELLITE FIRE STATION)
(BINA DESPATCH TERMINAL)

DRAWING NO.	REV.
B957-17-43-600-1125	0

1-1641-0503 REV.0 A3-420x297

Page 2816 of 5448 : B957-TENDER DOC-B957-999-69-41-PK-T-9501 : Rev. A

BPCL–BINA PETROCHEMICAL COMPLEX



LEGEND:–

- 66 KV POWER CABLES
- 33KV POWER CABLES
- 6.6KV POWER CABLES
- 6.6KV EMG POWER CABLES
- 6.6KV CRITICAL POWER CABLES
- 220kV GIS, 66KV GIS, 220/66KV, 66/6.6KV TRAFO. & 6.6KV SWBD.
- 66KV IBP, 66/6.6 KV TRAFO. & 6.6KV SWBD.
- 6.6KV SWBD, 6.6/0.415KV TRAFO. & 415V SWBD.

(* NOS.) * INDICATES NO. OF FEEDERS

NOTE–1: POWER FEEDING FOR DRIVER REST ROOM AND POLYMER GATE HOUSE SHALL BE FED FROM EXISTING SS–07.

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ENGINEERS INDIA LIMITED
NEW DELHI

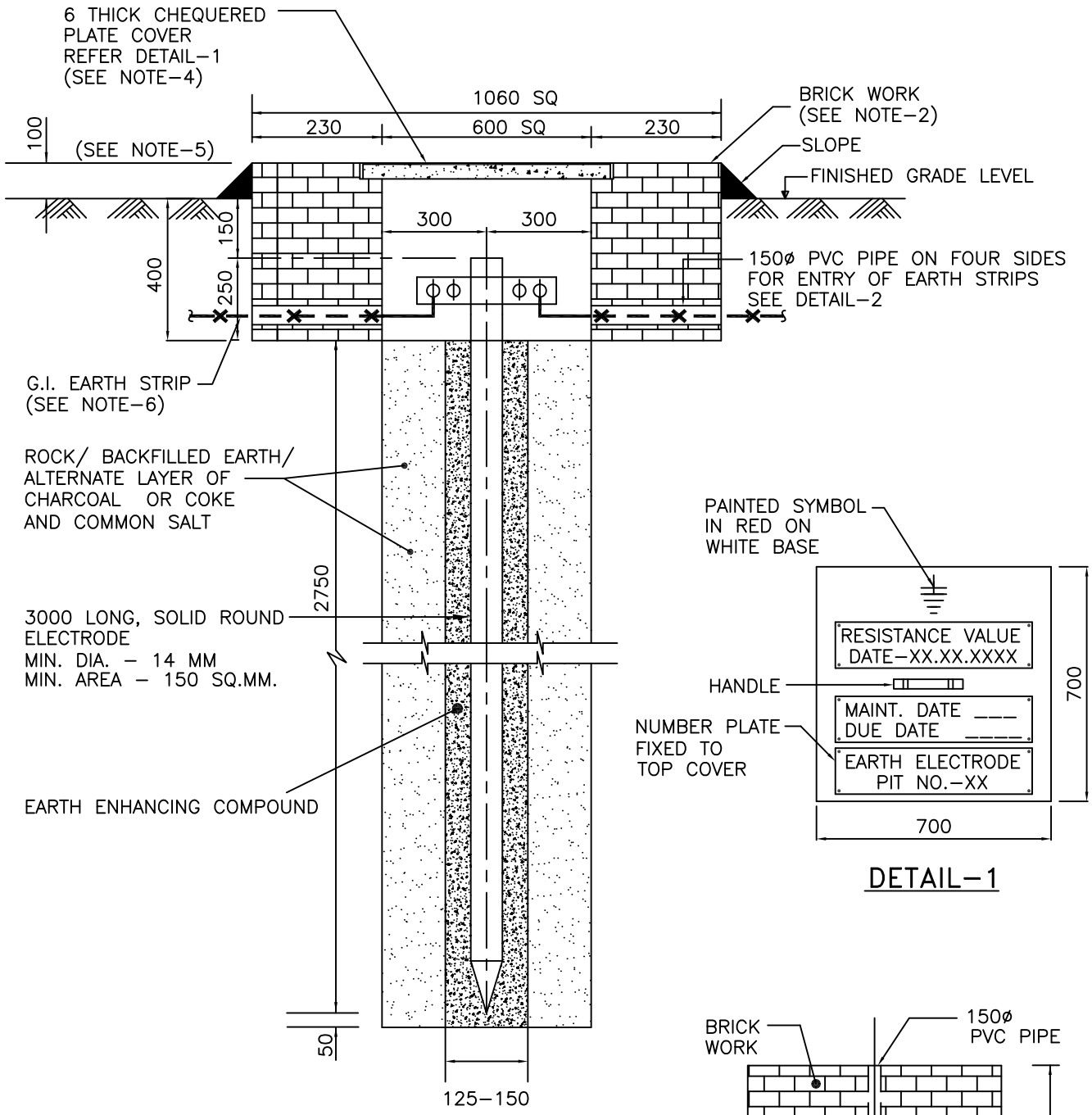
PROJECT:BPREP-PETCHEM

REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED
D	13.08.25	REVISED & ISSUED FOR ENGINEERING	SK	RSR	HK	
C	16.07.25	ISSUED FOR ENGINEERING	SK	RSR	HK	
B	12.09.24	REVISED BASED ON CLIENT COMMENTS	SK	RSR	HK	
A	20.08.24	ISSUED FOR CLIENT COMMENTS	SK	RSR	HK	

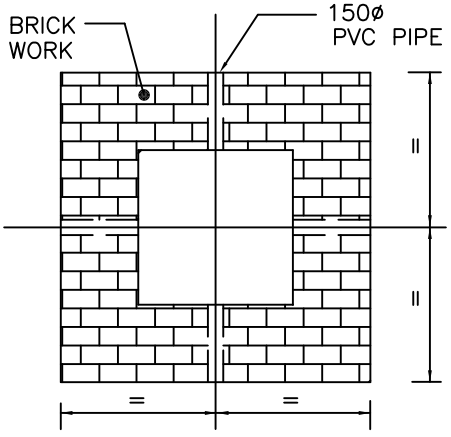
POWER DISTRIBUTION SYSTEM

DRAWING NO.	REV.
B957-000-16-50-SK-3111	D

1–1641–0503 REV.0 A3–420x297



DETAIL–1



DETAIL–2

NOTES:–

1. ALL DIMENSIONS ARE IN MM
2. BRICK WORK SHALL BE DONE AFTER COMPACTING THE SOIL IN UNPAVED AREA.
3. REFER JOB SPECIFICATION FOR SPECIFIC REQUIREMENT ON MAINTENANCE FREE EARTH PITS
4. COLOR CODING AND PAINTING OF COVERS SHALL BE AS PER PAINTING SPECIFICATION.
5. IN CASE OF PAVED AREAS, TOP OF PIT SHALL BE FLUSHED WITH FFL, WHEREAS IN UNPAVED AREAS, TOP OF PIT SHALL BE PROJECTED 100 MM ABOVE FGL.
6. CONNECTIONS OF G.I. EARTH STRIP TO THE PLATE SHALL BE IN LINE WITH 7–51–0103.

Rev. No.	Date	Purpose	Prepared by	Checked by	Checked by
A	13.05.25	ISSUED WITH TENDER	SK	RSR	RSR

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प्रस्तुत आरेख एवं इसमें दिया गया विवरण इंजीनियर्स इंडिया लिमिटेड की संपत्ति है। वे मात्र प्रदर्शित किया है कि न तो इन्हें पूर्ण या आंशिक रूप से प्रकाशित किया जाएगा, न नकल की जाएगी, न उपयोग किया जाएगा और न ही सीमित और लिखा प्रयोग के अलावा इसका इसका कोई अन्य उपयोग किए जाएंगे, न प्रदर्शित किए जाएंगे और न ही सीमित और लिखी

BPREP PROJECT	REV.	DATE	REVISION	BY	CHECKED	APPD.	APPD.
REFINERY EXPANSION BINA	0	21-11-25	ISSUED FOR ENGINEERING	SKANU	MKM	RSR	

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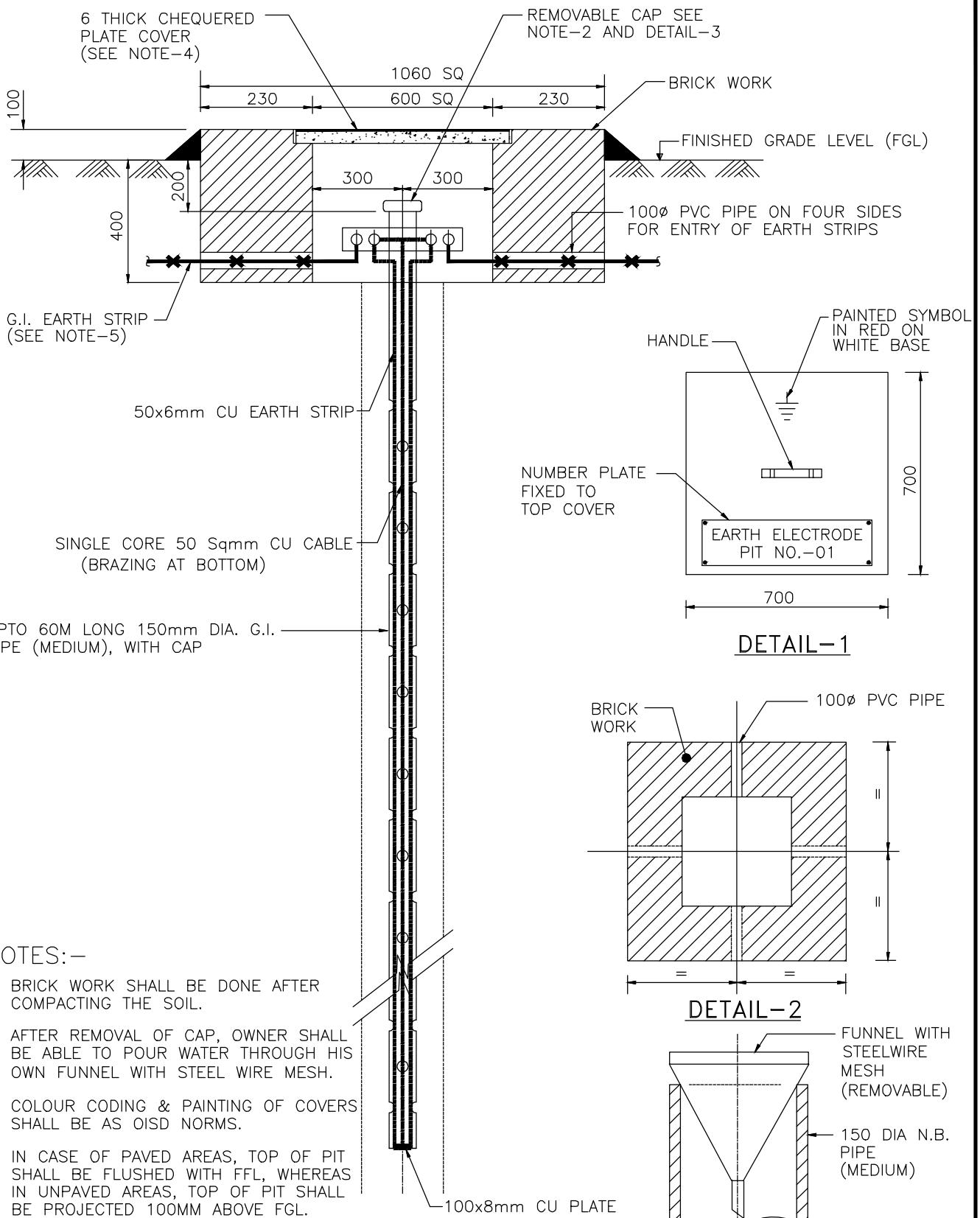
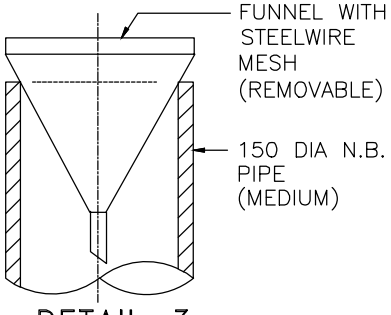


DETAIL-1

DETAIL-2



DETAIL-3

NOTES:-

1. BRICK WORK SHALL BE DONE AFTER COMPACTING THE SOIL.
2. AFTER REMOVAL OF CAP, OWNER SHALL BE ABLE TO POUR WATER THROUGH HIS OWN FUNNEL WITH STEEL WIRE MESH.
3. COLOUR CODING & PAINTING OF COVERS SHALL BE AS OISD NORMS.
4. IN CASE OF PAVED AREAS, TOP OF PIT SHALL BE FLUSHED WITH FFL, WHEREAS IN UNPAVED AREAS, TOP OF PIT SHALL BE PROJECTED 100MM ABOVE FGL.
5. CONNECTIONS OF G.I. EARTH STRIP TO THE PLATE SHALL BE IN LINE WITH EIL STD. 7-51-103.

ENGINEERS INDIA LIMITED NEW DELHI	TYPICAL DETAILS OF EARTH ELECTRODE UPTO 60 M LENGTH	DRAWING NO.	REV.
		B933-000-16-50-SK-4002	A

GENERAL NOTES

FOR

EARTHING AND LIGHTNING PROTECTION SYSTEM

PROJECT : BPREP PROJECT

OWNER : M/s BPCL

EPMC : ENGINEERS INDIA LTD.

JOB NO. : B957

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
0	25.07.2025	ISSUED FOR CONSTRUCTION	RS	RSR	RSR

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GENERAL NOTES: EARTHING AND LIGHTNING PROTECTION SYSTEM

1. Earthing and lightning protection system works shall be executed in accordance with EIL Specification 6-51-0084, EIL standard 7-51-0116 for equipment earthing schedule, EIL installation standards referred in the layout drawings, specific job requirement indicated in this document and the respective earthing and lightning protection layout drawings.

2. In case of any contradiction between various referred standards / documents / statutory regulations the following order of priority shall govern

- Statutory regulations
- Earthing & Lighting Protection drawing(s)
- This specification
- Installation standards
- Standard specification
- Codes and standards

However, concurrence of Engineer-in Charge shall always be obtained, before taking a decision in any such matter.

3. It shall be Contractor's responsibility to coordinate with other agencies associated with project for smooth execution of work.

4. All panels/cabinets, steel frames, field control box, junction box, special instruments etc. will be connected to the earth, the connection shall be according to respective layout drawings and standards, job specification for earthing.

5. Earth bonding to the ladder, any metal parts and staircase shall be according to respective layout drawings and standards, job specification for earthing.

6. All earth pits (both earthing & lightning protection) shall be maintenance free chemical earth pits with Cu bonded high tensile low carbon steel core electrode. 3-metre-long Copper Bonded Steel Earth Electrode of minimum diameter 14mm (solid round) and minimum cross-sectional area 150 sq. mm. shall be driven into the pit. Copper shall be intrinsically bonded to steel. There should be minimum 250 µm radial copper coating with 99.9% copper content in line with IEC 62561-2.

7. Unless otherwise specified, 100 X 12 mm G.I. earth strip shall be used for substations/ SRR/ CR/ MCR and 50 X 6 mm G.I. earth strip shall be used in process units and offsite area as main earth grid conductor.

8. Earth grid shall be provided for EHV GIS.

9. The resistance values of an earthing system to the general mass of earth shall comply to latest revision of OISD Std.-137.

10. Street lighting poles / high masts shall be earthed to the main earth grid, wherever available nearby, else separate 50 x 6 mm GI strip will be run for the street lighting system and shall be connected to main grid at minimum two points.

11. All lighting fixtures and single phase sockets shall be earthed using the third core of the feeding cable or third wire in circuit wiring as per respective lighting layout drawing.

12. The KW rating of motors, wherever indicated in the layout drawing is for guidance only. Selection of earthing conductor shall be done based on exact rating as per respective motor's nameplate.

13. In hazardous areas, all process equipment shall be connected to the earth grid at minimum two points. Pipelines shall be earthed at entry and exit of battery limit of

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process units as per EIL standard 7-51-0112. The earthing conductors shall be as per earthing layout drawings/ equipment earthing schedule 7-51-0116.

14. Reinforcement bars of pipe rack concrete column / pavement shall be connected to the main earth grid by using 50 x 6 mm GI strip at interval of not more than 24 m.

15. Tall columns as per layout drawing having continuous metallic structure shall be earthed at minimum 2 points at its bottom and shall be directly connected to individual earth electrodes for lightning protection.

16. Technological structure, vessels, columns shall be earthed minimum at two points, preferably diagonally opposite. The earthing conductors shall be as per earthing layout drawings/ equipment earthing schedule 7-51-0116.

17. Earth strip, wherever shown on platforms, shall be cleated below the platform.

18. Tappings from main grid upto the earth plate shall generally be of the same size as the main earth grid.

19. Reinforcement bars of extreme columns of sub-station building, reinforcement bars in ground and first floor slab of sub-station building shall be effectively earthed using 100 x 12 mm GI strip.

20. Lightning protection grid for buildings and sheds (wherever indicated) shall be formed by using 25x3mm G.I. strip suitably cleated along parapet wall / roof.

21. Earthing of transformer neutrals shall be done using two independent earth electrodes, as per standard / job specification, CEA guidelines. Their electrodes shall be interconnected to main earth grid.

22. If required/ suggested by the original equipment manufacturer of electronic equipment's like UPS, Excitation voltage regulator, Numerical Relays, LCP etc. dedicated clean earth shall be provided by having dedicated earth pits.

23. Clean earth system for instrumentation shall be separate from electrical earthing grid.

24. Common clean earth shall be provided for relays, VFD PLC, Thyristor & SAS separate from substation earthing system.

25. All equipment shall be earthed using GI wire ropes/ G.I. earth strip. The conductor size/type to be used for earth connection of various equipments shall be as per the equipment earthing schedule (EIL Standard No. 7-51-0116).

26. Earth pit cover shall be of chequered plate with minimum size of 650mm X 650mm.

27. Lightning Protection: Risk assessment against Lightning strike on plant structure, buildings (including Control room, SRR, Substation), Pump house sheds and tanks etc. shall be carried out as per OISD-GDN-180, IS/IEC 62305 and APIRP- 545. Based on risk level assessment mitigation arrangement required to lower the risk less than tolerable limit shall be carried out. In buildings where solar panels have been provided, lightning protection shall be taken care accordingly.

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GENERAL NOTES

FOR

LIGHTING SYSTEM

PROJECT : **BPREP PROJECT**

OWNER : **M/s BPCL**

EPMC : **ENGINEERS INDIA LTD.**

JOB NO. : **B957**

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
0	05.08.2025	ISSUED FOR CONSTRUCTION	RS	RSR	RSR

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GENERAL NOTES: LIGHTING SYSTEM

1. Lighting system works shall be executed in accordance with the requirements laid down in EIL Specification 6-51-0083, Lighting Fixture Schedule, EIL installation standards referred in the layout drawings, specific job requirement indicated in this document and the respective lighting layout drawings.

2. In case of any contradiction between various referred standards / documents / statutory regulations the following order of priority shall govern

- Statutory regulations
- Lighting layout drawing(s)
- This specification
- Installation standards
- Standard specification
- Codes and standards

However, concurrence of Engineer-in Charge shall always be obtained, before taking a decision in any such matter.

3. All cable wiring shall be done with 4x2.5 mm² copper conductor, XLPE insulated, armoured cable. For light fitting, 4 core cables shall be used. 4 core cable for lighting shall be stranded type. Cables shall be connected at terminals with use of lugs.

4. 2.5mm² wires shall be used for connection of fixtures to the marshalling box for all safe area street lighting fixtures.

5. Receptacles for exhaust fans and wall-mounted fans etc. shall be provided near respective fan while their controlling switch shall be mounted at 1200mm above FFL, under each fan or as indicated in the layout drawing.

6. Wherever ceiling fans are provided, lighting fixtures shall be suspended up to the bottom level of ceiling fan, unless otherwise noted in the drawing.

7. Wherever lighting switches for normal supply and emergency supply have been shown together, these shall be installed in separate boards. In no case, two sources of supply shall be clubbed in one switchboard.

8. Unless otherwise specified, all switches and sockets in concealed conduit wiring system and switchgear rooms with false ceiling shall be recess mounted type, whereas for surface conduit/armoured cable wiring systems, these shall be surface mounted type.

9. In general lighting fixtures in battery rooms shall be installed on walls at approximately two third the height of ceiling and shall be of flameproof enclosure type and certified for gas group II C classified locations.

10. In general, mounting height of flameproof floodlight fixtures in the unit areas shall be 7.5m (min.). In case height of available structure is less than 7.5m, additional structural member shall be provided for installation of the floodlight fixture at site. The exact orientation of floodlight fixtures shall be decided at site to achieve optimum utility of these fixtures.

11. Unless otherwise specified, the mounting heights of industrial sockets (safe & hazardous areas) shall be 1200 mm above FFL.

12. Where fan is to be provided, fan hook shall be embedded during casting of the roof slab at the locations of the fans shown in respective drawing.

13. Underground lighting cables (in paved areas) shall be laid in suitable G.I. pipes buried at a minimum depth of 300mm from FFL. For mechanical protection of such cables,

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G.I. pipe sleeves shall be extended to 300mm above FFL. Layout of G.I. pipes shall be decided at site to suit site conditions. Underground lighting cables (in unpaved areas) shall be laid in suitable polyolefin injection moulded cable duct.

14. Lighting and power circuit wiring in buildings shall be done with 4x2.5mm² (Phase, Neutral & Earth) copper conductor PVC insulated wires respectively. PVC Insulated wire shall be used in conduit system (for circuit and point wiring), with proper color coding and identified by the circuit number.

15. Exact conduit layout shall be decided at site based upon individual lighting layout/ Fire alarm and plant communication layout drawings. Location of drop conduits to switchboxes shall be decided considering final location of switchboxes.

16. Wiring type for lighting purpose is as under:

Process plant / Building / Shed - Armoured cable

Buildings with false ceiling - Black Enamelled Surface conduit above false ceiling / PVC concealed conduit below false ceiling

Substation (Switchgear Room) - METSEC above false ceiling / PVC concealed conduit below false ceiling

Substation (Cable Cellar) - Black Enamelled Surface Conduit

Other buildings in safe area - Black Enamelled surface conduit/ PVC concealed conduit

Battery Room - Armoured cable

17. 25mm dia. PVC conduits and 25 mm. dia. black enamelled conduits shall be used for concealed conduit wiring and surface conduit wiring respectively for lighting purpose.

18. Layout of lighting fixtures indicated in the lighting layouts inside rooms/hall with false ceiling is indicative. Same shall be coordinated with the false ceiling tile layout at the time of installation.

19. LED Lamps shall be provided for substation, control room/ SRR, non-plant buildings, process plants, utilities & offsites and for street lighting/ boundary lighting/ periphery lighting. Lamp type for emergency AC lighting shall be LED.

20. For LED fixture, integral junction box shall be provided with 4 nos. cable entries for loop-in, loop out and associated wiring to fixture. Alternatively, 2 nos. cable entries for loop-in and loop-out shall be provided with internal wiring for driver and lamp.

21. LDBs shall be provided with Astronomical type digital timer with programming over full year for outdoor/plant lighting auto control.

22. Normal Lighting in substation building shall be contactor controlled with switch at entrance.

23. Proximity sensors for normal lighting control shall be provided in Offices and CR/SRR Rack rooms.

24. Emergency lighting shall be based on Timer with bypass switch on the switchboard feeder.

25. AC Emergency Lighting (Power supply source by respective EPCC/ELDB fed from Diesel generator) shall be provided:

a) In process plants- All process areas (as per operation requirement)

b) In buildings- Substation, Control room, SRR

26. (a) Separate RCCB & MCB for each lighting outgoing circuit at local lighting distribution panel shall be provided. Common RCCB + MCB unit is not acceptable.

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RCCB shall be rated for 30mA in both field and indoors.

(b) Street lighting poles shall not be used for unit access way illumination. Floor mounted poles as per standard with hazardous area lighting shall be used.

27. For platform mounted poles, bottom of light fitting shall be 2 metre from floor/platform. All platform mounted poles shall be of GI type with all SS mounting hardware including SS U clamps & SS platform mounting lock nuts.

28. Goose neck poles mounted light fittings to be used wherever gratings are there e.g. on the columns, heaters, stair case etc. The bottom of light fitting from the grating shall be 2 metre. Goose neck pipes shall be installed on the railings and orientation shall be parallel to the railing and shall not obstruct the walkway. On the grating area where goose neck pole cannot be installed, lighting fittings can be installed on the structure in such a way that fitting height is 2 metre. Goose neck poles shall be of GI with coating of 100 microns.

29. The lighting fittings on ground floor shall be approachable by max 12 feet ladder and on upper floors wherever solid concrete surface is available the lighting fittings shall be approachable by max 8 feet ladder.

30. All lighting fittings and junction boxes shall be properly approachable. For e.g. location of lighting fitting should not be above any equipment motor/pump/panel etc.).

31. All hardware such as Nuts, Bolts & washers used for light fittings, JBs, goose neck pole etc shall be of SS304 material.

32. Unless otherwise specified, separate DC systems shall be provided for critical lighting so that fault in lighting circuit will not affect substation charger. DC critical lighting shall be 110V LED type.

33. DC Critical lighting for escape (110V DC Power supply source by Battery & Battery charger) shall be provided:

a) In process plants- As per OISD

b) In buildings- Substation, control room, SRR, Administration building/office, FWPH, Fire Station, Emergency generator shed, First aid center.

c) DCJB (DC Junction Box) shall be used for DC Critical lighting.

34. DC Critical lighting system shall be common for the complete substation and associated process units.

35. Lighting fittings shall be flameproof type Ex d for Zone-1 and Zone-2. Irrespective of the area classification (whether zone 1 or zone 2), all lighting fixtures within the storage areas/ pump house/ pump station/ compressor house/ cooling towers/ other facilities associated with offsite tank farm and within the loading/ unloading gantries shall be flameproof type.

36. All emergency/ critical lighting fixtures and associated junction boxes in hazardous areas (whether zone-1 and zone-2) shall be flame proof type.

37. Final LUX level study shall be carried out after mechanical completion of project activities.

38. Lighting system design shall be based on minimum illumination levels as specified in latest PNGRB guidelines. However, illumination level in cable cellar shall be as per 6-51-0099.

39. Other lighting requirements are as below.

a) Aviation lighting- Yes (LED Type, flashing). Tall structure shall have aviation obstruction LED based lighting as per statutory requirements.

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b) Security lighting for peripheral road boundary wall- As Required

c) Type of high mast flood light- 30 meters Telescopic tubular with LED Lamps for area lighting for general illumination. The high mast shall be smart enabled consisting of dimmable type lighting fixtures, along with dimmable drivers, dimming controller, smart high mast feeder pillar panel, associated cabling between drivers & controllers, controller & smart high mast feeder pillar panel etc.

d) 30m High mast control panel and motor shall be FLP type for Hazardous area.

e) Adequate number of street lighting poles shall be provided along the peripheral roads of the unit. The supply to street light shall be taken through plant lighting DB at substation. Street lighting poles shall be octagonal type, hot dip galvanised to 100 micron.

f) Lighting mast provided in the plant area during construction time shall have flame proof motor and flame proof starter with 24 nos. of LED lighting fitting/fixture(400W). The LUX level shall be minimum 5 LUX at 80 m radius of lighting mast. Height of the lighting mast shall be 30 meter. Lighting mast shall be installed during construction stage in such a way that same can be used after commissioning of the plant. Light Fittings on top of the mast shall be LED based with individual fuse for protection.

40. Level gauge / vessel lamp illumination shall be fed from normal lighting supply.

41. For lighting in battery rooms and transformer bays, armoured cables shall be used.

42. Switch ON/ OFF push button at substation entry shall be provided as per respective lighting layouts.

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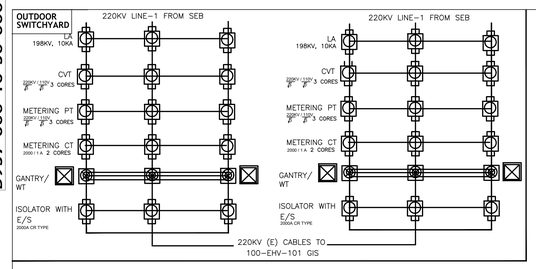

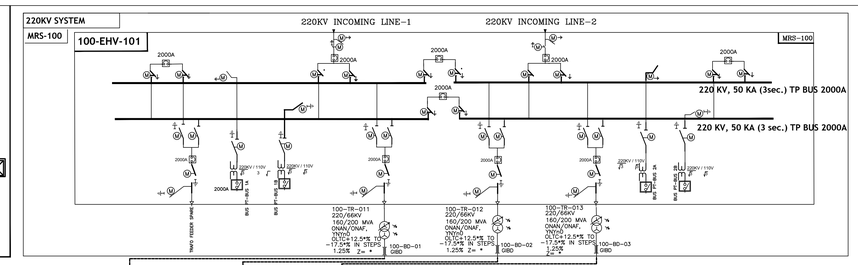

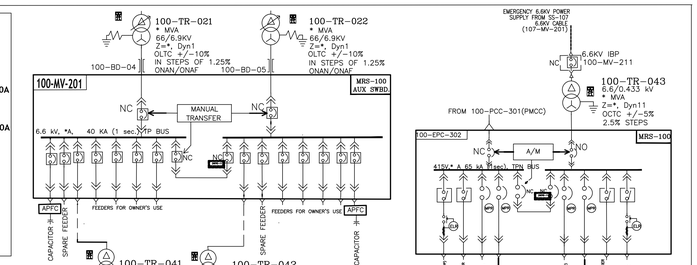

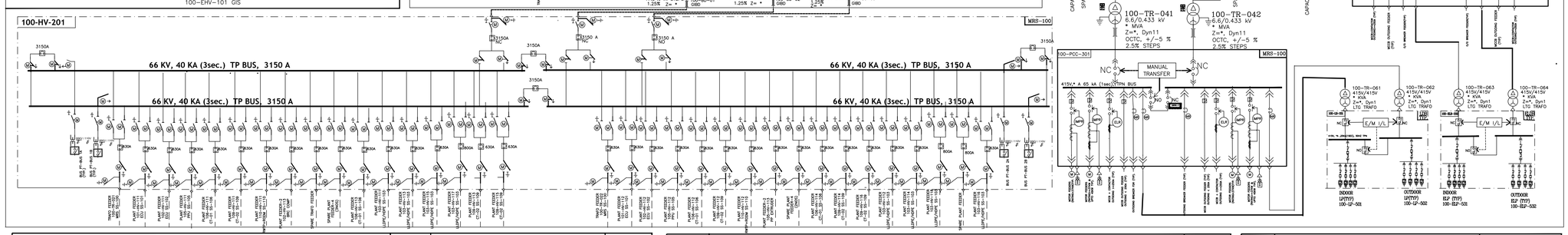

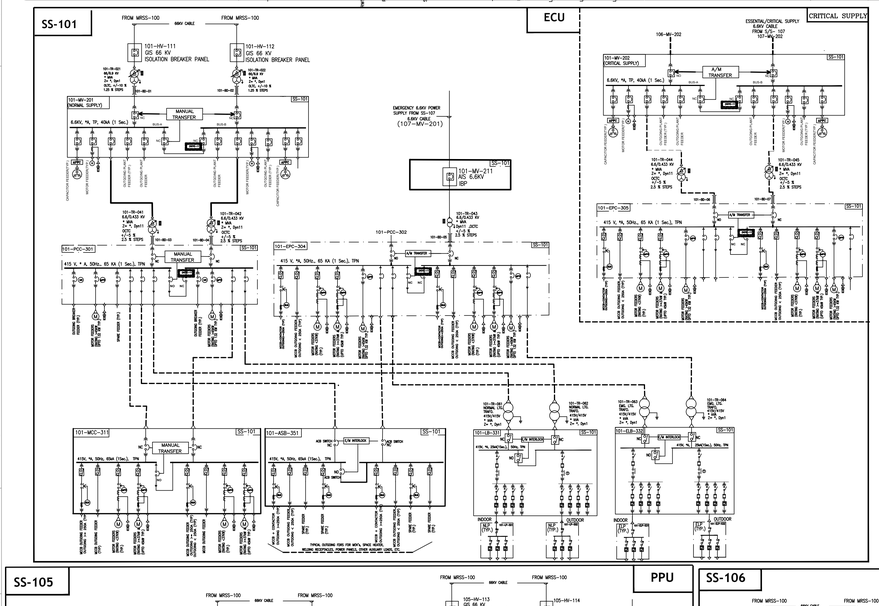

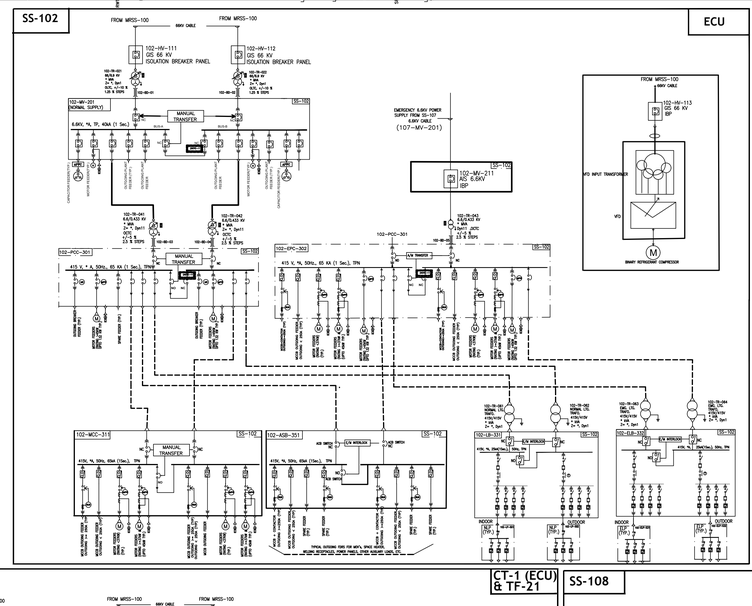

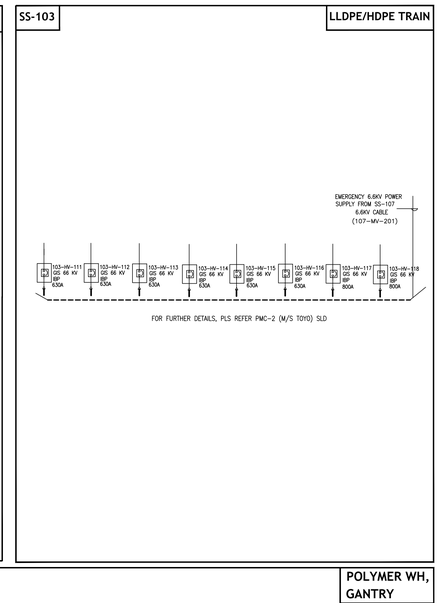

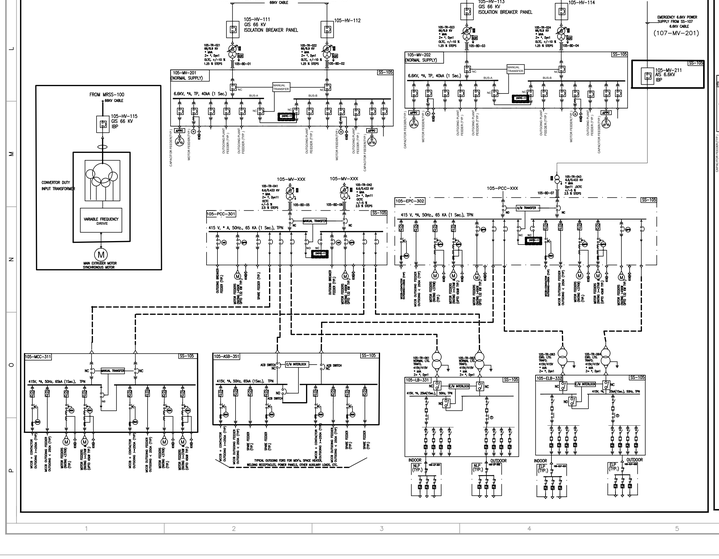

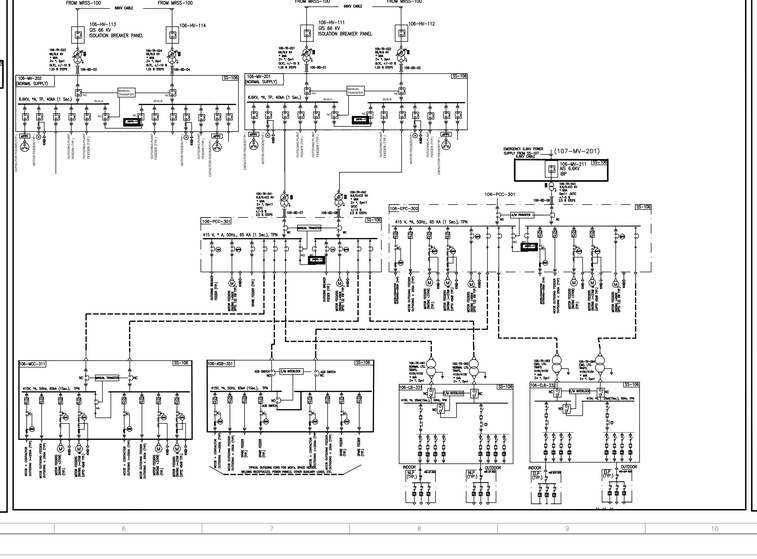

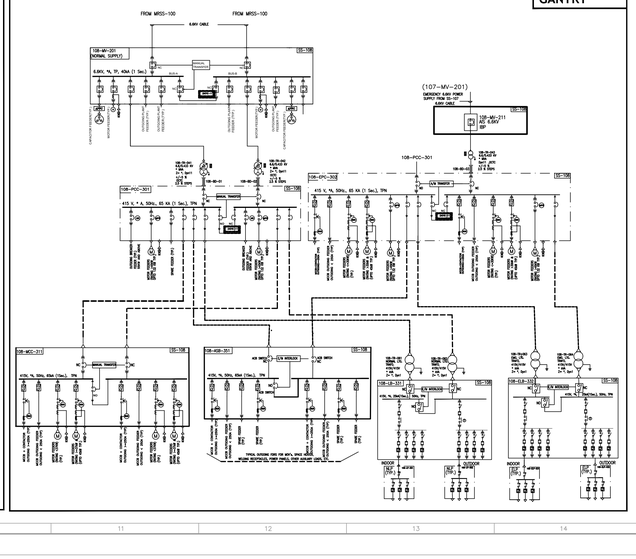

REF. DWG. NO.	REFERENCE DRAWING TITLE
B857-999-16-50-DB-1001-1	ELECTRICAL DESIGN BASIS
B957-999-81-45-00001	OVERALL PLOT PLAN

NOTES:

1. OVERALL KEY SLD INTENDS TO INDICATE POWER DISTRIBUTION PHILOSOPHY FOR NEW PETROCHEMICAL (PETCHEM) COMPLEX UNITS/FACILITIES.
2. THIS SINGLE LINE DIAGRAM IS INDICATIVE ONLY. IT IS INTENDED TO HIGHLIGHT THE POWER DISTRIBUTION PHILOSOPHY AND BROADLY DEFINE THE MAJOR ELECTRICAL EQUIPMENTS. RATINGS, IMPEDANCE VALUES OF THE POWER & DISTRIBUTION TRANSFORMERS SHALL BE INDICATED DURING DETAIL ENGINEERING UPON RECEIPT OF LOAD DATA.
3. THE RATING & QUANTITY OF ELECTRICAL EQUIPMENT SHOWN IN THE SLD ARE INDICATIVE. THE QUANTITIES & RATING OF THESE EQUIPMENTS SHALL BE DECIDED & FINALIZED DURING DETAILED ENGINEERING.
4. 1 NO. CENTRAL EMERGENCY DG AT 6.6 KV HAS BEEN CONSIDERED WHICH SHALL BE HOOKED UP AT SS-107 EMERGENCY HV SWITCHBOARD FOR FEEDING EMERGENCY LOAD OF THE NEW PETCHEM COMPLEX.
5. INCOMERS AND BUS COUPLERS OF ALL 6.6 MV SWITCHBOARD FOR FEEDING NORMAL & 415V PCC/PMCC/MCC, MANUAL CHANGEOVER WITH MOMENTARY PARALLELING SHALL BE PROVIDED.
6. CAPACITOR BANKS SHALL BE PROVIDED IN 6.6KV SWITCHBOARD FOR POWER FACTOR IMPROVEMENT TO ACHIEVE 0.995 PF AT POWER TRANSFORMER PRIMARY.
7. THE LOADS ARE ESTIMATED & SAME SHALL BE SUBJECT OF REVISION AFTER RECEIPT OF LICENSOR PACKAGE.
8. REFER INDIVIDUAL SUBSTATION SLDs FOR THE DETAILS REGARDING OUTGOING FEEDERS OF 6.6KV & 415V SWITCHBOARD, QUANTITIES OF VARIOUS ELECTRICAL EQUIPMENTS SUCH AS DISTRIBUTION TRANSFORMER, PCCs, EPMC, MCCs, ASB, LDBs ETC. AND THEIR RATING, RELAY & METER TO BE PROVIDED FOR EACH FEEDERS ETC
9. TYPICAL POWER DISTRIBUTION AND EQUIPMENTS ARE INDICATED FOR CRITICAL/MOST ESSENTIAL LOADS IN EACH SUBSTATION. ACTUAL POWER DISTRIBUTION AND NO. OF EQUIPMENTS IN EACH SUBSTATION SHALL BE DECIDED UPON RECEIPT OF CRITICAL / MOST ESSENTIAL LOAD DATA FROM PROCESS DURING DETAILED ENGINEERING.
10. 6.6KV SWITCHBOARD & 415 PMCC/EPMCC SHALL BE PROVIDED WITH TWO BUS COUPLERS. HOWEVER SECOND BUS COUPLER SHALL BE WITHOUT ANY NUMERICAL RELAY AND SHALL BE PROVIDED WITH ELECTROMECHANICAL TYPE TRIP CIRCUIT SUPERVISION RELAY.
11. FOLLOWING OPERATING CONDITION FOR 3 BUS SWITCHBOARD:

A. UNDER NORMAL CONDITION POWER SHALL BE FED FROM REFINERY CPP FOR COMPLETE LOAD (BOTH BUS COUPLERS CLOSED).

B. IN CASE OF REFINERY CPP POWER FAILURE, POWER SHALL BE FED FROM PETCHEM POWER THROUGH AUTO TRANSFER (BOTH BUS COUPLERS CLOSED)

C. IN CASE OF PETCHEM POWER ALSO FAILS, LEFT BUS AND MID BUS POWER SHALL BE FED FROM EMERGENCY POWER THROUGH DG THROUGH AUTO CHANGEOVER BETWEEN LEFT BUS AND MID BUS. HOWEVER RIGHT BUS COUPLER SHALL BE OPENED FIRST.

D. PROVISION FOR STARTING OF BOILER FEED PUMPS (THROUGH SOFT STARTER), FD FAN (THROUGH VFD) AND DM WATER TRANSFER PUMP SHALL BE THERE ON DG BY CHECKING THE DG AVAILABLE POWER AND BY CLOSING THE BUS COUPLER MANUALLY BETWEEN MID BUS AND RIGHT BUS-12.

LEGENDS

- EHV/HV CIRCUIT BREAKER
- AIR CIRCUIT BREAKER
- NEUTRAL GROUNDING RESISTOR
- TRANSFORMER
- BUSDUCT
- BUSBAR
- FUSE
- ON LOAD ISOLATOR/ HEAVY DUTY SWITCH
- MINIATURE CIRCUIT BREAKER
- RCCB
- I/L INTERLOCK
- A/M AUTO/MANUAL
- PUSH BUTTON STATION WITH AMMETER
- PUSH BUTTON STATION
- POTENTIAL TRANSFORMER
- CAPACITOR BANK
- TRANSFORMER TRIP PB (BREAK GLASS TYPE)
- CURRENT TRANSFORMER
- MFM MULTI FUNCTION METER
- CBCT
- E/L EARTH LEAKAGE RELAY
- M MOTOR
- RECTIFIER/CHARGER
- INVERTER
- SS STATIC SWITCH
- BATTERIES
- CONTACTOR
- THERMAL OVERLOAD RELAY
- DRAWOUT FEATURE
- CABLE GLAND TERMINATION
- MPR MOTOR PROTECTION RELAY
- T SYNCHRONOUS TIMER
- 66KV GIS IBP
- MCCB

* BY CONTRACTOR

REV	DATE	REVISIONS	BY	CHKD	APPD	PEMPC
B	19.08.25	REVISED & ISSUED FOR ENGINEERING	SKANU	SK	RSR	
A	17.06.25	ISSUED FOR CLIENT COMMENTS	SKANU	SK	RSR	

इंजीनियर्स इंडिया लिमिटेड (भारत सरकार का उपक्रम) ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

CLIENT: BHARAT PETROLEUM CORP. LTD.

बीना पैट्रोकैमिकल एवं रिफाईनरी एक्सपैन्शन परियोजना	BINA PETROCHEMICAL & REFINERY EXPANSION PROJECT (BPREP)
सम्पूर्ण एकल रेखिय चित्र (पैट्रोकैमिकल कॉम्पलैक्स)	OVERALL KEY SINGLE LINE DIAGRAM

SCALE	JOB NO.	UNIT	DIVN	DEPT	DWG NO.	REV
NTS	B 9 5 7 0 0 0 1 6 5 0 0 0 0 1 0					B

SHEET 1 OF 2

3-1641-0500 REV.2 A0-1189 x 841

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B957-000-16-50-00010

SS-109

CT-2 (POLYMER), TF-22,23,24,26

SS-109

BUTENE

SS-109

NITROGEN PKG

MCC + CR-01 ROOM

SS-110

RWTP, ROOM+ZLD, RWPS WAREHOUSE (PEB), FLARE, CATALYST WH, CHEMICAL, TF-20,WT,GH

SS-111

ETP & CPU

SS-112

STEAM GENERATION

SS-107

DG & CRITICAL POWER

SS-05A

FWPH EXTN, PETCHEM MCR, LAB, SITE OFFICE.

REF. DWG. NO. | REFERENCE DRAWING TITLE

B016-999-16-50-EDB-10010-0	ELECTRICAL DESIGN BASIS
B016-801-81-41-00001	OVERALL PLOT PLAN

NOTES:

1. OVERALL KEY SLD INTENDS TO INDICATE POWER DISTRIBUTION PHILOSOPHY FOR NEW PETROCHEMICAL (PETCHEM) COMPLEX UNITS/FACILITIES.
2. THIS SINGLE LINE DIAGRAM IS INDICATIVE ONLY. IT IS INTENDED TO HIGHLIGHT THE POWER DISTRIBUTION PHILOSOPHY AND BROADLY DEFINE THE MAJOR ELECTRICAL EQUIPMENTS. RATINGS, IMPEDANCE VALUES OF THE POWER & DISTRIBUTION TRANSFORMERS SHALL BE INDICATED DURING DETAIL ENGINEERING UPON RECEIPT OF LOAD DATA.
3. THE RATING & QUANTITY OF ELECTRICAL EQUIPMENT SHOWN IN THE SLD ARE INDICATIVE. THE QUANTITIES & RATING OF THESE EQUIPMENTS SHALL BE DECIDED & FINALIZED DURING DETAILED ENGINEERING.
4. 1 NO. CENTRAL EMERGENCY DG AT 6.6KV HAS BEEN CONSIDERED WHICH SHALL BE HOOKED UP AT S/S-107 EMERGENCY HV SWITCHBOARD FOR FEEDING EMERGENCY LOAD OF THE NEW PETCHEM COMPLEX.
5. INCOMERS AND BUS COUPLERS OF ALL 6.6 MV SWITCHBOARD FOR FEEDING NORMAL & 415V PCC/PMCC/MCC, MANUAL CHANGEOVER WITH MOMENTARY PARALLELING SHALL BE PROVIDED.
6. CAPACITOR BANKS SHALL BE PROVIDED IN 6.6KV SWITCHBOARD FOR POWER FACTOR IMPROVEMENT TO ACHIEVE 0.995 PF AT POWER TRANSFORMER PRIMARY.
7. THE LOADS ARE ESTIMATED & SAME SHALL BE SUBJECT OF REVISION AFTER RECEIPT OF LICENSOR PACKAGE.
8. REFER INDIVIDUAL SUBSTATION SLDs FOR THE DETAILS REGARDING OUTGOING FEEDERS OF 6.6KV & 415V SWITCHBOARD, QUANTITIES OF VARIOUS ELECTRICAL EQUIPMENTS SUCH AS DISTRIBUTION TRANSFORMER, PCCs, EPMC, MCCs, ASB, LDBs ETC. AND THEIR RATING, RELAY & METER TO BE PROVIDED FOR EACH FEEDERS ETC
9. TYPICAL POWER DISTRIBUTION AND EQUIPMENTS ARE INDICATED FOR CRITICAL/MOST ESSENTIAL LOADS IN EACH SUBSTATION. ACTUAL POWER DISTRIBUTION AND NO. OF EQUIPMENTS IN EACH SUBSTATION SHALL BE DECIDED UPON RECEIPT OF CRITICAL / MOST ESSENTIAL LOAD DATA FROM PROCESS DURING DETAILED ENGINEERING.
10. 6.6KV SWITCHBOARD & 415 PMCC/CPMCC SHALL BE PROVIDED WITH TWO BUS COUPLERS. HOWEVER SECOND BUS COUPLER SHALL BE WITHOUT ANY NUMERICAL RELAY AND SHALL BE PROVIDED WITH ELECTROMECHANICAL TYPE TRIP CIRCUIT SUPERVISION RELAY.
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- CBCT
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- M MOTOR
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- SS STATIC SWITCH
- BATTERIES
- CONTACTOR
- THERMAL OVERLOAD RELAY
- DRAWOUT FEATURE
- CABLE GLAND TERMINATION
- MPR MOTOR PROTECTION RELAY
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- 66KV GIS IBP
- MCCB

* BY CONTRACTOR

REV	DATE	REVISIONS	BY	CHKD	APPD	PEMPC
B	19.08.25	REVISED & ISSUED FOR ENGINEERING	SKANU	SK	RSR	
A	17.06.25	ISSUED FOR CLIENT COMMENTS	SKANU	SK	RSR	

इंजीनियर्स इंडिया लिमिटेड (भारत सरकार का उद्यम) ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

CLIENT: BHARAT PETROLEUM CORP. LTD.

बीना पेट्रोकेमिकल एवं रिफाईनरी एक्सपैन्शन परियोजना

BINA PETROCHEMICAL & REFINERY EXPANSION PROJECT (BPREP)

सम्पूर्ण एकल रेखिय चित्र (पेट्रोकेमिकल कॉम्प्लेक्स)

OVERALL KEY SINGLE LINE DIAGRAM

SCALE	JOB NO.	UNIT	DIVN.	DEPT.	DWG. NO.	REV.
NTS	B957	000	16	50	00010	B

SHEET 2 OF 2

3-1641-0598 REV-2 - A0-1189 x 841

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GENERAL NOTES

FOR

CABLING SYSTEM

PROJECT : BPREP PROJECT

OWNER : M/s BPCL

EPMC : ENGINEERS INDIA LTD.

JOB NO. : B957

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
0	05.08.2025	ISSUED FOR CONSTRUCTION	RS	RSR	RSR

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GENERAL NOTES: CABLING SYSTEM

1. The cabling system shall be executed in accordance with the requirements laid down in EIL Specification 6-51-0082, respective installation standards, cable schedules, General Notes Lighting, General Notes Earthing & Lightning Protection, applicable BIS codes & standards, CEA Regulations and other statutory regulations, specific job requirement indicated in this document and the respective cable layout drawings.

2. In case of any contradiction between various referred standards / documents / statutory regulations the following order of priority shall govern
   - Statutory regulations
   - Cable layout drawing(s)
   - This specification
   - Installation standards
   - Standard specification
   - Codes and standards

   However, concurrence of Engineer-in Charge shall always be obtained, before taking a final decision in any such matter.
3. It shall be Contractor's responsibility to coordinate with other agencies associated with project for smooth execution of work.
4. All cable trays shall be supported @ 3 m / @ 2m intervals along straight run (as specified in layout drawing) & vertical dropping of trays shall be supported generally @2m intervals. For exact location/ elevation of the electrical cable tray supports, refer respective structural drawings.
5. Electrical contractor shall provide cable tray supports (both vertical and horizontal) inside the substation cellar. Vertical supports shall be welded to MS insert plates provided by structural contractor. Wherever these insert plates are not available, electrical contractor shall provide required insert plates, insert angles, using anchor fasteners.
6. All cable tray supports on pipe rack/cable rack shall be provided by structural contractor as per respective structural drawings.
7. In general, HV cables and MV Power & control cables shall be laid in separate trays, unless otherwise indicated in the drawing. Wherever HV & MV cables are laid in the same tray, suitable barrier plates shall be provided between HV & MV cables with minimum spacing of 300 mm between HV & MV cables.
8. Plant communication, fire alarm & telephone cables and Optical Fibre Cables (OFC) in HDPE/ GI conduit, shall be laid in instrumentation overhead cable duct / instrumentation trenches as far possible. In other areas, these cables shall be laid in electrical routes, along berm of the roads, or separately in a suitable polyolefin injection moulded underground cable duct/ pre-cast RCC trench.
9. Signal cables i.e. Instrument, communication, fire alarm, LAN and data highway, etc. shall preferably not be laid in the same trench / tray along with electrical cables. In case they are laid in the same trench / tray, a clearance of minimum 300 mm from electrical cables shall be provided. The overall cable layouts shall be designed for minimum interference between signal and power cables.
10. All tray bends shall have uniform bending radius of 1000/ 1600/ 2000mm (as specified in the layout drawings). At any particular location all vertical outside/ inside bends shall have uniform bending radius i.e. 1000/ 1600/ 2000mm based on bending radius governed by if 66kV cable tray at that route.
11. After completion of laying of cables, all cables/ cable tray entries in substation/ other buildings (except process control room/ rack rooms) shall be suitably sealed with weatherproof compound to prevent water and entry of rodent/ creepers. MCTs shall be

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provided for cable entries to process control room/ rack room and shall have 20% spare provision for future use.

12. Cable trays, racks and trenches shall be sized to allow for 20 % space for future cables.
13. Jointing of prefabricated ladder type cable trays and their fittings shall be done by using splice plates. Splice plates shall be provided, one on inside face and one on outside face, of each side runner of cable tray, at each joint.
14. RCC cable trenches other than those of 220kV cable trenches shall be filled with stone dust / fine river sand.
15. The cable trenches in hazardous areas shall be filled up with stone dust.
16. In case of vehicular traffic over the RCC cable trench, the same shall be of heavy duty construction suitable for vehicular movement.
17. Street lighting cables shall not be laid along with fire alarm, communication and telephone cables. These cables shall be laid in separate buried cable trench in road berm or in suitable polyolefin injection moulded underground cable duct.
18. Perforated trays shall be used to run power cable of welding receptacles from the nearest main tray/ G.I. sleeves.
19. Perforated trays shall be used to run lighting cables. Routing of the same shall be decided suitably at site.
20. Walkways with handrail shall be provided on either side of overhead cable trays on pipe racks (with ladders at regular intervals) to facilitate movement of people while pulling cable.
21. No cable joints in overhead cable trays is permitted in Process unit/Hazardous.
22. Cable trays shall be Hot dip Galvanized (HDG) prefabricated.
23. Underground 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 160mm PVC/RCC pipes may be provided. The ERC shall have minimum 30% spare pipes. The pipes shall be embedded in concrete. Minimum 6 nos. 160mm pipes shall be provided in ERC at any road crossing.
24. Overhead Road crossings shall be provided with overhead cable bridge.
25. All single core cables (220kV, 66kV & 33kV) shall be laid in trefoil formation except for short run of cables within substations. Single core cables pertaining to 3-phase circuits shall be laid together & separated from multi-core cables as per requirements specified in IS-1255. Trefoil formation shall be braced by suitable clamps including necessary hardwares for fixing the cables at a distance not exceeding 3m for 33kV cables and 800mm for 66kV & 220kV Cables.
26. For 220kV & 66kV Single core cables, bonding arrangement (single point/ midpoint/ cross) shall be as per respective cable manufacturer recommendation which shall be provided during detail engineering. Surge voltage limiters (SVLs) shall also be installed as per respective cable manufacturer recommendation.
27. For 33kV Single core cables, bonding of armour and screen shall be as per cable manufacturer recommendation which shall be finalised during detail engineering.
28. Cutouts on both sides of panels (for future use) shall be covered by 6.0 mm thick chequered plates.
29. MS angle cleats shall be welded to the horizontal support at the end of the cable trays.
30. Cable laying philosophy
    a) Cables in general shall be laid in overhead cable trays in the unit area & in overhead cable trays/cable trenches in offsite paved and unpaved areas.
    b) EHV (220kV) cables shall be laid in RCC Trench, filled with stone dust without racks.

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c) Lighting cables in unit area shall be laid overhead in cable trays

d) For Offsite unpaved area, cable may be buried underground built-in cable trench depending on number and criticality of cables which may accordingly be decided during detailed engineering.

e) Preferably, total cable route connected to fire water pump/motors starting from receiving substation to Fire water pump house shall be through a built-in RCC cable trench.

f) Cable shall cross the road through cable culvert or ERC. For ERC details, refer structural design basis.

g) FO cables shall be laid in HDPE / GI conduit.

h) For Cable entry into Sub-station, overhead through trays (as far as possible) shall be considered.

31. No process pipe shall pass through cable trench. If unavoidable, minimum 300mm clearance to be provided between pipe and cables. In this case, either pipe or cables shall be taken through RCC congregate.
32. All cables shall be provided with Fire proofing coating upto 1.0m from termination point as per OISD requirement.
33. Care to be taken so that no hydrocarbon seepage in the cable trench takes place. Also the precast RCC cover should be such that no oil/ seepage is allowed into the trench.
34. All new substations shall be connected to MRS through fibre optic cable network. FO cable laying can be planned along with Power cable from MRS. All interfacing shall be through OFC cables such as differential protection, inter-tripping & ECS connectivity etc.
35. Fire proofing of all substation entries for cable / bus duct shall be done.
36. In case of direct burial, cable route markers shall be installed at 15 m interval all along the cable routes and where the direction of cable trench changes. 13) All cables shall have cable lead marker wrapped on cables for easy identification indicating Tag No., Size, voltage grade & source. These lead markers shall be put at each 15m interval, at all bend and at places from where cables come out from ground.
37. In case when cable is laid underground in normal soil (not in trench) then a layer of stone dust up to 150 mm shall be provided over laid cables, over the stone dust a single layer of bricks shall be provided and then the area shall be filled with loose soil. A PCC shall be made over these types of cable trenches which shall be of min. 100mm thickness. A red colour marking shall be done over the PCC for easy identification.
38. Cables, before and after upto a length of 1m from the GI kick pipe entry in process area & pump houses shall be provided with fire proof coating as per IEC-60331.
39. Sealing compound shall be used for sealing metallic kick pipes
40. Trenches shall be marked at all direction changes, intersections and straight runs.
41. All hardware used for joining cable trays shall be of SS material.
42. Cable trays used shall be GI coated of 100-micron thickness. All the hardware used for joining the cable trays shall be of SS-316 material. However, for cooling tower area and CWPH, FRP trays shall be used.
43. Cables shall not pass through area where high temperature lines, steam vents / drains etc are provided. However, adequate precautions shall be taken if un-avoidable in some cases.
44. Electrical cable layout drawing gives indicative route of trays/ trenches. For exact coordinates of these, Piping / General Civil area drawings of respective area shall be referred.
45. Unless otherwise specified, tray levels given in the drawing shall correspond to the bottom level of tray.

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46. For co-ordinates of directly buried trenches/ underground duct, RCC trenches, ERCs, CTCs & SCRCs etc. respective General Civil / piping area drawings shall be referred.
47. The dimensions shown for the cable trenches on the respective cable layout drawings are the clear dimensions. Details of trenches (i.e. thickness of wall/ bricks/ slab) shall be as per respective Structural Standards.
48. Exact termination / layout of G.I. Pipes (for protection of cables) shall be suitably decided at site depending upon the location of respective terminal block of the electrical equipment.
49. The G.I./ PVC sleeves shall be adjusted suitably at site during installation to avoid fouling with any underground equipments, pipes, foundations, etc.
50. Edges of cable trenches and cover slabs shall be provided with structured steel angles for nosing protection.
51. Where fire proofing columns/ structures are encountered, socket, receptacle, cable trays, lighting fixtures, etc. shall be installed on a suitable deep legged angle iron frame/ distance bracket.
52. All cables shall be supplied in metallic drums as specified in the data sheet. Each drum shall have the BPCL PO no., BPCL Project Electrical & BPCL Project Name mentioned on both sides of the drum. The cable shall have BPCL Project Name-Electrical printed on the cable outer sheath at regular intervals.
53. Wherever welding has been done on the cable tray, an anti-rust zinc coating shall be provided for preventing rusting of cable tray.
54. GI cover shall be considered for top most cable tray and bottom of the lowest cable trays shall also be covered with GI sheet. GI type sheet shall be selected based on the type of cable trays. Tray cover shall be provided for the outermost trays of vertical droppers.

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Marked-up For:

- Pre treatment cum on-stream cleaning of re-circulating fresh cooling water system. (As per B957-000-06-42-CCS-001)
- Chemical cleaning & passivation of compressor circuits. (As per B957-000-06-42-CCS-005)
- Chemical cleaning of VHP/HP steam piping. (As per B957-000-06-42-CCS-004)

Sahil.
Corrosion Control
SMMS
17/12/25

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500-TS-00-002
RAW C4 MIX / OFFSPEC BUTENE-1 SPHERE
STORAGE CAPACITY: 2100 M3 (PUMPABLE)
SIZE: 16.8M (DIA)

All PSVs, ROV & Instruments mounted on Sphere are EIL scope

BY SPC → BY OTHERS

SP-2501
20" DIA. PIPE 2m LONG

500-TS-00-002
NOTE-3

500-PA-CF-012 A

500-PA-CF-012 B

500-PA-CF-012A/B (1W+1S)
RAW C4 MIX\OFFSPEC BUTENE-I TRANSFER PUMPS
RATED CAPACITY: 105.0 m^3/hr
DIFF. HEAD: 1557M
(DETAIL-E, NOTE-C)

GENERAL NOTES:

A. ALL INSTRUMENTS TAGS TO BE PREFIXED BY UNIT NO. 500.
B. FOR STANDARD SYMBOLS, NOMENCLATURE, GENERAL NOTES FOR TYPICAL DETAIL REFER P&ID NO. B957-79-41-999-115/V1192.
C. FOR GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-500-1193.
D. FOR TYPICAL DETAIL REFER P&ID NO. B957-79-41-500-1194.
E. ALL THE INSTRUMENTS INDICATIONS/ALARMS/SIGNALS TO BE CONNECTED TO SRR 3104 AND SIGNALS TO BE REPEATED IN PETCHEM MCR.
F. ALL INSTRUMENTS MARKED AS TFMS SHALL BE ROUTED TO TANK FARM MANAGEMENT CAI WITH REPEAT INDICATION IN PETCHEM MCR.

NOTES:-

1. ROV 2502 SHALL BE THE FIRST BREAK FLANGE LOCATED OUTSIDE THE SHADOW OF THE SPHERE AND SHALL BE FIRE SAFE, FIRE SAFE ACTUATOR PIPING LAYOUT SHALL BE SUCH THAT IN THE EVENT OF LEAK OF ITS FLANGE ON THE STORAGE SIDE WITH POSSIBILITY OF FIRE THE STORAGE VESSEL DOES NOT COME IN THE LINE OF JET FLAME.
2. ROV SHALL BE OUTSIDE THE KERB WALL OF THE SPHERE. ROV'S OF ONE SPHERE TO BE LOCATED CLOSE TOGETHER.
3. HORTON SPHERE SHALL BE FIRE PROOFED AND ALL LINES INCLUDING PIPING UP TO FIRST ROV'S WILL BE FIRE PROOFED.
4. SPHERE BOTTOM GRADE LEVEL SHALL BE PROVIDED WITH SLOPE AWAY FROM THE SPHERE.
5. FOR OTHER INTERLOCKS AND SECURITY DIAGRAM REFER P&ID NO. B957-79-41-500-1150
6. ALL INSTRUMENTS LOCAL INDICATION PROVIDED ON SPHERE TO BE READABLE FROM GRADE.
7. MULTIPOINT TEMPERATURE INDICATOR FOR AVERAGE TEMPERATURE OF SPHERES.
8. ALL LIQUID BLEEDS TO BE ROUTED TO FLARE REFER DETAIL-D OF P&ID NO. B957-79-41-500-1194.
9. POINT GAS DETECTORS TO BE LOCATED NEAR EACH ROV, NEAR EACH SPHERE TOP, NEAR MANHOLE COVER, AT SAMPLING POINT AND NEAR EACH PUMP.
10. PUMP SUCTION LINE SHALL BE AS SHORT AS POSSIBLE WITH MIN. NO. OF BENDS AND NO POCKET.
11. DRAIN POT SHALL BE MADE WITH 20"DIA, 150# CS PIPE OF 2M HEIGHT.
12. ALL PUMPS SEAL FAILURE ALARMS LAL AND PAH TO BE AVAILABLE IN PETCHEM MCR.
13. PUMP CASING VENTS TO BE ROUTED TO FLARE THROUGH COMMON LINE.
14. THIS UTILITIES IS PROVIDED FOR SPHERE 500-TS-00-001, 500-TS-00-002.
15. GLOBE VALVE TO BE ANTIFREEZE TYPE.
16. ALL DRAIN AND SAMPLE POINT FIRST ISOLATION VALVE SHALL BE OF QUICK CLOSING AND TIGHT SHUT OFF TYPE.
17. PIPG NOZZLE ON THE SPHERE TO HAVE TWO ISOLATION VALVES AND ONE EXCESS FLOW CHECK VALVE.
18. ALL FREE DRAINING LINES WITH NO POCKETS (1:1000).
19. SPHERE PUMPING STATION CONSISTS OF 500-PA-CF-012AB, SCO-PA-CF-004AB , UTILITIES OF PUMP HOUSE SHALL BE COMMON FOR ALL THE PUMPS LOCATED IN SAME PUMP HOUSE. NUMBER AND LOCATION OF HOSE STATION IN PUMP HOUSE TO BE DECIDED BY ENGINEERING. HOSE TO BE FLANGE TYPE FOR NITROGEN AND LP STEAM. OTHER UTILITIES TO HAVE HOSE OF QUICK COUPLING TYPE.
20. PUMP STATUS (RUNNING/STOP) INDICATION TO BE AVAILABLE IN PETCHEM MCR. PROVISION FOR START/STOP SHALL BE GIVEN FROM FIELD AND STOP FROM ICR.
21. 1" BYPASS VALVE IS PROVIDED WHICH SHALL BE KEPT OPEN WHEN DOWNSTREAM VALVE IS IN CLOSED POSITION, TO AVOID OVER PRESSURIZATION DUE TO THERMAL EXPANSION OF LIQUID IN THE LINE.
22. THESE TSVS ARE FOR THERMAL RELIEF. TSVS SHOULD BE LOCATED AT ONE PLACE AND COMMON DISCHARGE SHOULD BE CONNECTED TO FLARE HEADER VIA DRAIN POT.

INTERLOCK	ACTUATED BY	ACTION UPON
I-2501	LTA,AHI-2503	CLOSE ROV-2501
I-2502	LTA,ALL-2502	TRIP PUMP 500-PA-CF-012A/B & CLOSE ROV-2502
I-2503	NON ZSH-2502 (CLOSING OF ROV-2502)	TRIP PUMP 500-PA-CF-012A/B

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
A	28.03.25	ISSUED FOR COMMENTS	GR	SA	PP	MS

इंजीनियर्स इंडिया लिमिटेड (भारत सरकार का उपक्रम) ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

भारत पैट्रोलियम कॉर्पोरेशन लिमिटेड
BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
RAW C4 MIX/OFFSPEC BUTENE-I
STORAGE AND TRANSFER

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	आरेख संख्या DWG. No.	संशो REV.
NTS	B957	79	41	500	1125	A

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410-LK-00-101
CRACKER COOLING TOWER (CT-1) NOTE 22,45,50,61

23M x (55) CELLS
CAPACITY = 4000 M3/HR (EACH CELL)

410-GN-00-101A/B/C/D/E/F/G
CRACKER CT SIDE STREAM FILTERS NOTE 33

CAPACITY = 500 M3/HR (EACH)

410-LG-00-101A/B
CRACKER CT CLO2 SYSTEM

410-GN-00-101A NOTE-30,34
410-GN-00-101B NOTE-30,34
410-GN-00-101C NOTE-30,34
410-GN-00-101D NOTE-30,34
410-GN-00-101E NOTE-30,34
410-GN-00-101F NOTE-30,34
410-GN-00-101G NOTE-30,34

410-LG-00-101A/B
CLO2 GENERATION AND DOSING SYSTEM
NOTE-1,24,31

410-LK-00-101

DETAIL-A
(ALL DIMENSIONS ARE IN MM)

DETAIL-A1
(ALL DIMENSIONS ARE IN MM)

GENERAL NOTES :-

A. LAST NUMBER 410 TO BE ADDED AS PREFIX TO ALL INSTRUMENT NUMBERS.
B. FOR STANDARD SYMBOLS & NOMENCLATURE REFER DWG NO B957-79-41-00-1191/1192.
C. FOR DETAILS OF PUMP VENT, DRAIN AND SAMPLE CONNECTION, REFER DWG NO. B957-79-41-00-1197.
D. ALL INSTRUMENT DRAINS FROM SULPHURIC ACID SYSTEM SHOULD GO TO LIME PIT.
F. DETAILS OF PACKAGE UNITS ARE PRELIMINARY AND CONTRACTOR TO DEVELOP FURTHER.

NOTES :-

1. SAFETY SHOWER, EYE WASH AND DRINKING WATER TO BE PROVIDED IN ACID, FORMULATION HANDLING AND BIOCIDE DOSING FACILITY AREA. DRINKING WATER TO BE PROVIDED TO SAFETY SHOWER & EYE WASH FACILITY.
2. LOCATE PH CELL CLOSE TO HEADER. ANY PRESSURE REDUCING DEVICE FOR PH CELL IF REQUIRED TO BE PROVIDED ALONG WITH ITS SAFETY DEVICE.
3. PROVIDE EXPANSION BELLOWS IN PUMP SUCTION LINES FOR PREVENTING VIBRATION.
4. PROVIDE OIL SKIMMING ARRANGEMENT WITH OVERFLOW TO OWS AT CONVENIENT STAGNANT POINT.
5. PROVIDE CORROSION PROBE (CP) AND CORROSION COUPON (CC) TESTING ASSEMBLY IN THE RETURN COOLING WATER HEADER, SUPPLY BY CT CONTRACTOR.
6. FAN ASSEMBLY SHALL BE STATICALLY BALANCED & FAN HUB SHALL BE DYNAMICALLY BALANCED.
7. THIS HP/CMH TO BE FIXED BASED ON CT BASIN & CHANNEL DIMENSIONS EXCLUDING SUMP.
8. COOLING TOWER FAN SHOULD HAVE MOTORS SUITABLE FOR AREA CLASSIFICATION ZONE 2, TYPE OF MOTOR TO BE PROVIDED SHALL BE AS PER ELECTRICAL SPECIFICATION. COOLING TOWER FANS TO HAVE FRP BLADES AND HIGH-HIGH VIBRATION TRIP. VIBRATION TRANSMITTERS SHALL BE IN SCOPE OF VENDOR.
9. BASIN OF EACH CELL SHOULD HAVE PROVISION TO ISOLATE FOR MAINTENANCE.
10. ALL DEAD ENDS OF CW HEADER TO BE PROVIDED WITH 4" LINE WITH ISOLATION VALVES AT THE LOWEST POINT OF THE BUND. SEE SKETCH-1.
11. (A) EACH CELL BASIN SHALL HAVE DRAIN OF 8" TO FACILITATE DRAINING.
(B) EACH CELL BASIN SHALL HAVE OVERFLOW CONNECTION OF 12" MINIMUM.
(C) EACH CELL BASIN SHALL HAVE UTILITY CONNECTION FOR HOSE CONNECTION FOR CLEANING.
(D) DRAIN VALVES TO BE APPROACHABLE.
(E) FOR CLEANING OF THE SUMP, 2 NOS OF DRAIN PIT WILL BE PROVIDED FOR BASIN DRAIN IN EACH CELL TO BE CONSIDERED.
12. TYPICAL ARRANGEMENT FOR CT FAN, PROVIDE START/STOP PUSH BUTTON AT CT DECK AND STOP BUTTON AT GRADE AND CONTROL ROOM FOR COOLING TOWER FAN MOTOR.
13. FLUSHING CONNECTION FROM COOLING WATER RETURN LINE TO BASIN SHOULD BE PROVIDED SLIGHTLY ABOVE THE BASIN, ONE OF THE LINES TO BE LOCATED AT FARTHEST END OF RETURN HEADER. REMAINING LINES SHALL BE EQUALLY SPACED ALONG RETURN HEADER ACROSS COOLING TOWER BASINS. THESE LINES SHALL BE BLINDED AFTER FLUSHING.
14. PROVIDE 1/2" (2NOS.) AND 10 MESH (2NOS.) SS 304 SCREEN IN SERIES AT THE INTERSECTION OF COOLING TOWER SUMP AND CHANNEL. SUPPLY BY CT CONTRACTOR.
15. SULPHURIC ACID DOSING TO BE PROVIDED NEAR MAKE UP WATER POINT.
16. CLO2 DIFFUSER OF UPVC SHOULD BE PROVIDED IN COOLING TOWER SUMP TO BE LOCATED CLOSE TO THE BOTTOM. IT SHOULD RUN FOR APPROXIMATE SIDE OF THE SUMP LENGTH.
17. FOR OVERALL INSPECTION OF SUMP IN COOLING WATER SYSTEM, PROVIDE ADEQUATE ROOF OPENING DISTRIBUTED OVER FLOW SYSTEM SHALL BE PROVIDED TO REMOVE OF SLUDGE IN CASE OF EXIGENCIES. OVERFLOW DRAINS SHALL BE CONNECTED TO OWS.
18. ALL MOV'S TO BE PROVIDED WITH OPEN/CLOSE INDICATION. TAG NOS. TO BE 1101 TO 1116. INTERLOCK DETAILS IN RESPECTIVE PUMP DISCHARGE MOV AND ITS MOTOR CURRENT INDICATOR SHOULD BE AVAILABLE FROM ITS DISCHARGE MOV OPERATION SWITCH. MOTOR OF PUMP SHALL BE AUTOMATICALLY STOPPED WHEN MOV IS LESS THAN 80% OPEN AND CANNOT BE RESTARTED UNTIL MOV IS FULLY OPEN.
19. PUMP DRAIN TO BE ROUTED TO SS.
20. ABSD LINE ENTRY 300MM ABOVE OVERFLOW LEVEL AND 300MM AWAY FROM WALL.
21. DISTANCE BETWEEN FORMULATION/POLY DISPERSAN DIOCIDE DOSING POINT AND ACID DOSING POINT SHALL BE MAXIMUM.
22. THIS P&ID IS SCHEMATIC ONLY. SCOPE OF CT PACKAGE WILL NOT BE LIMITED TO THIS P&ID.
23. SEAL FLUSHING PLAN BY CW PUMP VENDOR.
24. MOC OF ClO_2 DOSING LINE SHALL BE UPVC. TO BE CONFIRMED DURING ENGINEERING.
25. PSV'S ON SAND FILTER VESSELS ARE PART OF FILTER PACKAGE VENDOR.
26. TO BE SIZED / CONFIRMED BY ENGINEERING. MINIMUM SIZE TO BE PROVIDED SHALL BE 8" FOR DRAIN, 12" FOR OVERFLOW DRAIN.
27. VALVE TO BE APPROACHABLE.
28. PERMANENT STRAINER WITH MS BODY & SS(316)+PTFE SYS TO BE PROVIDED.
29. LINE SIZES OF SCOURING AIR SUPPLY, SCOURING AIR VENT, SAFETY VALVE INLET AND SAFETY VALVE OUTLET AND SIZE OF SAFETY VALVE TO BE FIXED / CONFIRMED BY CW SYSTEM PACKAGE VENDOR.
30. SIZE OF WATER LINE TO/FROM ClO_2 SYSTEM TO BE CONFIRMED BY VENDOR.
31. NORMALLY ALL SIDE STREAM FILTERS SHALL OPERATE AT A TIME DURING AIR SCOURING TOWER WILL OPERATE WITHOUT THAT PARTICULAR SIDE STREAM FILTER.
32. ClO_2 GENERATION AND DOSING SYSTEM SHALL BE PROVIDED BY VENDOR AS PER OF CUSTOMER'S.
33. INTERLOCK LOGIC

IN LOGIC NO.	ACTUATED BY	ACTION UPON
410-I-1101	PT/FAIL 1102A/B/C	START STAND BY PUMP OF 410 PA 00 102A/B/C/D/E/F/G/H/J/K/L/M
410-I-1102 TO 1123	VAIB-1101 1122	TRIP THE RESPECTIVE FAN
410-I-1124 TO 1136		IRESPECTIVE PUMPS SHALL START ONLY IF MOV IN DISCHARGE LINE IS OPEN AS PER STATUS
410-I-1141/1142		INDICATION AVAILABLE IN PLC
410-I-1140	FAIL 1152A/B/C	START STANDBY PUMP OF 410 PA 00 109 CLOSE HV 1101
410-I-1143		MOTOR OF THE PUMP SHALL BE AUTOMATICALLY STOPPED WHEN MOV IS LESS THAN 80% OPEN

34. THIS HP/CMH TO BE FIXED AS PER RESPECTIVE PIPING/PUMP VENDOR'S REQUIREMENTS.
35. PIPING ARRANGEMENTS ARE INDICATED FOR A SINGLE COMPARTMENT SIDE STREAM FILTER IN CASE TWO COMPARTMENT SIDE STREAM FILTER IS INSTALLED, VENDOR TO UPDATE P&ID ACCORDINGLY.
36. CT VENDER SHALL PROVIDE ARRANGEMENT TO PROVIDE DCS SIGNALS FOR WET BULB TEMPERATURE, AMBIENT TEMPERATURE, BAROMETRIC PRESSURE FOR EFFICIENCY MONITORING AT COOLING TOWER ALONG WITH SUPPLY & TAG NO. OF INSTRUMENT.
37. VIBRATION TRANSMITTER SHALL BE CONNECTED TO ESD PLC FOR TRIPPING OF FAN.
38. GAS DETECTORS TUBING TO BE PROVIDED AT THE MOUTH OF THE RETURN CW DISTRIBUTOR FOR ALL CT CELLS.
39. EACH CELL OF COOLING TOWER SHALL HAVE PROVISION TO ISOLATE COMPLETELY FOR MAINTENANCE. RETURN HEADER TO EACH CELL SHALL HAVE LOCK OPEN TYPE ISOLATION VALVE.
40. THE BLOW DOWN SHALL NOT BE CARRIED OUT FOR 24 HOURS AFTER SHOCK DOSING OF BIOCIDE.
41. HOSE STATION SHOWN IS INDICATIVE ONLY. ACTUAL NO. OF HOSE STATIONS SHALL BE FINALIZED BY CONTRACTOR.
42. MIN. WATER LEVEL TO MAINTAIN IN CT SUMP UNDER ALL OPERATING CONDITIONS TO PREVENT PUMP OPERATION BELOW REQUIRED NPSH.
43. THE RETURN HEADER LINE SIZE REDUCED BY :

No.	DATE	REVISION	BY	CHKD	APPD
4	10.12.25	REVISED AS MARKED & ISSUED FOR HAZOP	RJ	MK	AM	VM
3	13.06.25	CLIENT COMMENTS INCORP & RESULTS FOR HAZOP	RJ	MK	AM	VM
2	31.01.25	REVISED INCORPORATING CLIENTS COMMENTS	PD	MK	AM	VM
1	30.11.24	ISSUED AS MATERIALS FOR ENGINEERING	RJ	MK	AM	VM
0	21.11.24	ISSUED FOR ENGINEERING	RJ	MK	AM	VM
A	14.11.24	ISSUED FOR COMMENTS	GR	MK	AM	VM

ENGINEERS INDIA LIMITED
(A Govt. of India undertaking)

भारत पैट्रोलियम कॉर्पोरेशन लिमिटेड
BHARAT PETROLEUM CORPORATION LTD.

BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायग्राम
PIPING AND INSTRUMENTATION DIAGRAM
CRACKER COOLING WATER SYSTEM(CT-1)
COOLING TOWER

DESIGN SCALE	WBS KKKD JOB NO.	BNAK DEPT.	PROJECT NO.	इकाई UNIT	क्रमांक संख्या DWG. No.	REV.
S	B957	79	41	410	1111	4

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FROM COOLING TOWER SUMP WCS 410-1111-1

410-PM-00-109

410-PT-00-108

410-PA-CF-101A/B/C/D/E/F/G/H/I/J/K/L/M
(NOTE-19, 23)

CW RETURN 410-1111-1

HP STEAM 410-1111-3

LP STEAM 410-1111-3

SKETCH-1 (NOTE-10)

410-PM-00-109
CRACKER EMERGENCY COOLING WATER RECIRCULATION PUMP-1
NOTE-C,19,58,62
RATED CAPACITY : 1375 m3/hr (STAND BY)
DIFFERENTIAL HEAD=72.7 m.

410-PT-00-108
CRACKER EMERGENCY COOLING WATER RECIRCULATION PUMP-2
NOTE-C,19,62
RATED CAPACITY : 1375 m3/hr (WORKING)
DIFFERENTIAL HEAD=72.7m

410-PA-CF-101A/B/C/D/E/F/G/H/I/J/K/L/M
CRACKER COOLING WATER RECIRCULATION PUMPS
(NOTE-C,19,46) (10W + 3S)
RATED CAPACITY = 9000 M3/HR (EACH PUMP)
DIFFERENTIAL HEAD=59.6m

DETAIL-X

DETAIL-B

DETAIL-B2

EMERGENCY CW TO ECU

C.W. SUPPLY 441-1111

TO CLO2 GENERATION AND DOSING SYSTEM WCS 410-1111-1

COOLING WATER SUPPLY TO ECU

C.W. SUPPLY 441-1111

TO ROOM PLANT BLDG/RO DM PLANT 441-1118

FROM FILTER BACKWASH PIT PUMP BACKWASH WATER 410-1114

MAIN DRFW 441-1113

HP STEAM 441-1121

LP STEAM 441-1122

DEDICATED EMERGENCY CW RETURN HEADER 20"-WCR-411-1151-A3A

LOCATION OF CELL TO BE DECIDED BY CT VENDOR

BY OTHERS BY CT CONTRACTOR (CTC)

BY OTHERS BY CTC

BY CTC BY OTHERS

TYPICAL FLUSHING LINE DETAILS

GENERAL NOTES :-

A. UNIT NUMBER 410 TO BE ADDED AS PREFIX TO ALL INSTRUMENT NUMBERS.
B. FOR STANDARD SYMBOLS & NOMENCLATURE REFER DWG. NO. B957-79-41-00-1101/1102.
C. FOR DETAILS OF PUMP VENT, DRAIN AND SAMPLE CONNECTION, REFER DWG. NO. B957-79-41-00-1102.
D. ALL INSTRUMENT DRAINS FROM SULPHURIC ACID SYSTEM SHOULD GO TO LINE FIT.
E. DETAILS FOR PACKAGE UNITS ARE PRELIMINARY AND CONTRACTOR TO DEVELOP FURTHER.

NOTES CONTINUED :-

43. VENT TO SAFE LOCATION TO BE PROVIDED AT FAN DECK LEVEL IN EACH RISER PIPE FOR HYDROCARBON VENTING.
44. DRAIN IN FLUSHING CONNECTION SHALL BE PROVIDED AS BELOW :
45. CT-1 CELLS SHALL BE INSTALLED AS PER ECU DESIGN CASE-1 (1200KTPA) REQUIREMENT.23W . FUTURE PROVISION AND SPACE SHALL BE LEFT FOR 3 NOS ADDITIONAL CELLS ENVISAGED FOR ECU DESIGN CASE-3 (1500KTPA).
46. FUTURE PROVISION AND SPACE SHALL BE LEFT FOR 2NOS ADDITIONAL PUMP ENVISAGED FOR ECU DESIGN CASE-3 (1500KTPA).
47. BELL MOUTH ALONG WITH PUMP SUCTION LINES WILL BE PROVIDED WITH VALVE & BLIND FLANGE FOR CATERING FUTURE DEMAND OF ECU-DESIGN CASE-3.
48. DELETED.
49. GAS DETECTORS WILL BE FREE ISSUE TO CT CONTRACTOR.
50. CONTROL FROM SSR 101 AND MCR PETCHEM.
51. COOLING WATER FLOW METER SHALL BE INSTALLED ABOVE GROUND ONLY.
52. BEARING COOLING WATER LINE WILL BE PUT IN CHANNEL AT APPROPRIATE LOCATION FOR UNIFORM MIXING.
53. DELETED.
54. BACKWASH WATER SHALL BE PUMPED TO CTBD LINE FOR FURTHER ROUTING TO RO-DM. HYDRAULICS TO BE CARRIED OUT BY CT CONTRACTOR. PRELIMINARY PIT PUMP DISCHARGE PRESSURE WILL BE 6.7 kg/cm2(g). THE SAME WILL BE COMMUNICATED TO CT CONTRACTOR DURING DETAIL ENGINEERING BASED ON CW PUMP HYDRAULICS.
55. LINE SIZE TO BE FINALIZED BASED ON VENDOR INPUT.
56. TURBINE STEAM INLET/OUTLET PIPING IN OTHER'S SCOPE.
57. CONTROL VALVE AT INLET STEAM LINES OF TURBINE DRIVE SHALL BE IN TURBINE VENDOR'S SCOPE OF SUPPLY.
58. PUMP SHALL BE FED FROM EMERGENCY POWER SOURCE.
59. *** MARKED INSTRUMENTS ARE IN TURBINE VENDOR'S SCOPE OF SUPPLY & SHALL BE MOUNTED ON RESPECTIVE GUAGE BOARD.
60. INTERNAL DISTRIBUTION SHALL BE AS PER TURBINE VENDOR REQUIREMENT.
61. a) COOLING TOWER FAN MOTORS SHALL BE PROVIDED WITH BEARING TEMPERATURE MONITORING THROUGH RTD's WITH TRANSMITTER WIRED TO DCS.
b) COOLING TOWER FAN GEAR BOX SHALL BE PROVIDED WITH LUBE OIL LEVEL SWITCH (OEM STANDARD LEVEL) WHICH SHALL BE WIRED TO DCS FOR LOW LEVEL ALARM.
c) COOLING TOWER FAN SHALL BE PROVIDED WITH LIGHT WEIGHT CARBON FIBRE COUPLING.
62. FOR ECU BLOCK, EMERGENCY COOLING WATER WILL BE PROVIDED FOR PACKAGES (COMPRESSOR OIL PUMPS). A DEDICATED EMERGENCY COOLING WATER SUPPLY & RETURN HEADER IS PROVIDED IN CT-1. FANS OF ANY TWO COOLING TOWER CELLS WILL BE PROVIDED WITH EMERGENCY POWER CONNECTIONS FOR AUTOMATICALLY RESTARTING DURING POWER FAILURE. RETURNING COOLING WATER IN THE EMERGENCY COOLING WATER RETURN HEADER WILL BE SENT THROUGH RISERS TO THE TOP OF THESE TWO CELLS (PROVIDED WITH EMERGENCY POWER TO FAN) OUT OF THE TOTAL CELLS OF THE CRACKER COOLING TOWER. THIS WILL BE IN ADDITION TO THE RISERS CARRYING NORMAL COOLING WATER RETURN TO THESE TWO CELLS.
63. HOT TREATED WATER RETURN FROM RWTP/RO-DM/ZLD/OFFSITE & FLARE AREA (HWS) WILL BE ROUTED TO COOLING WATER MAIN RETURN HEADER.
64. BACK FLUSH CONNECTION FOR THE EMERGENCY CW RETURN HEADER TO BE LOCATED AT THE FARTHEST END OF HEADER.
65. AT -1178 & AT-1177 WILL BE FREE ISSUE TO CT CONTRACTOR.
66. a) CONDUCTIVITY ANALYZER ON LINE 24"-WC-410-1101-A3A & 24"-WR-410-1101S-A3A & 30"-WR-410-1104-A3A WILL BE FREE ISSUED TO CT VENDOR.
66. LINE SIZE SHALL BE FINALIZED AFTER RECEIPT OF DATA FROM TURBINE VENDOR.
67. ALL MOVs TO BE PROVIDED WITH OPEN/CLOSE INDICATION. TAG NO. WILL BE FROM 1118 TO 1130. REFER DETAIL-B2.
68. NORMALLY EMERGENCY COOLING WATER IS SUPPLIED BY EMERGENCY COOLING WATER PUMP 410-PT-00-106/410-PM-00-109 IN CASE THESE PUMPS ARE NOT AVAILABLE PROVISION IS PROVIDED TO ROUTE COOLING WATER FROM MAIN COOLING WATER PUMP (410-PA-CF-101) DISCHARGE HEADER TO EMERGENCY HEADER.

No.	DATE	REVISIONS	DRN	CHKD	APPD
5	03.12.21	REVISED AS MARKED & ISSUED FOR HAZOP	VS	MK	AM	VM
4	23.08.21	CLIENT'S COMMENTS INCORP. & REVISED FOR TENDER	PD	MK	AM	VM
3	25.05.21	CLIENT'S COMMENTS INCORP. & REVISED FOR TENDER	RJ	MK	AM	VM
2	26.04.21	REVISED INCORPORATING CLIENTS COMMENTS	PD	MK	AM	VM
1	08.01.21	REVISED FOR ENGINEERING	RJ	MK	AM	VM
0	22.12.20	ISSUED FOR ENGINEERING	RJ	MK	AM	VM
A	07.11.20	ISSUED FOR COMMENTS	GR	MK	AM	VM

ENGINEERS INDIA LIMITED

BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

PIPING AND INSTRUMENTATION DIAGRAM
CRACKER COOLING WATER SYSTEM(CT-1)
COOLING WATER PUMPS

SCALE	JOB NO.	DEPT.	SECTN.	UNIT	DWG. No.	REV.
	B957	79	41	410	1111-2	5

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410-PT-00-108
CRACKER EMERGENCY COOLING WATER RECIRCULATION PUMP TURBINE

START UP VENT TO ATM AT SAFE LOCATION
NOTE-77
SP VF
HIC 11XX VF
HV 11XX VF
B2A D2A
FC
NOTE-76
B2A A1A
SS
H"-SH-410-1102-D2A-IH
CLOSE HS 11XX
CLOSE ZLH 11XX
CLOSE HS 11XX VF
LOCATE 15 METER AWAY
HS 11XX RESET
ZLL 11XX
MIN.
ZSH 11XX VF
ZSL 11XX VF
VF UY 11XX
S A/I
VF UY 11XX
S I/A
ATM
VF UY 11XX
VF
HP STEAM 410-1111-2
6"(H)-SH-410-1101-D2A-IH(NOTE-93)
ST NOTE-72
BALL VALVE FC,150 NOTE-82,84
VF NOTE-79
STEAM TURBINE
PUMP
CONTROL CENTRE-FIELD SCALED SPEED
HS
HS 11XX
HS 11XX
SI 11XX SAH
SR
SIC
SH 11XX
VF VF VF
ST ST ST
ST ST ST
VF VF VF
2oo3 VOTING LOGIC OVER SPEED TRIP
NOTE-89,90,91,92

VF
PSV 11XX
TO SAFE LOCATION
SIGNAL FROM TIC
MP BFW
LO
MIN.
DESUPERHEATER
IA
IB
MP BFW SPEC. STEAM SPEC.
DETAIL-X NOTE-73,87

VENT TO SAFE LOCATION
SP VF
VF
CAPACITY BY VENDOR
A1A
A2A-IH
H"-SL-410-1104-A2A-IH
SS
LP STEAM 410-1111-2
10"(H)-SL-410-1101-A2A-IH(NOTE-93)
ST NOTE-72
VENDOR SCOPE
H"-AI-410-1103-A3K
INSTRUMENT AIR 410-1111

NOTES:-
71. "VF" DENOTES ITEMS UNDER TURBINE VENDOR SCOPE OF SUPPLY.
72. LINE TRAP TO BE PROVIDED IN THE STEAM LINE. OTHER STEAM TRAPS AS REQUIRED FOR PIPING LOW POINTS TO BE SUITABLY PROVIDED. THE TRAP SHOWN IS LINE STEAM TRAP ONLY.
73. DETAILS OF DESUPERHEATER TO BE UPDATED DURING DETAIL ENGG. BASED ON CONFIGURATION BY VENDOR.
74. DISTANCE OF TEMPERATURE ELEMENT FROM DESUPERHEATER WILL BE A MINIMUM OF 10 PIPE DIA. ACTUAL ARRANGEMENT, STRAIGHT LENGTH AND DIAMETER TO BE CONFIRMED BY VENDOR.
75. PIPING PMS SHALL BE SUITABLE FOR TURBINE EXHAUST CONDITIONS AND NO LOAD CONDITIONS OF TURBINE.
76. LINE RATING AND PMS SHALL BE FINALIZED BASED ON EXHAUST STEAM CONDITION AT GLOBE VALVE OUTLET.
77. STEAM SILENCER RATING TO BE DECIDED AS PER DESIGN TEMP CONDITION OF THE FLASHED STEAM.
78. SET PRESSURE OF PSV'S TO BE STAGGERED AND MAXIMUM SET PRESSURE OF PSV SHOULD BE SAME AS DESIGN PRESSURE OF EXHAUST SYSTEM.
79. STRAINER IS PART OF T&T VALVE. T&T VALVE & STRAINER SHALL BE IN VENDOR SCOPE.
80. NRV SHALL BE INSTALLED IN HORIZONTAL LINE AND AS CLOSE AS POSSIBLE FROM STEAM TURBINE. QUICK CLOSING NRV TO BE PROVIDED.
81. PROVIDE 10MM WEEP HOLE AT LOWEST POINT. SPARING OF PSV SHALL BE AS PER BEDB PART-B.
82. TRIP LOGIC REQUIREMENT OF THESE INSTRUMENT TO BE DEFINED BY TURBINE VENDOR.
83. TE SHALL BE MOUNTED AS CLOSE AS POSSIBLE FROM STEAM TURBINE.
84. ON/OFF VALVE SHALL BE BALL TYPE AS PER ENGINEERING DESIGN BASIS.
85. B/L VALVE SHALL BE AT TURBINE VENDOR B/L.
86. COMMON CWS/CWR FOR LO COOLER, GLAND CONDENSER, BEARING COOLER ETC.
87. DESUPERHEATER TO BE PROVIDED BY TURBINE VENDOR.
88. DESUPERHEATER SHALL BE DESIGNED TO MEET THE OPERATING/DESIGN CONDITIONS AS PER CONDITION SPECIFIED INTERSECT.
89. SEPARATE SPEED PROBES + TRANSMITTERS (MIN. 2 NOs.) SHALL BE PROVIDED FOR GOVERNOR.
90. STEAM TURBINE OVER SPEED TRIP SHALL BE BASED ON 2 OUT OF 3 (2oo3) VOTING LOGIC. SPEED PROBES + TRANSMITTERS (3 NOs.) FOR OVER SPEED TRIP SHALL BE PROVIDED.
91. ONE SEPARATE SPEED PROBE + TRANSMITTER SHALL BE PROVIDED FOR SPEED MONITORING.
92. AUXILIARY OIL PUMP SHALL BE FED WITH EMERGENCY POWER SUPPLY.
93. IBR SERVICE.

No.	DATE	REVISIONS	DRN BY	CHKD	APPD.
0	10.12.25	ISSUED FOR ENGINEERING & HAZOP	RS	MK	VM	VM
B	02.12.25	REVISED INCORP. CLIENT COMMENT.	RS	MK	VM	VM
A	23.06.25	ISSUED FOR COMMENTS	RS	MK	AM	VM

इंजीनियर्स इंडिया लिमिटेड (भारत सरकार का उपक्रम) ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

भारत पैट्रोलियम कॉर्पोरेशन लिमिटेड
BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
CRACKER EMERGENCY COOLING WATER RECIRCULATION PUMP TURBINE

SCALE	JOB NO.	DEPT.	SECTN.	UNIT	DWG. No.	REV.
	B957	79	41	410	1111-3	0

EIL-0241-502-REV-0-A
DISTRIBUTION CODE

CAD. DWG-VHP STEAM TURBINE

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411-LK-00-101
POLYMER COOLING TOWER
15W + 1S CELLS
CAPACITY = 4000 M3/HR (EACH CELL)

411-GN-00-101A/B/C/D
POLYMER CT SIDE STREAM FILTERS
CAPACITY = 300 M3/HR (EACH)

411-LG-00-101A/B
POLYMER CT CLO2 SYSTEM

411-LG-00-101
CLO2 GENERATION AND DOSING SYSTEM

411-LK-00-101

411-GN-00-101A

411-GN-00-101B

411-GN-00-101C

411-GN-00-101D

DETAIL-A
(ALL DIMENSIONS ARE IN MM)

DETAIL-A1
(ALL DIMENSIONS ARE IN MM)

DETAIL-B

SKETCH -1

GENERAL NOTES :-

A. UNIT NUMBER 411 TO BE ADDED AS PREFIX TO ALL INSTRUMENT NUMBERS.
B. FOR STANDARD SYMBOLS & NOMENCLATURE REFER DWG. NO. B957-79-41-00-1131/1132.
C. FOR DETAILS OF PUMP VENT, DRAIN AND SAMPLE CONNECTION, REFER DWG. NO. B957-79-41-00-1132.
D. ALL INSTRUMENT DRAINS (NON SULPHURIC ACID SYSTEM SHALL GO TO LRS PIT.
E. DETAILS FOR PACKAGE UNITS ARE PRELIMINARY AND CONTRACTOR TO DEVELOP FURTHER.

NOTES :-

1. SAFETY SHOWER, EYE WASH & DRINKING WATER TO BE PROVIDED IN ACID FORMULATION HANDLING & BIOCIDE DOSING FACILITIES AREA. DRINKING WATER TO BE PROVIDED TO SAFETY SHOWER & EYE WASH FACILITY.
2. LOCATE PH CELL CLOSE TO HEADER. ANY PRESSURE REDUCING DEVICE FOR PH CELL IF REQUIRED TO BE PROVIDED ALONG WITH ITS SAFETY DEVICE.
3. PROVIDE EXPANSION BELLOWS IN PUMP SUCTION LINES FOR PREVENTING VIBRATION.
4. PROVIDE SIL SKIMMING ARRANGEMENT WITH OVERFLOW TO OWS AT CONVENIENT STAGNANT POINT.
5. PROVIDE CORROSION PROBE (CP) & CORROSION COUPON (CC) TESTING ASSEMBLY IN THE RETURN COOLING WATER HEADER.
6. FAN BLADES SHALL BE OF HOLLOW DESIGN.
7. THIS HEIGHT TO BE FIXED BASED ON CT BASIN & CHANNEL DIMENSIONS EXCLUDING SUMP.
8. COOLING TOWER FAN SHOULD HAVE MOTORS SUITABLE FOR AREA CLASSIFICATION ZONE-2. TYPE OF MOTOR TO BE PROVIDED SHALL BE AS PER ELECTRICAL SPECIFICATION. COOLING TOWER FANS TO HAVE FRP BLADES & HIGH-HIGH VIBRATION TRIP. VIBRATION TRANSMITTERS SHALL BE IN SCOPE OF VENDOR.
9. BASIN OF EACH CELL SHOULD HAVE PROVISION TO ISOLATE FOR MAINTENANCE.
10. ALL DEAD ENDS OF CW HEADER TO BE PROVIDED WITH 4" LINE WITH ISOLATION VALVES AT THE LOWEST POINT OF THE BLIND. SEE SKETCH-1.
11. (A) EACH CELL BASIN SHALL HAVE DRAIN OF 8" TO FACILITATE DRAINING.
(B) EACH CELL BASIN SHALL HAVE OVERFLOW CONNECTION OF 12" MIN.
(C) EACH CELL BASIN SHALL HAVE UTILITY CONNECTION FOR HOSE CONNECTION.
(D) DRAIN VALVES TO BE APPROACHABLE.
(E) FOR CLEANING OF THE SUMP 2 NOS OF DRAIN PIT WILL BE PROVIDED FOR EACH DRAIN IN EACH CELL TO BE CONSIDERED.
12. TYPICAL ARRANGEMENT FOR CT FANS. PROVIDE START/STOP PUSH BUTTON AT CT DECK & STOP BUTTON AT GRADE & CONTROL ROOM FOR COOLING TOWER FAN MOTOR.
13. FLUSHING CONNECTION FROM COOLING WATER RETURN LINE TO BASIN SHOULD BE PROVIDED SLIGHTLY ABOVE THE BASIN. ONE OF THE LINES TO BE LOCATED AT FARTHEST END OF RETURN HEADER. REMAINING LINES SHALL BE EQUALLY SPACED ALONG RETURN HEADER ACROSS COOLING TOWER BASINS. THESE LINES SHALL BE BLINDED AFTER FLUSHING.
14. PROVIDE 1/2" (2 NOS) & 10 MESH (2 NOS) SS 304 SCREEN IN SUMPS AT THE INTERSECTION OF COOLING TOWER SUMP & CHANNEL.
15. SULPHURIC ACID DOSING TO BE PROVIDED NEAR MAKE-UP WATER PIT.
16. CLO2 DIFFUSER OF UPVC SHOULD BE PROVIDED IN COOLING TOWER SUMP TO BE LOCATED CLOSE TO THE BOTTOM. IT SHOULD RUN FOR APPROXIMATE 80% OF THE SUMP LENGTH.
17. FOR OVERALL INSPECTION OF SUMP IN COOLING WATER SYSTEM, PROVIDE ADEQUATE ROOF OPENING. DISTRIBUTED OVERFLOW SYSTEM SHALL BE PROVIDED TO REMOVE OIL SLUDGE IN CASE OF EMERGENCIES. OVERFLOW DRAINS SHALL BE CONNECTED TO OWS.
18. ALL MOV'S TO BE PROVIDED WITH OPEN/CLOSE INDICATION. TAG NOs. TO BE 1101 TO 1131. REFER DETAIL-B. RESPECTIVE PUMP DISCHARGE VALVE & ITS MOTOR CURRENT INDICATOR SHOULD BE INTERLOCKED FROM ITS RESPECTIVE MOV OPERATION SWITCH. MOTOR OF PUMP SHALL BE AUTOMATICALLY STOPPED WHEN MOV IS LESS THAN 80% OPEN AND CANNOT BE RESTARTED UNTIL MOV IS FULLY OPEN.
19. PUMP DRAIN TO BE ROUTED TO SS.
20. ADD LAT ENDS 300MM ABOVE OVERFLOW (EVEL & 300MM AWAY FROM WALL.
21. DISTANCE BETWEEN FORMULATION/POLY DISPERSAN BIOCIDE DOSING POINT & ACID DOSING POINT SHALL BE MAXIMUM.
22. THIS PAID IS SCHEMATIC ONLY. SCOPE OF CT PACKAGE WILL NOT BE LIMITED TO THIS P&ID.
23. SEAL FLUSHING PLAN (JY CW PUMP V.INDUT.
24. MOC OF ClO_2 DOSING LINE SHALL BE UPVC. TO BE CONFIRMED DURING ENGINEERING.
25. PSVs ON SAND FILTER VESSELS ARE PART OF FILTER PACKAGE.
26. TO BE SIZED/ CONFIRMED BY ENGINEERING. MINIMUM SIZE TO BE PROVIDED SHALL BE 8" FOR DRAIN, 12" FOR OVER FLOW DRAIN VALVE TO BE APPROACHABLE.
27. PERMANENT STRAINER WITH MS BODY & SS INTERNALS IS TO BE PROVIDED.
28. TYPE SIZES OF SCOURING AIR SUPPLY, SCOURING AIR VENT, SAFETY VALVE INLET & SAFETY VALVE OUTLET & SIZE OF SAFETY VALVES TO BE FIXED/ CONFIRMED BY CW SYSTEM PACKAGE VENDOR.
29. SIZE OF WATER LINE TO/FROM ClO_2 SYSTEM TO BE CONFIRMED BY VENDOR.
30. NORMALLY ALL SIDE STREAM FILTERS SHALL OPERATE AT A TIME DURING AIR SCOURING. TOWER WILL OPERATE WITHOUT THAT PARTICULAR SIDE STREAM FILTER.
31. ClO_2 GENERATION & DOSING SYSTEM SHALL BE PROVIDED BY VENDOR AS PER CCC GUIDE NPS.
32. INTERLOCK LOGIC

INTERLOCK NO	ACTION BY	ACTION UPON START/STAND BY
411-I-1101	PAL/PAA 1122A/B/C	PUMP OF 411-P-101 A/B/C/D/E/F/G/H/J
411-I-1102 TO 1117	VARH 1101-1116	TRIP TO RESPECTIVE FAN
411-I-1118 TO 1125	RESPECTIVE PUMPS SHALL START ONLY IF MOV IN DISCHARGE LINE IS OPEN AS PER STATUS INDICATION AVAILABLE IN PLC	
411-I-1126 TO 1131/1132		
411-I-1130	PALL 1145A/B/C	START STAND BY PUMP OF 411-PM-00-101 CLOSE MV-1101
411-I-1131	MOTOR OF THIS PUMP SHALL BE AUTOMATICALLY STOPPED WHEN RESPECTIVE MOV IS LESS THAN 80% OPEN	

33. THIS HEIGHT TO BE FIXED AS PER PIPING/PUMP VENDOR'S REQUIREMENTS.
34. PIPING ARRANGEMENTS ARE INDICATED FOR A SINGLE COMPARTMENT SIDE STREAM FILTER IN CASE TWO COMPARTMENT SIDE STREAM FILTER IS INSTALLED, VENDOR TO UPDATE P&ID ACCORDINGLY.
35. CONTRACTOR SHALL PROVIDE ARRANGEMENT TO PROVIDE DCS SIGNALS FOR WET BULB TEMPERATURE, AMBIENT TEMPERATURE, BAROMETRIC PRESSURE FOR EFFICIENCY MONITORING AT COOLING TOWER.
36. VIBRATION TRANSMITTER SHALL BE CONNECTED TO FSD PLC FOR TRIPPING OF FANS.
37. GAS DETECTORS TUBING TO BE PROVIDED AT THE MOUTH OF THE RETURN CW DISTRIBUTION FOR ALL CT CELLS.
38. EACH CELL OF COOLING TOWER SHALL HAVE PROVISION TO ISOLATE COMPLETELY FOR MAINTENANCE. RETURN HEADER TO EACH CELL SHALL HAVE LOCK OPEN TYPE ISOLATION VALVE.

NOTES :-

39. THE BLOW DOWN SHALL NOT BE CARRIED OUT FOR 24 HOURS AFTER SHOCK DOSING OF BIOCIDE.
40. HOSE STATION SHOWN IS INDICATIVE ONLY. ACTUAL NO OF HOSE STATIONS SHALL BE FINALIZED BY CONTRACTOR.
41. MIN. WATER LEVEL TO MAINTAIN IN CT SUMP UNDER ALL OPERATING CONDITIONS TO PREVENT PUMP OPERATION BELOW TRIP/RLD NPSH.

No.	DATE	REVISION	BY	CHKD	APPD
4	03.12.25	REVISED AS MARKED & ISSUED FOR RATIFY	RJ	MK	AM	VM
3	13.05.25	CLIENT COMMENTS INCORP & ISSUED FOR STUDY	RJ	MK	AM	VM
2	24.04.25	REVISED INCORPORATING CLIENT'S COMMENTS	SM	MK	AM	VM
1	08.01.25	ISSUED FOR ENGINEERING	RJ	MK	AM	VM
0	21.12.24	ISSUED FOR ENGINEERING	RJ	MK	AM	VM
A	04.12.24	ISSUED FOR COMMENTS	GR	MK	AM	VM

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BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

PIPING AND INSTRUMENTATION DIAGRAM
POLYMER COOLING WATER SYSTEM (CT-2)
COOLING TOWER

UNIT	AREA	SEQUENCE NO.	SHEET NO.	DRAWING NO.	REV.
S	B957	79	41	411 1111-1	4

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FROM COOLING TOWER SUMP WCS 411-1111-1

42"x120" NOTE-10

411-PM-00-108 NOTE-49

411-PT-00-109

411-PA-CF-101A/B/C/D/E/F/G/H/I (NOTE-19, 23)

CW RETURN 411-1111-1

HP STEAM 410-1111-3

LP STEAM 410-1111-3

TO ATM AT SAFE LOCATION

TO TURBINE GOVERNOR CONTROL

DETAIL-B2

DETAIL-X NOTE-59,87,88

BY OTHERS BY CT CONTRACTOR (CTC)

TO ClO2 GENERATION SP. DOSING SYSTEM

COOLING WATER SUPPLY TO POLYMER BLOCK UNITS C.W. SUPPLY 441-1112

EMERGENCY CW TO BUTENE-1 & NEW STEAM GENERATION BLOCK C.W. SUPPLY 441-1112

BACKWASH WATER 411-1114

HP STEAM 441-1121

LP STEAM 441-1122

18"-BD-441-1802-A3A TO RO-DM PLANT BLOWDOWN SUMP PUMP 441-1119

411-PM-00-108
POLYMER EMERGENCY COOLING WATER RECIRCULATION PUMP-1
NOTE-C,19,49,60
RATED CAPACITY = 1750 m3/hr (STAND BY)
DIFFERENTIAL HEAD=70.7m

411-PT-00-109
POLYMER EMERGENCY COOLING WATER RECIRCULATION PUMP-2
NOTE-C,19
RATED CAPACITY = 1750 m3/hr (WORKING)
DIFFERENTIAL HEAD=70.7m

411-PA-CF-101A/B/C/D/E/F/G/H/I
POLYMER BLOCK COOLING WATER RECIRCULATION PUMPS
(NOTE-C, 19) (7W + 2S)
RATED CAPACITY = 9000 M3/HR. (EACH PUMP)
DIFFERENTIAL HEAD=67.7m

GENERAL NOTES :-

A. UNIT NUMBER 411 TO BE ADDED AS PREFIX TO ALL INSTRUMENT NUMBERS.
B. FOR STANDARD SYMBOLS & NOMENCLATURE REFER DWG. NO. 8957-79-41-00-1191/1192.
C. FOR DETAILS OF PUMP VENT, DRAIN AND SAMPLE CONNECTION, REFER DWG. NO. 8957-79-41-00-1192.
D. ALL INSTRUMENT DRAINS FROM SULPHURIC ACID SYSTEM SHOULD GO TO LIME PIT.
E. DETAILS FOR PACKAGE UNITS ARE PRELIMINARY AND CONTRACTOR TO DEVELOP FURTHER.

NOTES CONTINUED:-

42. THE RETURN HEADER LINE SIZE REDUCED BY : 120"-WCR-411-1101-A91A
43. VENT TO SAFE LOCATION TO BE PROVIDED AT FAN DECK LEVEL IN EACH RISER PIPE FOR HYDROCARBON VENTING. REFER VENDOR P&ID FOR DETAIL.
44. DRAIN IN FLUSHING CONNECTION SHALL BE PROVIDED AS BELOW
45. CONTROL VALVE AT INLET STEAM LINES OF TURBINE DRIVE SHALL BE IN TURBINE VENDOR'S SCOPE OF SUPPLY.
46. LINE SIZE TO BE FINALIZED BASED ON TURBINE VENDOR INPUT.
47. *** MARKED INSTRUMENTS ARE IN TURBINE VENDOR'S SCOPE OF SUPPLY & SHALL BE MOUNTED ON RESPECTIVE GAUGE BOARD.
48. PSV IN TURBINE VENDOR'S SCOPE OF SUPPLY.
49. PUMP SHALL BE FED FROM EMERGENCY POWER.
50. INTERNAL DISTRIBUTION SHALL BE AS PER TURBINE VENDOR REQUIREMENT.
51. THERE IS EMERGENCY CW (1750 m³/hr) IN CT-2. A DEDICATED EMERGENCY CW SUPPLY & RETURN HEADER WILL BE PROVIDED IN CT-2. ACCORDINGLY A DEDICATED EMERGENCY COOLING WATER SUPPLY AND RETURN HEADER IS PROVIDED IN CT-2. FANS OF ANY TWO COOLING TOWER CELLS WILL BE PROVIDED WITH EMERGENCY POWER CONNECTIONS FOR AUTOMATICALLY RESTARTING DURING POWER FAILURE. RETURNING COOLING WATER IN THE EMERGENCY COOLING WATER RETURN HEADER WILL BE SENT THROUGH RISERS TO THE TOP OF THESE TWO CELLS (PROVIDED WITH EMERGENCY POWER TO FAN) OUT OF THE TOTAL CELLS OF THE POLYMER COOLING TOWER. THEY WILL BE IN ADDITION TO 2NE RISERS CARRYING NORMAL COOLING WATER RETURN TO THESE TWO CELLS.
52. BACK FLUSH CONNECTION FOR THE EMERGENCY CW RETURN HEADER TO BE LOCATED AT THE FASTEST END OF HEADER.
53. TURBINE STEAM INLET/OUTLET PIPING IN OTHER'S SCOPE.
54. GAS DETECTORS WILL BE FREE ISSUE TO CT VENDOR.
55. CONTROL FROM SRR NO3 AND NOT PETCHEM.
56. COOLING WATER FLOW METER SHALL BE INSTALLED ABOVEGROUND ONLY.
57. BEARING COOLING WATER RETURN LINE WILL BE PUT IN CHANNEL AT APPROPRIATE LOCATION FOR UNIFORM MIXING.
58. BACKWASH WATER SHALL BE PUMPED TO CTED LINE FOR FURTHER ROUTING TO RO-DM. HYDRAULICS TO BE CARRIED OUT BY CT CONTRACTOR. PRELIMINARY PIT PUMP DISCHARGE PRESSURE WILL BE 6.7 kg/cm2(g). THE SAME WILL BE COMMUNICATED TO CT CONTRACTOR DURING DETAIL ENGINEERING BASED ON CW PUMP HYDRAULICS.
59. DELETED.
60. a) COOLING TOWER FAN MOTORS SHALL BE PROVIDED WITH BEARING TEMPERATURE MONITORING THROUGH RTD's WITH TRANSMITTER WIRED TO DCS.
b) COOLING TOWER FAN GEAR BOX SHALL BE PROVIDED WITH LUBE OIL LEVEL SWITCH (OEM STANDARD LEVEL) WHICH SHALL BE WIRED TO DCS FOR LOW LEVEL ALARM.
c) COOLING TOWER FAN SHALL BE PROVIDED WITH LIGHT WEIGHT CARBON FIBRE COUPLING.
61. THE ISOLATION VALVE & SPECTACLE BLIND IS TO BE LOCATED CLOSE TO EMERGENCY PUMP 411-PT-00-109.
62. AT 1106 & AT-1156 WILL BE FREE ISSUE TO CT CONTRACTOR.
62 a) CONDUCTIVITY ANALYZER ON LINE 24"-WR-411-1101-A3A & 24"-WR-411-1101-A3A WILL BE FREE ISSUED TO CONTRACTOR.
63. LINE SIZE SHALL BE FINALIZED AFTER RECEIPT OF DATA FROM TURBINE VENDOR.
64. ALL MOVs TO BE PROVIDED WITH OPEN/CLOSE INDICATION. TAG NO. WILL BE FROM 1112 TO 1122. REFER DETAIL-B2.
65. NORMALLY EMERGENCY COOLING WATER IS SUPPLIED BY EMERGENCY COOLING WATER PUMP 411-PT-00-109 / 411-PM-00-108 IN CASE THESE PUMPS ARE NOT AVAILABLE PROVISION IS PROVIDED TO ROUTE COOLING WATER FROM MAIN COOLING WATER PUMP (411-PA-CF-101) DISCHARGE HEADER TO EMERGENCY HEADER.

No.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
5	30.12.20	REVISED AS MARKED & ISSUED FOR IMDP	RS	MK	AM	VM
4	31.08.17	CLIENT'S COMMENTS INCORP. & REVISED FOR TENDER	RS	MK	AM	VM
3	15.05.17	CLIENT'S COMMENTS INCORP. & REVISED FOR TENDER	RJ	MK	AM	VM
2	24.04.17	REVISED, INCORPORATING CLIENTS COMMENTS	RS	MK	AM	VM
1	08.12.16	REVISED FOR ENGINEERING	RJ	MK	AM	VM
0	31.10.16	ISSUED FOR ENGINEERING	RJ	MK	AM	VM
A	14.10.16	ISSUED FOR COMMENTS	GR	MK	AM	VM

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BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
POLYMER COOLING WATER SYSTEM (CT-2)
COOLING WATER PUMPS

SCALE	JOB NO.	DEPT.	SECTN.	UNIT	DWG. No.	REV.
	B957	79	41	411	1111-2	5

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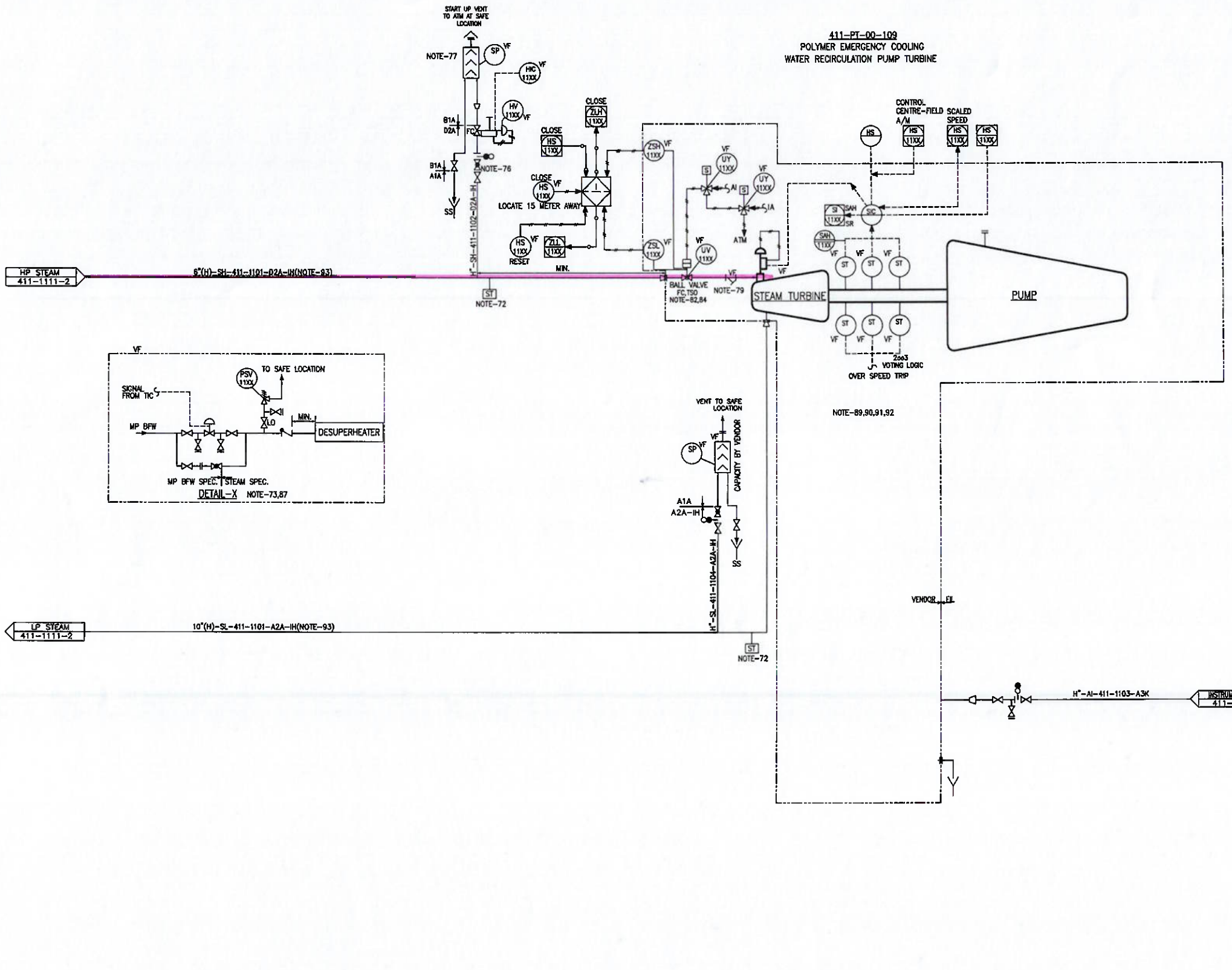

NOTES:-

71. "VF" DENOTES ITEMS UNDER TURBINE VENDOR SCOPE OF SUPPLY.
72. LINE TRAP TO BE PROVIDED IN THE STEAM LINE. OTHER STEAM TRAPS AS REQUIRED FOR PIPING LOW POINTS TO BE SUITABLY PROVIDED. THE TRAP SHOWN IS LINE STEAM TRAP ONLY.
73. DETAILS OF DESUPERHEATER TO BE UPDATED DURING DETAIL ENGG. BASED ON CONFIGURATION BY VENDOR.
74. DISTANCE OF TEMPERATURE ELEMENT FROM DESUPERHEATER WILL BE A MINIMUM OF 10 PIPE DIA. ACTUAL ARRANGEMENT, STRAIGHT LENGTH AND DIAMETER TO BE CONFIRMED BY VENDOR.
75. PIPING PMS SHALL BE SUITABLE FOR TURBINE EXHAUST CONDITIONS AND NO LOAD CONDITIONS OF TURBINE.
76. LINE RATING AND PMS SHALL BE FINALIZED BASED ON EXHAUST STEAM CONDITION AT GLOBE VALVE OUTLET.
77. STEAM SILENCER RATING TO BE DECIDED AS PER DESIGN TEMP CONDITION OF THE FLASHED STEAM.
78. SET PRESSURE OF PSV'S TO BE STAGGERED AND MAXIMUM SET PRESSURE OF PSV SHOULD BE SAME AS DESIGN PRESSURE OF EXHAUST SYSTEM.
79. STRAINER IS PART OF T&T VALVE. T&T VALVE & STRAINER SHALL BE IN VENDOR SCOPE.
80. NRV SHALL BE INSTALLED IN HORIZONTAL LINE AND AS CLOSE AS POSSIBLE FROM STEAM TURBINE. QUICK CLOSING NRV TO BE PROVIDED.
81. PROVIDE 10MM WEEP HOLE AT LOWEST POINT. SPARING OF PSV SHALL BE AS PER BEDB PART-B.
82. TRIP LOGIC REQUIREMENT OF THESE INSTRUMENT TO BE DEFINED BY TURBINE VENDOR.
83. TE SHALL BE MOUNTED AS CLOSE AS POSSIBLE FROM STEAM TURBINE.
84. ON/OFF VALVE SHALL BE BALL TYPE AS PER ENGINEERING DESIGN BASIS.
85. B/L VALVE SHALL BE AT TURBINE VENDOR B/L.
86. COMMON CWS/CWR FOR LO COOLER, GLAND CONDENSER, BEARING COOLER ETC.
87. DESUPERHEATER TO BE PROVIDED BY TURBINE VENDOR.
88. DESUPERHEATER SHALL BE DESIGNED TO MEET THE OPERATING/DESIGN CONDITIONS AS PER CONDITION SPECIFIED INTERSECT.
89. SEPARATE SPEED PROBES + TRANSMITTERS (MIN. 2 NOs.) SHALL BE PROVIDED FOR GOVERNOR.
90. STEAM TURBINE OVER SPEED TRIP SHALL BE BASED ON 2 OUT OF 3 (2oo3) VOTING LOGIC. SPEED PROBES + TRANSMITTERS (3 NOs.) FOR OVER SPEED TRIP SHALL BE PROVIDED.
91. ONE SEPARATE SPEED PROBE + TRANSMITTER SHALL BE PROVIDED FOR SPEED MONITORING.
92. AUXILIARY OIL PUMP SHALL BE FED WITH EMERGENCY POWER SUPPLY.
93. IBR SERVICE.

No.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
0	10.12.25	ISSUED FOR ENGINEERING & HAZOP	RS	MK	VM	VM
B	02.12.25	REVISED INCORP. CLIENT COMMENT.	RS	MK	VM	VM
A	23.06.25	ISSUED FOR COMMENTS	RS	MK	AM	VM

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BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम

PIPING AND INSTRUMENTATION DIAGRAM

POLYMER EMERGENCY COOLING WATER RECIRCULATION PUMP TURBINE

SCALE	JOB NO.	DEPT.	SECTN.	UNIT	DWG. No.	REV.
NTS	B957	79	41	411	1111-3	0

EIL-0241-502-REV-0-A

DISTRIBUTION CODE

CAD DWG-WHP STEAM TURBINE

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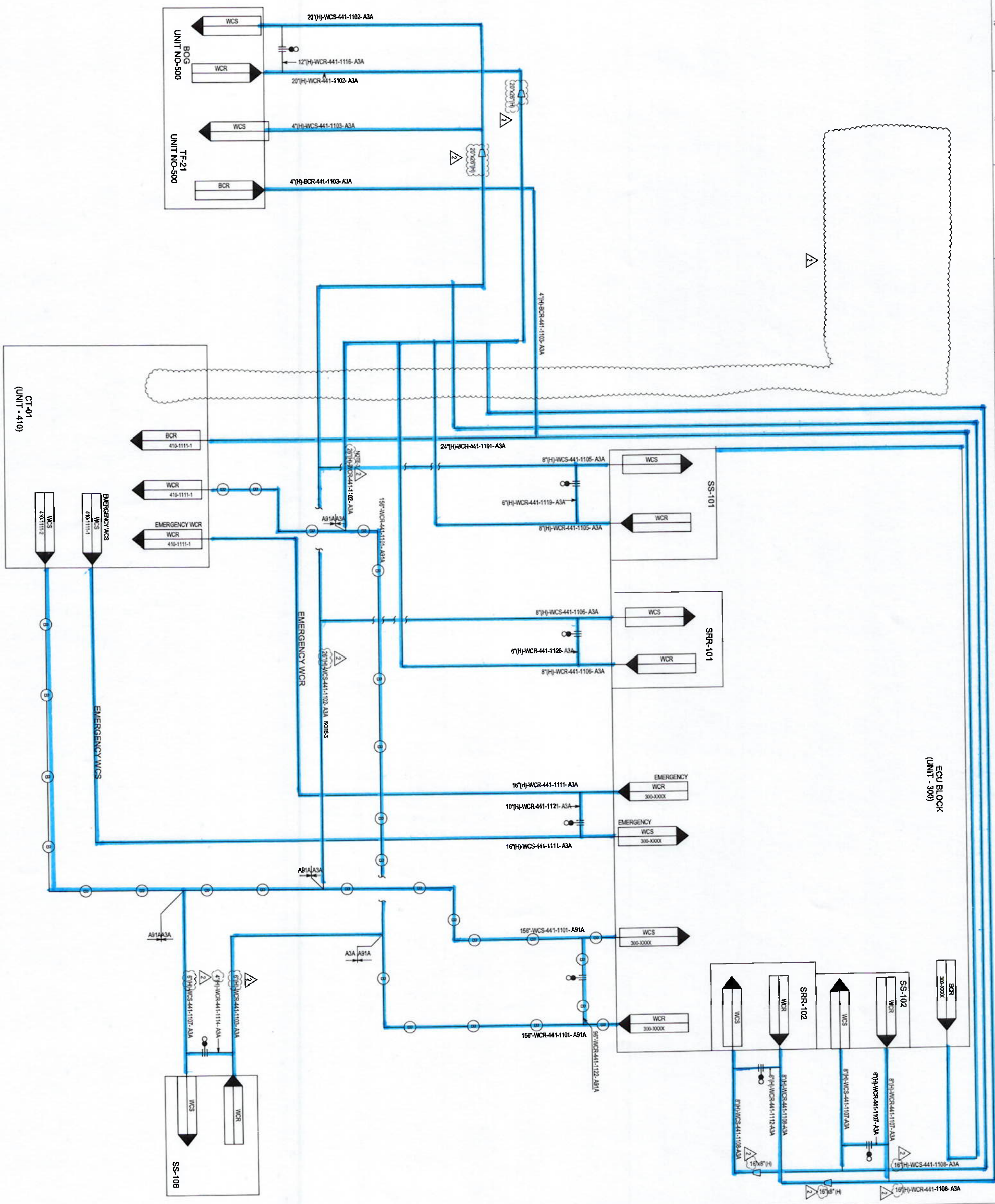

GENERAL NOTES:-

A. FOR STANDARD SYMBOLS & NOMENCLATURE REFER DWG NO. B957-P-41-09-1151/152
B. VALVES IN OFFSITES SHOULD BE EASILY ACCESSIBLE.
C. INTER CONNECTIVITY BETWEEN EACH BLOCK IS INDICATIVE ONLY. REFER OVERALL PLOT PLAN DWG NO. B957-999-51-45-9001.

NOTES:-

1. EXPANDER/REDUCER SHALL BE PROVIDED IN CBBL SCOPE TO MATCH CBBL & BBBL LINE SIZE AT BBL OF UNIT / UTILITY & OFFSITE FACILITY.
2. ALL DEAD ENDS OF CW HEADER TO BE PROVIDED 4" LINE WITH ISOLATION VALVE AT THE LOWER POINT OF THE BLIND SEE SKETCH-1

SKETCH-1 (NOTE-2)

3. LINE SIZE WITH HOLD SHALL BE FINALISED AFTER RECEIPT OF FINAL DATA FROM VENDOR.
4. FOR COOLING WATER LINES GREATER THAN EQUAL TO 42" MANWAYS CAN BE PROVIDED EVERY 100M (APPROX) IN HORIZONTAL LINES ONLY. HOWEVER NO OF MANWAYS TO BE MINIMIZED IN CONSIDERATION OF MAN ENTRY FOR INSPECTION AND CLEANING INSIDE THE HEADER.

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
2	22.07.25	REVISED AS MARKED	MD	MK	VM	MS
1	25.03.25	ISSUED FOR ENGG.	GR	MK	VM	MS
0	31.01.25	ISSUED FOR ENGG. FOR UG LINES	MD	MK	VM	MS
A	21.01.25	ISSUED FOR COMMENTS	AK	MK	AM	VM

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भारत पैट्रोलियम कॉर्पोरेशन लिमिटेड
BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY
EXPANSION PROJECT (BPREEP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायग्राम

PIPING AND INSTRUMENTATION DIAGRAM
UTILITY INTERCONNECTION
CT-1 COOLING WATER /BCR NETWORK

कार्य संख्या JOB NO.	विभाग DEPT.	उपखण्ड SECTN.	इकाई UNIT	प्रपत्र संख्या DWG. No.	संशो. REV.
B957	79	41	441	1111	2

स्केलरहित SCALE

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GENERAL NOTES:-

A. FOR STANDARD SYMBOLS & NOMENCLATURE REFER DWG. NO. 8867-79-41-00-1191/1192
B. VALVES IN OFFSITES SHOULD BE EASILY ACCESSIBLE
C. INTER CONNECTIVITY BETWEEN EACH BLOCK IS INDICATIVE ONLY. REFER OVERALL PLOT PLAN DWG NO. 8857-999-81-45-00001-

NOTES:-

1. EXPANDER/REDUCER SHALL BE PROVIDED IN OSBL SCOPE TO MATCH OSBL & ISBL LINE SIZE AT BL OF UNIT, UTILITY & OFFSITE FACILITY
2. ALL DEAD ENDS OF CW HEADER TO BE PROVIDED 4" LINE WITH ISOLATION VALVE AT THE LOWER POINT OF THE BUND SEE SKETCH-1

SKETCH-1 (NOTE-2)

3. LINE SIZE WITH HOLD SHALL BE FINALISED AFTER RECIPT OF FINAL DATA FROM VENDOR.
4. FOR COOLING WATER LINES GREATER THAN EQUAL TO 42" MANWAYS CAN BE PROVIDED EVERY 100M (APPROX) IN HORIZONTAL LINES ONLY. HOWEVER NO OF MANWAYS TO BE MINIMIZED IN CONSIDERATION OF MAN ENTRY FOR INSPECTION AND CLEANING INSIDE THE HEADER.

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
2	22.07.25	REVISED AS MARKED	MD	MK	VM	MS
1	25.03.25	RE-ISSUED FOR ENGG.	GR	MK	VM	MS
0	31.01.25	ISSUED FOR ENGG. FOR UG LINES	MD	MK	VM	MS
A	16.01.25	ISSUED FOR COMMENTS	AK	MK	AM	VM

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भारत पैट्रोलियम कॉर्पोरेशन लिमिटेड
BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
UTILITY INTERCONNECTION
CT-2 COOLING WATER /BCR NETWORK

जनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	आरेख संख्या DWG. No.	संशो REV.
~	B957	79	41	441	1112	2

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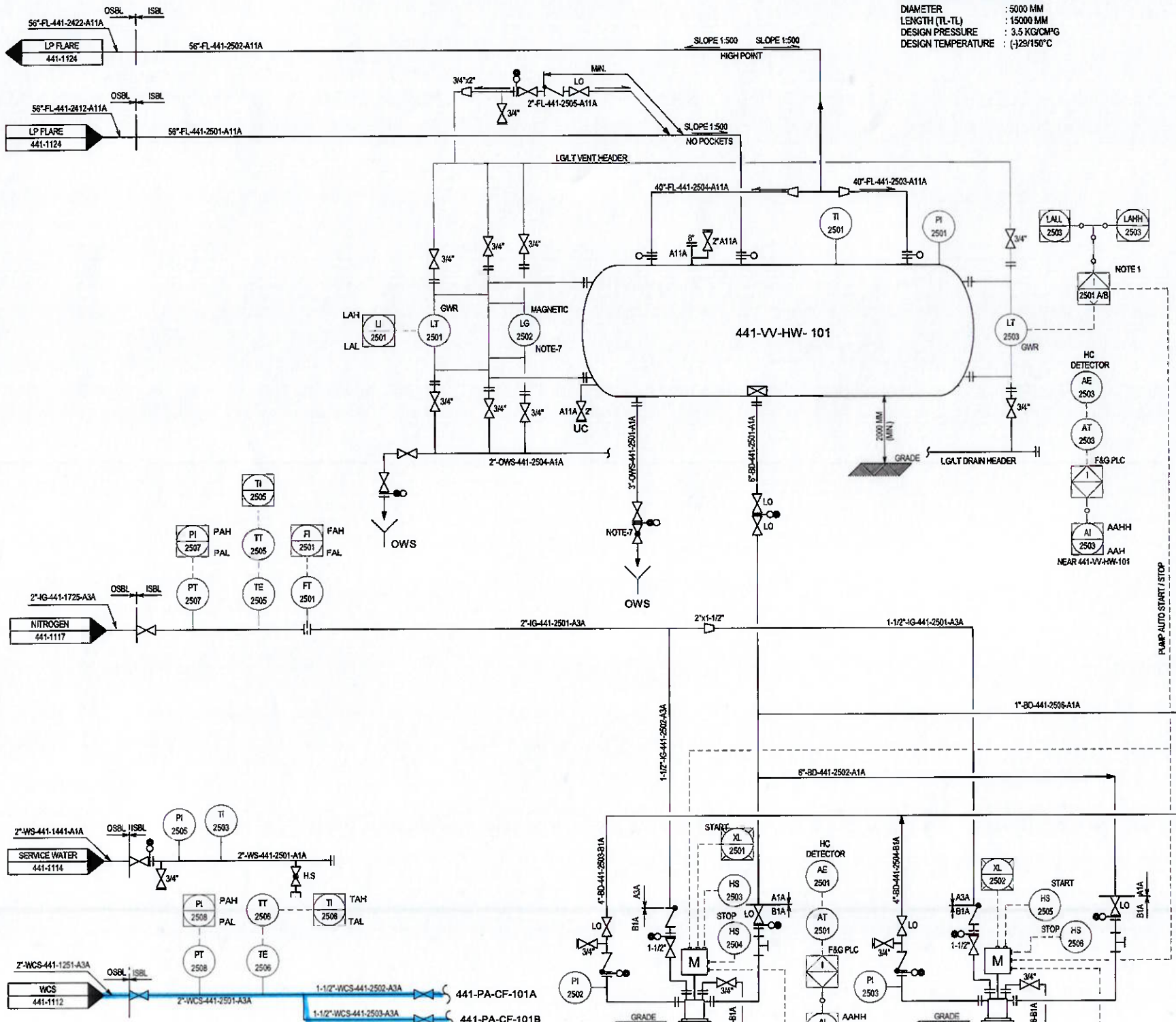
441-VV-HW-101
INTERMEDIATE LP FLARE KOD

DIAMETER : 5000 MM
LENGTH (TL-TL) : 15000 MM
DESIGN PRESSURE : 3.5 KG/CMPG
DESIGN TEMPERATURE : (-)29/150°C



441-PA-CF-101A /B
INTERMEDIATE LP FLARE KOD PUMPS NOTE-2,3,4,5
RATED CAPACITY: 40.0 m^3/hr
DIFF. HEAD: 105.3 M

GENERAL NOTES:

A. FOR STANDARD SYMBOLS & NOMENCLATURE, REFER P&ID NO. B857-79-41-999-1191/1192.
B. VALVES IN OFFSITE AREA SHOULD BE EASILY ACCESSIBLE.
C. REFER BPREP OVERALL PLOT PLAN DWG. NO. B957-999-81-45-00001 FOR ACTUAL LOCATION OF INDIVIDUAL UNITS.

NOTES:

1. INTERLOCK LOGIC :-

INTERLOCK	ACTUATED BY	ACTION
441-I-2501A	LT/LAHH-2503	START 441-PA-CF-101A/B
441-I-2501B	LT/LALL-2503	STOP 441-PA-CF-101A/B

2. AUTO START / STOP PROVISION TO BE PROVIDED IN PUMPS 441-PA-CF-101A/B.
3. PUMPS SHALL HAVE START/ STOP BUTTONS IN FIELD.
4. PUMP VENT AND DRAIN SHALL BE ROUTED TO OWS ONLY.
5. PUMP SHALL BE CONNECTED TO EMERGENCY POWER SUPPLY.
6. ALL INSTRUMENT SIGNALS OF P&ID B957-79-41-441-1125 SHALL BE CONNECTED TO SRR #102 FOR FURTHER MONITORING / OPERATION FROM THE PETCHEM MCR.
7. LG SHALL BE READABLE FROM GLOBE VALVE.

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
0	10.07.25	ISSUED FOR ENGINEERING	MD	SK	KG	VM
A	15.04.25	ISSUED FOR COMMENTS	MD	KG	VM	MS

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पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
UTILITY INTERCONNECTION
INTERMEDIATE LP FLARE KOD AND PUMPS

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT.	आरेख संख्या DWG. No.	पंक्ति REV.
NTS	B957	79	41	441	1125	0

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500-VV-VI-004
PROPYLENE UNLOADING COMPRESSOR SUCTION KOD
SIZE: 1M(DIA)X3.4(TL-TL)

500-KA-RP-002 A / B
PROPYLENE UNLOADING COMPRESSOR
CAPACITY - 1821 KG/HR (EACH)
NOTE-13

500-EE-00-006 A / B
PROPYLENE UNLOADING COMPRESSOR
AFTER COOLER

GENERAL NOTES:-

A. ALL INSTRUMENTS TAGS TO BE PREFIXED BY UNIT NO. 500
B. FOR STANDARD SYMBOLS, NOMENCLATURE, GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-999-11915192.
C. FOR GENERAL NOTES AND TYPICAL DETAILS REFER P&ID NO. B957-79-41-500-1193.
D. FOR TYPICAL DETAIL REFER P&ID NO. B957-79-41-500-1194.
E. ALL THE INSTRUMENTS INCLUDING F&G DETECTOR INDICATIONS ALARMS/SIGNALS TO BE CONNECTED TO PLC BASED CONTROL SYSTEM IN C/R-04 AND OPERATED FROM C/R-04.

NOTES:-

1. 500-KA-RP-002A/B COMPRESSORS ARE IN VENDOR SCOPE. PSV-2002A/B AND PSV-2003A/B SHALL BE LOOSE SUPPLY BY VENDOR.
2. ALL ITEMS MARKED 'VF' IN COMPRESSOR VENDOR SCOPE OF SUPPLY.
3. VENDOR TO INDICATE THE TOTAL UTILITY REQUIRMENT FOR HIS SCOPE OF WORK.
4. INTERSTAGE COOLING IF REQUIRED, TO BE PROVIDED BY VENDOR.
5. CONNECTION TO BE USED FOR START-UP PURGING OF SUCTION PIPING AND VOLUME BOTTLES.
6. PI-2017 SHOULD BE READABLE FROM GLOBE VALVE.
7. COMPRESSOR DETAILS SHOWN ARE INDICATIVE ONLY & MIN. TO BE CONSIDERED /PROVIDED BY VENDOR.
8. ALL FREE DRAINING LINES WITH NO POCKETS.
9. ALL VENT & DRAIN VALVES ARE NORMALLY CLOSED.
10. HOSE STATION CONSISTING OF PLANT AIR, SERVICE WATER AND NITROGEN TO BE PROVIDED HOSE TO BE FLANGE TYPE FOR NITROGEN & LP STEAM. OTHER UTILITIES TO HAVE HOSE OF QUICK COUPLING TYPE. NUMBER OF HOSE STATIONS TO BE DECIDED BY ENGINEERING AND SHALL COVER PROPYLENE, BUTENE-1 TANKER UNLOADING AREA AND UNLOADING COMPRESSOR AREA.
11. FOR SAFETY DIAGRAM REFER P&ID NO. B957-79-41-500-1139
12. POINT GAS DETECTORS TO BE LOCATED NEAR EACH COMPRESSOR AREA AND SUCTION KOD.
13. IT SHALL BE ENSURED THAT WHILE UNLOADING SINGLE TANKER OF PROPYLENE, ONLY ONE PROPYLENE UNLOADING COMPRESSOR SHALL BE OPERATED.
ONLY WHILE UNLOADING TWO PROPYLENE TANKERS, BOTH PROPYLENE UNLOADING COMPRESSORS SHALL BE OPERATED.
WHILE UNLOADING SINGLE PROPYLENE TANKER, BOTH PROPYLENE UNLOADING COMPRESSORS SHALL NOT BE OPERATED.
14. FOR CONTROL VALVE VENT AND DRAIN CONNECTION REFER P&ID NO B957-79-41-500-1140.

INTERLOCK	ACTUATED BY	ACTION
I-2001	LT/LAHH-2003	TRIP COMPRESSOR 500-KA-RP-002A/B
I-2002	PT/PALL-2007	TRIP COMPRESSOR 500-KA-RP-002A
I-2003	PT/PAHH-2009	
I-2004	TT/TAHH-2004	
I-2005	PT/PALL-2012	TRIP COMPRESSOR 500-KA-RP-002B
I-2006	PT/PAHH-2014	
I-2007	TT/TAHH-2008	

LEGEND:-

VF: UNLOADING COMPRESSOR VENDOR FURNISHED

DETAIL-Y

STAGE - 1 WHEN PUSHING LIQUID FROM ROAD TANKER TO BULLET.
USING N2 — FROM COMPRESSOR
USING VAPOR BALANCE LINE — TO COMPRESSOR — FROM COMPRESSOR
STAGE - 2 WHEN SUCKING VAPOR (RESIDUAL) FROM ROAD TANKER AND PUSHING TO BULLET.
TO BULLET
TO COMPRESSOR

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
1	02.12.25	ISSUED FOR HAZOP	PD	SA	PP	MS
0	1.08.25	ISSUED FOR ENGG.	AN	SA	PP	MS
A	18.07.25	ISSUED FOR COMMENTS	AN	SA	PP	MS

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BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
PROPYLENE UNLOADING COMPRESSOR

SCALE	JOB NO.	DEPT.	SECTN.	UNIT	DWG. No.	REV.
	B957	79	41	500	1120	1

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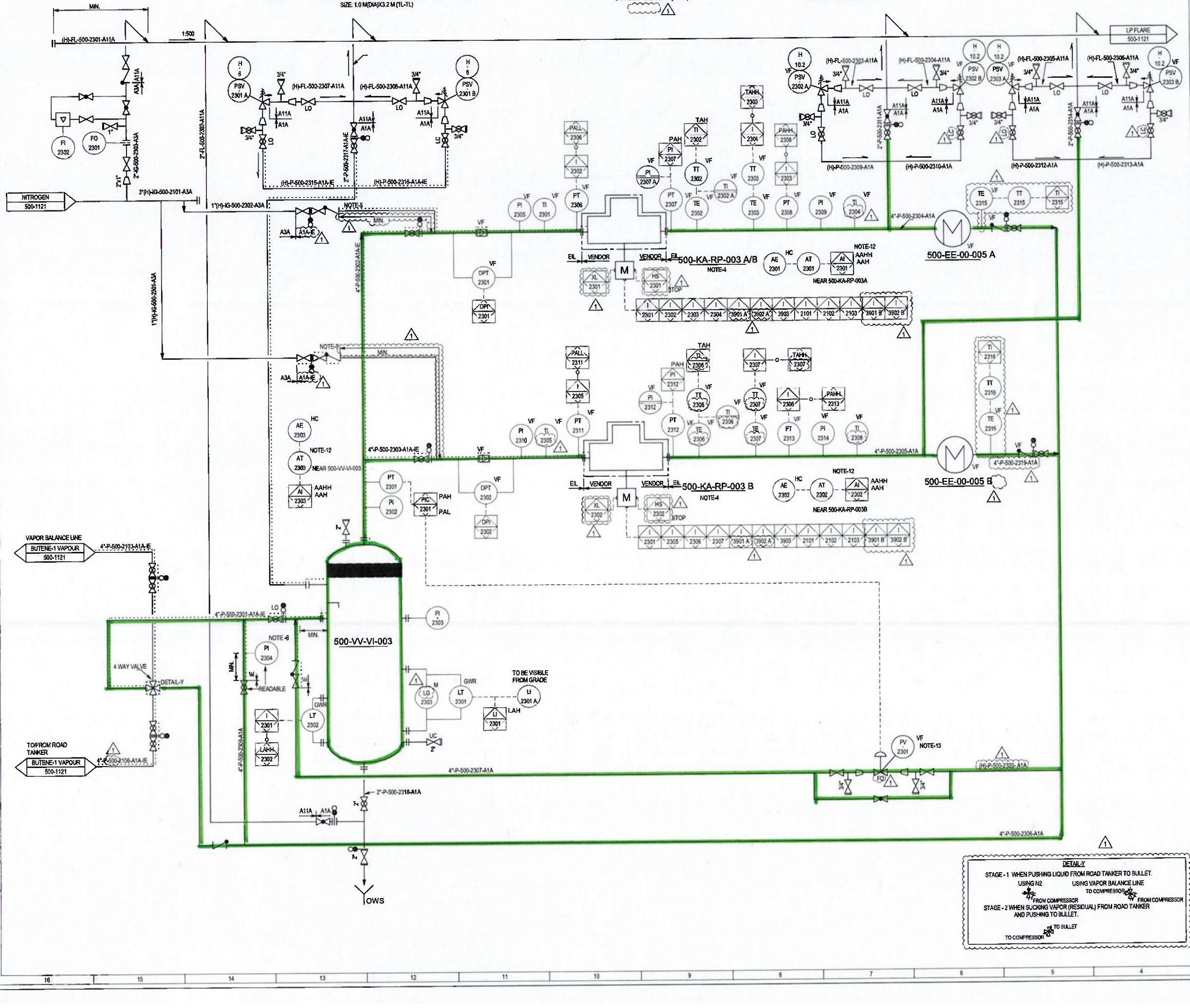
500-VV-VI-003
BUTENE-1 UNLOADING COMPRESSOR SUCTION KOD
SIZE: 1.0 M(DIA)X3.2 M (TL-TL)

500-KA-RP-003 A/B
BUTENE-1 UNLOADING COMPRESSOR
CAPACITY - 578 KG/HR (EACH)

500-EE-00-005 A
BUTENE-1 UNLOADING COMPRESSOR
AFTER COOLER



DETAIL-Y

STAGE - 1 WHEN PUSHING LIQUID FROM ROAD TANKER TO BULLET.
USING N2 — FROM COMPRESSOR
USING VAPOR BALANCE LINE — TO COMPRESSOR — FROM COMPRESSOR
STAGE - 2 WHEN SUCKING VAPOR (RESIDUAL) FROM ROAD TANKER AND PUSHING TO BULLET.
TO BULLET
TO COMPRESSOR

GENERAL NOTES:-

A. ALL INSTRUMENTS TAGS TO BE PREFIXED BY UNIT NO. 500
B. FOR STANDARD SYMBOLS, NOMENCLATURE, GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-999-1191/1192
C. FOR GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-500-1193.
D. FOR TYPICAL DETAIL REFER P&ID NO. B957-79-41-500-1194.
E. ALL THE INSTRUMENTS INCLUDING F&G DETECTOR INDICATIONS ALARMS/SIGNALS TO BE CONNECTED TO PLC BASED CONTROL SYSTEM IN C/R-04 AND OPERATED FROM C/R-04.

NOTES:-

1. 500-KA-RP-003A/B COMPRESSORS ARE IN VENDOR SCOPE. PSV-2302A/B AND PSV-2303A/B SHALL BE LOOSE SUPPLY BY VENDOR
2. ALL ITEMS MARKED VF ARE IN COMPRESSOR VENDOR SCOPE OF SUPPLY.
3. VENDOR TO INDICATE THE TOTAL UTILITY REQUIREMENT FOR HIS SCOPE OF WORK.
4. INTERSTAGE COOLING,IF REQUIRED, TO BE PROVIDED BY VENDOR.
5. CONNECTION TO BE USED FOR START-UP PURGING OF SUCTION PIPING AND VOLUME BOTTLES.
6. PI-2304 SHOULD BE READABLE FROM GLOBE VALVE.
7. COMPRESSOR DETAILS SHOWN ARE INDICATIVE ONLY & MIN. TO BE CONSIDERED /PROVIDED BY VENDOR.
8. ALL FREE DRAINING LINES WITH NO POCKETS.
9. ALL VENT & DRAIN VALVES ARE NORMALLY CLOSED.
10. HOSE STATION CONSISTING OF PLANT AIR, SERVICE WATER AND NITROGEN TO BE PROVIDED. HOSE TO BE FLANGE TYPE FOR NITROGEN. OTHER UTILITIES TO HAVE HOSE OF QUICK COUPLING TYPE. NUMBER OF HOSE STATIONS TO BE DECIDED BY ENGINEERING AND SHALL COVER PROPYLENE, BUTENE-1 TANKER UNLOADING AREA AND UNLOADING COMPRESSOR AREA.
11. FOR SAFETY DIAGRAM REFER P&ID NO. B957-79-41-500-1139.
12. POINT GAS DETECTORS TO BE LOCATED NEAR EACH COMPRESSOR AREA AND SUCTION KOD.
13. FOR CONTROL VALVE VENT, DRAIN DETAILS REFER P&ID B957-79-41-500-1140.

INTERLOCK	ACTUATED BY	ACTION
I-2301	LT/LAHH-2302	TRIP COMPRESSOR 500-KA-RP-003A/B
I-2302	PT/PALL-2306	TRIP COMPRESSOR 500-KA-RP-003A
I-2303	PT/PAHH-2308	
I-2304	TT/TAHH-2303	
I-2305	PT/PALL-2311	TRIP COMPRESSOR 500-KA-RP-003B
I-2306	PT/PAHH-2313	
I-2307	TT/TAHH-2307	

LEGEND:-
VF: UNLOADING COMPRESSOR VENDOR FURNISHED

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
1	01.12.25	ISSUED FOR HAZOP	PD	SA	PP	MS
0	01.08.25	ISSUED FOR ENGG.	SP	SA	PP	MS
A	18.07.25	ISSUED FOR COMMENTS	AN	SA	PP	MS

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BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमैन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
BUTENE-1 UNLOADING COMPRESSOR

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	ड्रारेख संख्या DWG. No.	संशो REV.
NTS	B957	79	41	500	1123	1

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500-LZ -00021
RPG VAPOUR RECOVERY SYSTEM

FROM RAW PY. GASOLINE TANK
RPG LEAN HC 500-1132 — 3"(H)-P-500-3257- A9A — NOTE-1

FROM RAW PY. GASOLINE TANK
HC VAPOUR 500-1132 — 6"-P-500-3232- A9A

TO RAW PY. GASOLINE TANK
RPG LEAN HC 500-1132 — 3"(H)-P-500-3258- A9A — NOTE-1

NITROGEN 500-1132 — 2"-IG-500-2601- A3A — NOTE-2
HS 1" — NOTE-4

INST. AIR 510-1112 (1) — 2"-AI-500-2601- A3K — NOTE-2

PLANT AIR 510-1112 (1) — 2"-AP-500-2601- A3A — NOTE-2
HS 1" — NOTE-4

SERVICE WATER 510-1112 (1) — 2"-WS-500-2601- A1A — NOTE-2
HS 1" — NOTE-4

LP STEAM 510-1112 (1) — 2"(H)-SL-500-2601-A2A-IH — NOTE-2
HS 1" — NOTE-4

WR 500-1134-2 (1) — 1-1/2"(H)-WR-500-2601- A3A (1) — NOTE-2

BCR 500-1134-2 (1) — 1-1/2"(H*)-BCR-500-2601- A3A (1) — NOTE-2

BY PACKAGE VENDOR

2"(H)-P-500-2601- A9A — NOTE-1

TPDO ABD-1 ABD 500-1145-1

500-LZ -00021
RPG VAPOUR RECOVERY SYSTEM

GENERAL NOTES:-

A. FOR STANDARD SYMBOLS, NOMENCLATURE, GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B857-79-41-999-1191/1192.
B. ALL INSTRUMENTS TAGS TO BE PREFIXED BY UNIT NO. 500.
C. FOR GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-500-1193.
D. FOR TYPICAL DETAIL REFER P&ID NO. B857-79-41-500-1194.
E. ALL THE INSTRUMENTS INDICATIONS / ALARMS/SIGNALS TO BE CONNECTED IN SRR#104 AND SIGNALS TO BE REPEATED IN PETCHEM / MCR.

NOTES:-

1. LINE SIZE IS HOLD SAME SHALL BE CONFIRMED AFTER RECEIVING VRU PACKAGE VENDOR INPUT.
2. UTILITY REQUIREMENT OF VRU SYSTEM SHALL BE CONFIRMED BY VRU PACKAGE VENDOR.
3. THIS VAPOUR RECOVERY SYSTEM IS FOR RECOVERING VAPOUR FROM RAW PYROLYSIS GASOLINE TANK (GENERATE DURING OUTBREATHING OF TANK). THIS UNIT SHALL BE LOCATED NEAR THIS TANK.
4. NO. AND LOCATION OF HOSE STATION TO BE DECIDED BY ENGINEERING. HOSE TO BE FLANGE TYPE FOR NITROGEN AND LP STEAM. FOR OTHER UTILITES TO HAVE HOSE OF QUICK COUPLING TYPE.

LEGEND :

VENDOR LIMIT LINE

ABD: AROMATIC BLOWDOWN

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
1	28.11.25	ISSUED FOR HAZOP	PD	AC	PP	MS
0	31.07.25	ISSUED FOR ENGINEERING	MD	AC	PP	MS
A	18.07.25	ISSUED FOR COMMENTS	PD	SA	PP	MS

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पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
RPG VAPOR RECOVERY SYSTEM

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	आरेख संख्या DWG. No.	संशो REV.
NTS	B957	79	41	500	1126	1

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C. FOR GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-500-1193.
D. FOR TYPICAL DETAIL REFER P&ID NO. B957-79-41-500-1194.
E. ALL THE INSTRUMENTS INDICATIONS ALARMS/SIGNALS TO BE CONNECTED TO SRR#105 AND SIGNALS TO BE REPEATED IN PETCHEM MCR.
F. ALL INSTRUMENTS MARKED AS TFMS SHALL BE ROUTED TO TANK FARM MANAGEMENT CIU WITH REPEAT INDICATION IN PETCHEM MCR.
G. ALL CONTROL VALVES (INCLUDING SELF ACTUATED PCV) AND SHUTDOWN VALVES/ROSOV FLANGE RATING SHALL BE MINIMUM 300 CLASS.
H. STORAGE TANKS 500-TT-FR-005A/B/C AND 500-TT-FR-007 SHALL BE INTER CHANGEABLE FOR ON AND OFF SPEC BTX. 1

NOTES:

1. MANIFOLD SHOULD BE OUTSIDE DYKE AND AREA UNDER IT TO BE PAVED AND BOUNDED. THERE SHOULD BE PROVISION TO DIVERT FLOOR WASHING TO OWS.
2. LOCAL LEVEL INDICATION TO BE READABLE FROM GRADE OUTSIDE DYKE.
3. INTERMEDIATE PUMPING STATION CONSISTS OF PUMPS 510-PA-CF-003A/B/C (HEXENE), 510-PA-CF-001A/B (HEXANE), 500-PA-CF-025A/B/C(0°-180°), 500-PA-CF-024A/B (OFFSPECAROMATICS), 500-PA-CF-011A/B(BTX), 500-PA-CF-010A/B(RPG), UTILITIES OF PUMP HOUSE SHALL BE COMMON FOR ALL THE PUMPS LOCATED IN SAME PUMP HOUSE. NO. & LOCATION OF HOSE STATION IN PUMP HOUSE TO BE DECIDED BY ENGINEERING. HOSE TO BE FLANGE TYPE FOR NITROGEN & LP STEAM. OTHER UTILITIES TO HAVE HOSE OF QUICK COUPLING TYPE.
4. NO. OF ROOF DRAINS AND SIZES TO BE DECIDED BY VENDOR. ROOF DRAIN WILL BE CONNECTED TO CLOSED DRAIN SYSTEM OPEN TO DYKE DRAIN PIT, WHICH CAN BE ROUTED TO EITHER SS OR OWS.
5. PROVIDE ALARM FOR ELECTRICAL TRACING FAILURE IN OFFSITE CONSOLE.
6. ALL TSV'S TO BE LOCATED PREFERABLY AT ONE PLACE.
7. POINT GAS DETECTORS TO BE LOCATED NEAR TANKS INSIDE THE DYKE, NEAR TANK MANIFOLD AND PUMPS. ALARM SHALL BE SHOWN IN CR.
8. MULTI POINT TEMPERATURE ELEMENT WITH AVERAGE TEMPERATURE INDICATION.
9. PT IS FOR DENSITY MEASUREMENT. PT NOZZLE TO BE LOCATED AT TANK LOWER LIQUID LEVEL.
10. TWO NOS OF 3" SIPHON DRAIN SHALL BE PROVIDED FOR EACH TANK. LINE NUMBERS FOR OTHER DRAIN LINE TO OWS/ABD SHALL BE SUFFIX WITH A/B.
11. PUMP SUCTION HEADERS, PSV OIC HEADERS SHALL BE FREE FROM POCKET.
12. FILLING AND EMPTYING OF THE TANKS SHALL NOT BE DONE SIMULTANEOUSLY.
13. TANK FARM TF-20 CONSISTS OF TANKS 510-TT-FR-001, 510-TT-FR0002A/B, 500-TT-CR-008, 500-TT-00-004A/B, 500-TT-FR-005A/B/C, 500-TT-FR-007. 1
14. ALL ABD LINE TO BE ROUTED TO U/G ABD HEADER.
15. ALL PUMP SUCTION/DISCHARGE FLANGES TO BE OF 300# AS PER API REQUIREMENT.
16. PUMP STATUS (RUNNING/STOP) INDICATION TO BE AVAILABLE IN PETCHEM C/R. PROVISION FOR START/STOP SHALL BE GIVEN FROM FIELD AND STOP FROM PETCHEM MCR.
17. PUMP MINIMUM FLOW LINE SHALL BE CONNECTED TO PUMP SUCTION AT LEAST 50 METER AWAY FROM PUMP SUCTION.
18. PIPING DOWN STREAM OF PCV SHALL BE DRAINING TO THE TANK. PCVS TO BE LOCATED ON TANK TOP.
19. PVRV TO BE MOUNTED TO THE TANK TOP.
20. PROVISION OF UTILIZING BTX UNIT FEED STORAGE AS OFF-SPEC AROMATIC.
21. LIMIT SWITCH SHALL BE PROVIDED FOR ROOF/SIPHON/DYKE DRAIN VALVE TO INDICATE OPEN/CLOSE POSITIONS IN DCS. FOR LIMIT SWITCH DETAILS REFER "DETAIL-D" OF P&ID B957-79-41-500-1194.
22. TRIPLE OFFSET BUTTERFLY VALVE.
23. TANK BOTTOM TO BE SLOPED (1:100) TOWARDS THE PERIPHERY OF THE TANK.
24. NUMBER OF PVRV SHALL BE FINALIZED DURING DETAIL ENGINEERING.
25. FOR PUMP VENT/DRAIN/BLEEDER CONNECTION DETAILS REFER P&ID NO. 9957-79-41-500-1152.
26. FOR CONTROL VALVE VENT AND DRAIN CONNECTION REFER P&ID NO B957-79-41-500-1140.
27. SIZES OF CONTROL VALVE, PUMP INLET/OUTLET NOZZLE & PUMP MCF LINE SHALL BE FINALIZED DURING DETAIL ENGINEERING.
28. PUSH BUTTON ON ROSOV SHOULD BE JUST OUTSIDE THE DYKE AND SHOULD BE VISIBLE TO OPERATOR.
29. TWO NRV OF DIFFERENT TYPE. 1

INTERLOCK	ACTUATED BY	ACTION UPON
I-3406	PUSH BUTTON IN HWC (HS-3403A) OR PUSH BUTTON IN FIELD (HS-3403B)	CLOSE ROSOV-3403
I-3407	LAHH-3409	CLOSE ROSOV-3403

* INTERLOCK ACTUATIONS SGOULD BE BASED ON TANKS SELECTION I.E. INTERLOCK SHOULD BE ACTUATED BY THE ZSL OF THE TANK WICH IS GIVEING SUCTION TO THE PUMP. 1

TABLE-A LIMIT SWITCH DETAILS

TANK NO.	LIMIT SWITCH NO	VALVE NO.	LOCATION
500-TT-FR-005C	ZSH/ZSL/ZAH/ZAL-3410A/B ZSH/ZSL/ZAH/ZAL-3411 ZSH/ZSL/ZAH/ZAL-3412	500-WB-00-3410A/B 500-WB-00-3411 500-WB-00-3412	SIPHON DRAIN DYKE DRAIN ROOF DRAIN

LEGEND:
ABD : AROMATIC BLOWDOWN

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
1	28.11.25	ISSUED FOR HAZOP	PD	AC	PP	MS
0	25.07.25	ISSUED FOR ENGINEERING	PD	AC	PP	MS
A	18.04.25	ISSUED FOR COMMENTS	PD	AC	SA	PP

इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

भारत पैट्रोलियम कॉर्पोरेशन लिमिटेड
BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
BTX FEED STORAGE AND TRANSFER
(SHEET 2 OF 2)

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	उल्लेख संख्या DWG. No	संशो REV.
~	B957	79	41	500	1134-2	1

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NOTE-15
NOTE-2,3
UNLOADING POINT-14 (NOTE-1)
500-LZ-00-017
FLUX OIL UNLOADING HOSE
NOTE-6
3"
AAH AI 4401 NOTE-11
AT 4401
AE 4401 HC
4"-P-500-4401-A9A
3"x4"
3/4"-P-500-4418-A9A
3/4"-P-500-4419-A9A
A9A
A1A
OWS
3/4"x2"
TO CBD
CBD 500-1151 NOTE-8

NOTE-15
NOTE-2,3
UNLOADING POINT-14 (NOTE-1)
500-LZ-00-018
WASH OIL UNLOADING HOSE
NOTE-6
3"
4"-P-500-4409-A9A
3"x4"
3/4"-P-500-4420-A9A
3/4"-P-500-4421-A9A
A9A
A1A
OWS
3/4"x2"
TO CBD
CBD 500-1151 NOTE-8

FI 4401
FT 4401
FE-4401
RO 4401
1-1/2"(H)-P-500-4408- A9A
FLUX OIL/WASH OIL PUMP MCF HEADER
NOTE-12,14

1"D"
(3.8)
NOTE-5
TSV 4401
3/4"
LO
3/4"-500-4416-A9A
3/4"-500-4417-A9A
TO CBD
CBD 500-1151 NOTE-8

HEXANE PUMP SUCTION HEADER 4"-P-500-4402-A9A
NOTE-9

B/L
4"-P-500-1258-A9A
TO TF-20/ECU
FLUX/WASH OIL
440-1112
3"x4"
3"-P-500-4401-A9A

4"-P-500-4403-A9A
3"-P-500-4405-A9A
4"-P-500-4404-A9A
3"-P-500-4406-A9A
NOTE-4
3/4"
PI 4402
PI 4401
PI 4404
PI 4403
NOTE-11
AAHH AAH
AI 4402
AT 4402
AE 4402 HC
NEAR PUMP
AI 4403
AT 4403
AE 4403 HC
NEAR PUMP
500-PA-CF-015 A
DETAIL-E, NOTE-C
500-PA-CF-015 B
DETAIL-E, NOTE-C
M
XL 4401 NOTE-10
XL 4402 NOTE-10
HS 4401 STOP
HS 4402 STOP

CW SUPPLY
500-1120
2"(H)-WCS-500-4401- A3A
NOTE-14
1-1/2"(H)-WCS-500-4403- A3A
NOTE-14
TO 500-PA-CF-015A
1-1/2"(H)-WCS-500-4402- A3A
NOTE-14
TO 500-PA-CF-015B

BCR
510-1115
3"(H)-WCR-500-1401- A3A
NOTE-7
1-1/2"(H)-WCR-500-4403- A3A
NOTE-14
1-1/2"(H)-WCR-500-4402- A3A
NOTE-14

500-PA-CF-015 A/B (1W+1S) (NOTE-13)
FLUX OIL / WASH OIL UNLOADING PUMPS
RATED CAPACITY : 27.5 MCF M3/HR (EACH)
DIFF. HEAD : 107.5 M

GENERAL NOTES:

A. ALL INSTRUMENTS TAGS TO BE PREFIXED BY UNIT NO. 500.
B. FOR STANDARD SYMBOLS, NOMENCLATURE, GENERAL NOTES AND TYPICAL DETAIL REFER P&ID NO. 8957-79-41-999-1191/1192.
C. FOR GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. 8957-79-41-500-1193.
D. FOR TYPICAL DETAIL REFER P&ID NO. 8957-79-41-500-1194.
E. ALL THE INSTRUMENTS INCLUDING F&G DETECTOR INDICATION ALARMS / SIGNALS TO BE CONNECTED TO PLC BASED CONTROL SYSTEM IN C/R-04 AND SHALL BE OPERATED FROM C/R-04.

NOTES:-

1. ONE COMMON UNLOADING POINT-14 & ONE COMMON SPARE UNLOADING POINT-15 IS USED FOR UNLOADING OF FOLLOWING SERVICES -

SERVICE	HOSE NO.
HEXANE	510-LZ-00-001A/B
HEXENE-1	510-LZ-00-002A/B
ISOPENTANE	510-LZ-00-003A/B
FLUX OIL	500-LZ-00-017A/B
WASH OIL	500-LZ-00-018A/B

2. ALL CHEMICAL UNLOADING TO BE DONE IN NITROGEN ATMOSPHERE, UTILISING NITROGEN LOADING HOSE (510-LZ-004) FOR UNLOADING POINT-14 & 15.
3. PROVIDE A SUITABLE RAMP FOR TANKERS SUCH THAT THE TANKER OUTLET NOZZLE IS AT LEAST 1.5 M ABOVE THE PUMPS' C/L.
4. GLOBE VALVE TO BE LOCATED SUCH THAT THE PUMP DISCHARGE PRESSURE GAUGE IS VISIBLE FROM IT.
5. ALL PSV/TSV INLET & OUTLET LINE SHALL BE FREE DRAINING AWAY FROM SAFETY VALVES.
6. END BLIND SHALL BE PROVIDED AFTER TANKER UNLOADING.
7. UNLOADING PUMPING STATION CONSISTS OF 510-PA-CF-005A/B, 500-PA-CF-015A/B, 510-PA-CF-002A/B, AND 510-PA-CF-004-A/B UTILITIES OF PUMP HOUSE SHALL BE COMMON FOR ALL THE PUMPS LOCATED IN SAME PUMP HOUSE. NO. AND LOCATION OF HOSE STATION IN PUMP HOUSE TO BE DECIDED BY ENGINEERING. HOSE TO BE FLANGE TYPE FOR NITROGEN AND LP STEAM. OTHER UTILITIES TO HAVE HOSE OF QUICK COUPLING TYPE.
8. ALL DRAINS TO BE CONNECTED TO CBD SYSTEM. A COMMON HEADER SHALL BE PROVIDED TO ROUTE ALL THE DRAINS/ SAFETY RELIEFS TO CBD HEADER.
9. PUMP SUCTION LINE SHALL BE AS SHORT AS POSSIBLE WITH MIN. NO. OF BENDS AND NO POCKET.
10. START/STOP OF PUMPS TO BE PROVIDED IN FIELD AND STOP FROM C/R-04. RUNNING INDICATION TO BE AVAILABLE IN C/R-04.
11. POINT GAS DETECTORS TO BE LOCATED NEAR EACH UNLOADING POINT/TRUCK, AND AT EACH PUMP.
12. PUMP MINIMUM FLOW LINE SHALL BE CONNECTED TO PUMP SUCTION AT LEAST 50 METER AWAY FROM PUMP SUCTION. MCF SIZE SHALL BE FINALISED DURING DETAIL ENGINEERING.
13. FOR PUMP VENT/DRAIN/BLEEDER CONNECTION DETAILS REFER P&ID NO. 8957-79-41-500-1152.
14. LINE SIZES SHALL BE FINALIZED UPON RECEIPT OF PUMP VENDOR INPUT DURING DETAIL ENGINEERING.
15. TANKER EARTHING CONNECTION TO BE PROVIDED. LOADING SHOULD START ONLY WHEN THE TANKER IS EARTHED.

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
1	28.11.25	ISSUED FOR HAZOP	PD	AC	PP	MS
0	31.07.25	ISSUED FOR ENGINEERING	MD	AC	PP	MS
A	15.07.25	ISSUED FOR COMMENTS	PD	AC	PP	MS

इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

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BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
FLUX OIL / WASH OIL UNLOADING SYSTEM

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	जारेख संख्या DWG. No.	संशो REV.
	B957	79	41	500	1144	1

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510-TT-00-003 A
ISOPENTANE BULLET
STORAGE CAPACITY : 500M^3 (PUMPABLE)
SIZE : 4.6M(DIA) X 34.5M(TL-TL)

510-TT-00-003 B
ISOPENTANE BULLET
STORAGE CAPACITY : 500M^3 (PUMPABLE)
SIZE : 4.6M(DIA) X 34.5M(TL-TL)

INSTRUMENT AIR 441-1115
INSTRUMENT AIR 510-1116
PLANT AIR 441-1116
SERVICE WATER 441-1114
FROM UNLOADING POINT ISOPENTANE 440-1112
LP STEAM 441-1122
CW SUPPLY 441-1112
BCR 441-1312
NITROGEN 441-1117
TO/FROM SWING UNIT ISOPENTANE 440-1112
LP FLARE 441-1124
TO LP FLARE LP FLARE 441-1124

LP FLARE HEADER
PUMP MINIMUM FLOW HEADER
PUMP SUCTION HEADER
PUMP DISCHARGE HEADER

SP-1301 20" DIA. PIPE 2M LONG

TFMS-CIU

510-PA-CF-006 A (DETAIL-E, NOTE-C)
510-PA-CF-006 B (DETAIL-E, NOTE-C)

NEAR ROV-1301 NEAR ROV-1304
NEAR ROV-1302 NEAR ROV-1303 NEAR SC-1301
NEAR MANHOLE (M1) OF 510-TT-00-003A
NEAR MANHOLE (M2) OF 510-TT-00-003B
NEAR SC-1302 NEAR ROV-1305 NEAR ROV-1306 NEAR MANHOLE (M2) OF 510-TT-00-003A NEAR MANHOLE (M2) OF 510-TT-00-003B
NEAR PUMP 510-PA-F-006A
NEAR PUMP 510-PA-CF-006B

510-PA-CF-006A/B (EACH (1W + 1S)
ISOPENTANE TRANSFER PUMPS
RATED CAPACITY : 8.3 m^3/hr
DIFF. HEAD : 191.9M

GENERAL NOTES:-

A. ALL INSTRUMENTS TAGS TO BE PREFIXED BY UNIT NO. 510.
B. FOR STANDARD SYMBOLS, NOMENCLATURE, GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-999-1191/1192.
C. FOR GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-500-1193.
D. FOR TYPICAL DETAIL REFER P&ID NO. B957-79-41-500-1194.
E. ALL THE INSTRUMENTS INDICATIONS / ALARMS/SIGNALS TO BE CONNECTED TO SRR#104 AND SIGNAL TO BE REPEATED IN PETCHEM MCR.
F. ALL INSTRUMENTS MARKED AS TFMS SHALL BE ROUTED TO TANK FARM MANAGEMENT CIU WITH REPEAT INDICATION IN PETCHEM MCR.

NOTES:-

1. TWO NRV'S OF DIFFERENT TYPES.
2. THIS UTILITY IS PROVIDED FOR BULLET 510-TT-00-003A/B.
3. ALL PUMP SEAL FAILURE ALARMS LAL & PAH TO BE AVAILABLE IN PETCHEM MCR.
4. ROV-1301,1305 SHALL BE THE FIRST BREAK FLANGE LOCATED 3M OUTSIDE THE SHADOW OF THE BULLET AND SHALL BE FIRE SAFE WITH FIRE SAFE ACTUATOR. PIPING LAYOUT SHALL BE SUCH THAT IN THE EVENT OF LEAK OF ITS FLANGE ON THE STORAGE SIDE WITH POSSIBILITY OF FIRE THE STORAGE VESSEL DOES NOT COME IN THE LINE OF JET FLAME.
5. ROV SHALL BE OUTSIDE THE KERB WALL OF THE BULLET. ROV'S OF ONE BULLET TO BE LOCATED CLOSE TOGETHER.
6. BULLET SHALL BE FIRE PROOFED AND ALL LINES UP TO 15.0M DISTANCE FROM BULLET WILL BE FIRE PROOFED.
7. BULLET BOTTOM GRADE LEVEL SHALL BE PROVIDED WITH SLOPE 1:1000 TO FACILITATE DRAINING OF THE BULLET.
8. FOR OTHER INTERLOCK AND SAFETY DIAGRAM REFER P&ID NO. B957-79-41-510-1116.
9. PUMP SUCTION LINE SHALL BE AS SHORT AS POSSIBLE WITH MIN. NO. OF BENDS AND NO POCKET.
10. PUMPING STATION CONSISTS OF PUMPS 510-PA-CF-006A/B UTILITIES OF PUMP HOUSE SHALL BE COMMON FOR ALL THE PUMPS LOCATED IN SAME PUMP HOUSE. NO. AND LOCATION OF HOSE STATION IN PUMP HOUSE TO BE DECIDED BY ENGINEERING. HOSE TO BE FLANGE TYPE FOR NITROGEN AND LP STEAM. OTHER UTILITIES TO HAVE HOSE OF QUICK COUPLING TYPE.
11. ALL INSTRUMENTS LOCAL INDICATION PROVIDED ON BULLET TO BE READABLE FROM GRADE.
12. MULTIPOINT TEMPERATURE INDICATOR FOR AVERAGE TEMPERATURE OF BULLET.
13. ALL BLEEDS TO BE ROUTED TO FLARE. REFER DETAIL-D OF P&ID NO.B957-79-41-500-1194.
14. WATER SPRINKLER ARRANGEMENT TO BE PROVIDED FOR BULLET TOP NOZZLES/ STRUCTURES/PUMPS.
15. DRAIN POT SHALL BE MADE WITH 20" 150# CS PIPE OF 2M HEIGHT.
16. PUMP CASING VENTS TO BE ROUTED TO FLARE THROUGH COMMON LINE.
17. VALVE TO BE OF ANTIFREEZE TYPE.
18. ALL PSVS INLET & OUTLET LINE SHALL BE FREE DRAINING AWAY FROM SAFETY VALVES.
19. ALL ISOLATION VALVES PROVIDED IN FLARE LINES SHALL HAVE STEM EITHER IN HORIZONTAL OR VERTICALLY DOWNWARDS DIRECTION.
20. THIS LINE SHALL BE USED FOR SUPPLYING AND DE-INVENTORY OF ISOPENTANE TO SWING UNIT AND FROM SWING UNIT RESPECTIVELY.
21. NRV BYPASS IS PROVIDED FOR DE-INVENTORY PURPOSE FROM SWING UNIT DURING SHUTDOWN.
22. THESE TSV'S ARE FOR THERMAL RELIEF. TSV'S SHOULD BE LOCATED AT ONE PLACE AND COMMON DISCHARGE SHOULD BE CONNECTED TO FLARE HEADER VIA DRAIN POT.
23. START/STOP OF PUMPS TO BE PROVIDED IN FIELD AND STOP FROM C/R. RUNNING INDICATION TO BE AVAILABLE IN C/R.
24. INSTRUMENT AIR VOLUME BOTTLE ARRANGEMENT TO BE PROVIDED FOR ALL ROVS. VOLUME BOTTLE TO BE PROVIDED FOR MIN. THREE OPERATIONS.
25. ALL DRAIN AND SAMPLE POINT FIRST ISOLATION VALVE SHALL BE OF QUICK CLOSING AND TIGHT SHUT OFF TYPE.
26. POINT GAS DETECTORS TO BE LOCATED NEAR EACH ROV, NEAR EACH BULLET, NEAR MANHOLE COVER, AT SAMPLING POINT AND NEAR EACH PUMP.
27. TRIPLE OFFSET BUTTERFLY VALVE.
28. FOR CONTROL VALVE VENT AND DRAIN CONNECTION REFER P&ID NO. B957-79-41-500-1140.

INTERLOCK	ACTUATED BY	ACTION UPON
I-1301	ZSL-1301 (CLOSING OF ROV-1301	TRIP ISOPENTANE TRANSFER PUMP 510-PA-CF-006A/B
I-1302	LT/LAHH-1302	CLOSE ROV-1302, TRIP ISOPENTANE UNLOADING PUMP 510-PA-CF-005A/B
I-1303	LT/LAHH-1305	CLOSE ROV-1304, TRIP ISOPENTANE UNLOADING PUMP 510-PA-CF-005A/B
I-1304	ZSL-1305 (CLOSING OF ROV-1305)	TRIP ISOPENTANE TRANSFER PUMPS 510-PA-CF-006A/B
I-1305	LT/LALL-1303	CLOSE ROV-1301 TRIP PUMP 510-PA-CF-006A/B
I-1306	LT/LALL-1306	CLOSE ROV-1305 TRIP PUMPS 510-PA-CF-006A/B

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
1	02.12.25	ISSUED FOR HAZOP	PD	SA	PP	MS
0	31.07.25	ISSUED FOR ENGG.	AK	SA	PP	MS
A	16.07.25	ISSUED FOR COMMENTS	PD	SA	PP	MS

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BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
ISOPENTANE STORAGE & TRANSFER SYSTEM

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	आरेख संख्या DWG. No.	संशो REV.
NTS	B957	79	41	510	1113	1

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NOTE-15

NOTE-2,3

UNLOADING POINT-14 (NOTE-1)

510-LZ-00-001 A/B

HEXANE UNLOADING HOSE

AAH-IH AAH AI 1401 NOTE-11 AT 1401 AE 1401 HC

3" NOTE-6 3"x4" 4"-P-510-1401-A1A

3/4"-P-510-1434-A1A 3/4"-P-510-1433-A1A 3/4"x2"

OWS TO CBD CBD 500-1151 NOTE-8

NOTE-15

NOTE-2,3

UNLOADING POINT-14 (NOTE-1)

510-LZ-00-002 A/B

HEXENE-1 UNLOADING HOSE

3" NOTE-6 3"x4" 4"-P-510-1403-A1A

3/4"-P-510-1436-A1A 3/4"-P-510-1435-A1A 3/4"x2"

OWS TO CBD CBD 500-1151 NOTE-8

FOR UNLOADING PS (NOTE-7)

4"-IG-510-1401-A3A NITROGEN 500-1119

2"-IG-510-1403-A3A NITROGEN 510-1115

2"-IG-510-1402-A3A NITROGEN 510-1115

INSTRUMENT AIR 500-1119 2"-AI-510-1401-A3K FOR UNLOADING PS (NOTE-7)

PLANT AIR 500-1119 2"-AP-510-1401-A3A FOR UNLOADING PS (NOTE-7) HS 1" NOTE-7

SERVICE WATER 500-1119 2"-WS-510-1401-A1A FOR UNLOADING PS (NOTE-7) HS 1" NOTE-7

PAH PAL PI 1410 PI 1409 PT 1410

LP STEAM 441-1122 2"-SL-441-2216-A2A-IH B/L

2"-SL-510-1401-A2A-IH FOR UNLOADING PS (NOTE-7) HS 1" NOTE-7

LP STEAM 500-1151 2"-SL-510-5101-A2A-IH

CW SUPPLY 500-1120 3"-WCS-510-1401- A3A FOR UNLOADING PS (NOTE-7)

1-1/2"(H)-WCS-510-1403- A3A NOTE-14 TO 510-PA-CF-004A

1-1/2"(H)-WCS-510-1402- A3A NOTE-14 TO 510-PA-CF-004B

1-1/2"(H)-WCS-510-1404- A3A NOTE-14 TO 510-PA-CF-002A

1-1/2"(H)-WCS-510-1405- A3A NOTE-14 TO 510-PA-CF-002B

BCR 500-1119 PI 1412 TI 1405 3"(H)-WCR-510-1401- A3A FOR UNLOADING PS (NOTE-7) DETAIL-H, NOTE-D

CW RETURN 510-1115

FI 1403 FT 1403 RO 1401 FE-1403

2"(H)-P-510-1410- A1A HEXANE PUMP MCF HEADER NOTE-12,14

FI 1404 FT 1404 RO 1402 FE-1404

2"(H)-P-510-1418- A1A HEXENE-1 PUMP MCF HEADER NOTE-12,14

(1"DZ) 3.7 TSV 1401 3/4" LO

2"-510-1411-A1A 2"-510-1412-A1A NOTE-8 CBD 500-1151

(1"DZ) 3.7 TSV 1402 3/4" LO

2"-510-1420-A1A 2"-510-1419-A1A 500-1151 CBD NOTE-8

HEXANE PUMP SUCTION HEADER 4"-P-510-1402-A1A NOTE-9

4"-P-510-1404-A1A HEXENE-1 PUMP SUCTION HEADER NOTE-9

3"-P-510-1409-A1A

FQI FI 1405 FT 1405 FE-1405

FI 1406 FQI FT 1406 FE-1406

B/L 4"-P-440-1272-A1A TO TF-20 HEXANE 440-1112 3"x4"

TO TF-20 HEXENE-1 440-1112 3"x4" 4"-P-440-1267-A1A

3"-P-510-1417-A1A

4"-P-510-1405-A1A 3"-P-510-1407-A1A NOTE-11 AAHH AAH AI 1402 AT 1402 HC AE 1402 NEAR PUMP NOTE-4 3/4" PI 1401 PI 1402 PI 1403

510-PA-CF-002 A DETAIL-E, NOTE-C M XL 1401 NOTE-10 HS 1401 STOP

4"-P-510-1406-A1A 3"-P-510-1408-A1A NOTE-11 AAHH AAH AI 1403 AT 1403 HC AE 1403 NEAR PUMP NOTE-4 3/4" PI 1404

510-PA-CF-002 B DETAIL-E, NOTE-C M XL 1402 NOTE-10 HS 1402 STOP

4"-P-510-1413-A1A 3"-P-510-1415-A1A NOTE-11 AAHH AAH AI 1404 AT 1404 HC AE 1404 NEAR PUMP NOTE-4 3/4" PI 1405 PI 1406

510-PA-CF-004 A DETAIL-E, NOTE-C M XL 1403 NOTE-10 HS 1403 STOP

4"-P-510-1414-A1A 3"-P-510-1416-A1A NOTE-11 AAHH AAH AI 1405 AT 1405 HC AE 1405 NEAR PUMP NOTE-4 3/4" PI 1407 PI 1408

510-PA-CF-004 B DETAIL-E, NOTE-C M XL 1404 NOTE-10 HS 1404 STOP

1-1/2"-WCR-510-1402-A3A NOTE-14

1-1/2"-WCR-510-1403-A3A NOTE-14

1-1/2"-WCR-510-1404-A3A NOTE-14

1-1/2"-WCR-510-1405-A3A NOTE-14

510-PA-CF-002 A /B (1W+1S) (NOTE-13)
HEXANE UNLOADING PUMPS
RATED CAPICITY : 27.5+MCF M^3/HR (EACH)
DIFF. HEAD: 95.7 M

510-PA-CF-004 A/B (1W+1S) (NOTE-13)
HEXENE-1 UNLOADING PUMPS
RATED CAPICITY : 27.5+MCF M^3/HR (EACH)
DIFF. HEAD: 101.9 M

GENERAL NOTES:

A. ALL INSTRUMENTS TAGS TO BE PREFIXED BY UNIT NO. 510.
B. FOR STANDARD SYMBOLS, NOMENCLATURE, GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-999-1191/1192.
C. FOR GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-500-1193.
D. FOR TYPICAL DETAIL REFER P&ID NO. B957-79-41-500-1194.
E. ALL THE INSTRUMENTS INCLUDING FAG DETECTOR INDICATION ALARMS / SIGNALS TO BE CONNECTED TO PLC BASED CONTROL SYSTEM IN CR-04 AND OPERATED FROM CR-04.

NOTES:-

1. ONE COMMON UNLOADING POINT-14 & ONE COMMON SPARE UNLOADING POINT-15 IS USED FOR UNLOADING OF FOLLOWING SERVICES:-

SERVICE	HOSE NO.
HEXANE	510-LZ-00-001(A/B)
HEXENE-1	510-LZ-00-002(A/B)
ISOPENTANE	510-LZ-00-003(A/B)
FLUX OIL	500-LZ-00-017(A/B)
WASH OIL	500-LZ-00-018(A/B)

2. ALL CHEMICAL UNLOADING TO BE DONE IN NITROGEN ATMOSPHERE, UTILISING NITROGEN LOADING HOSE (510-LZ-004) FOR UNLOADING POINT-14 & 15.
3. PROVIDE A SUITABLE RAMP FOR TANKERS SUCH THAT THE TANKER OUTLET NOZZLE IS AT LEAST 1.5 M ABOVE THE PUMPS' CL.
4. GLOBE VALVE TO BE LOCATED SUCH THAT THE PUMP DISCHARGE PRESSURE GAUGE IS VISIBLE FROM IT.
5. ALL PSV/TSV INLET & OUTLET LINE SHALL BE FREE DRAINING AWAY FROM SAFETY VALVES.
6. END BLIND SHALL BE PROVIDED AFTER TANKER UNLOADING.
7. UNLOADING PUMPING STATION CONSISTS OF 510-PA-CF-005A/B, 500-PA-CF-015A/B, 510-PA-CF-002A/B, AND 510-PA-CF-004-A/B UTILITIES OF PUMP HOUSE SHALL BE COMMON FOR ALL THE PUMPS LOCATED IN SAME PUMP HOUSE. NO. AND LOCATION OF HOSE STATION IN PUMP HOUSE TO BE DECIDED BY ENGINEERING. HOSE TO BE FLANGE TYPE FOR NITROGEN AND LP STEAM. OTHER UTILITIES TO HAVE HOSE OF QUICK COUPLING TYPE.
8. ALL DRAINS TO BE CONNECTED TO CBD SYSTEM. A COMMON HEADER SHALL BE PROVIDED TO ROUTE ALL THE DRAINS/ SAFETY RELIEFS TO CBD HEADER.
9. PUMP SUCTION LINE SHALL BE AS SHORT AS POSSIBLE WITH MIN. NO. OF BENDS AND NO POCKET.
10. START/STOP OF PUMPS TO BE PROVIDED IN FIELD AND STOP FROM C/R-04. RUNNING INDICATION TO BE AVAILABLE IN C/R-04.
11. POINT GAS DETECTORS TO BE LOCATED NEAR EACH UNLOADING POINT/TRUCK, AND AT EACH PUMP.
13. DELETED.
13. FOR PUMP VENT/DRAIN/BLEEDER CONNECTION DETAILS REFER P&ID NO. B957-79-41-500-1152.
14. LINE SIZES SHALL BE FINALIZED UPON RECEIPT OF PUMP VENDOR INPUT DURING DETAIL ENGINEERING.
15. TANKER EARTHING CONNECTION TO BE PROVIDED UNLOADING SHOULD START ONLY WHEN THE TANKER IS EARTHED.

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
1	01.12.25	ISSUED FOR HAZOP	PD	AC	PP	MS
0	31.07.25	ISSUED FOR ENGINEERING	MD	AC	PP	MS
A	15.07.25	ISSUED FOR COMMENTS	PD	AC	PP	MS

इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

भारत पैट्रोलियम कॉर्पोरेशन लिमिटेड
BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
HEXANE, HEXENE-1 UNLOADING SYSTEM

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	आरेख संख्या DWG. No.	संशो REV.
NTS	B957	79	41	510	1114	1

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NITROGEN 510-1114
2"-IG-510-1402-A3A
2"x1"
FI 1503
FO 1502
A3A | A11A
AAHH AAH
AI 1501
AT 1501
HC
AE 1501
NOTE-13
NOTE-17
NOTE-2,3
3"
NOTE-6
3"x4"
4"-P-510-1501-A1A-IC
UNLOADING POINT-14 (NOTE-1)
510-LZ-00-003
ISOPENTANE UNLOADING HOSE
MIN.
1:500
2"-FL-510-1502-A11A
1"-FL-510-1505-A11A
NOTE-8
FI 1502
FQI
FT 1502
FE-1502
RO 1501
A1A-IC | A1A
2"(H)-P-510-1508- A1A
NOTE-14,16
PUMP MCF HEADER
4"-P-510-1502-A1A-IC
PUMP SUCTION HEADER
1"-FL-510-1506-A11A
2"-FL-510-1501-A11A
LP FLARE 500-1119
SP-1501
20" DIA. PIPE 2m LONG
GRADE
LI 1501 A
MAG
LG 1502
LT 1501
LI 1501
UC
1"
NOTE-11
3/4"-P-510-1513-A11A
3/4"-P-510-1512-A1A
3/4"
A1A | A11A
OWS
1"-FL-510-1504-A11A
NOTE-6
(1"DZ") 7.3.8
TSV 1501
A1A-IC | A11A
3/4"
LO
2"-P-510-1505-A11A
TWO PHASE
1"-P-510-1509-A1A-IC
NITROGEN 510-1114
2"-IG-510-1403-A3A
1"-IG-510-1502-A3A
1"-IG-510-1501-A3A
4"-P-510-1503-A1A-IC
4"-P-510-1504-A1A-IC
3/4"-P-510-1510-A11A
3/4"-P-510-1511-A11A
3"-P-510-1505-A1A
3"-P-510-1506-A1A
1603
1604 B
1604 A
1303
1302
1501
XL 1501
XL 1502
NOTE-10
HS 1501
HS 1502
STOP
DETAIL-D (NOTE-D)
1"
PI 1501
PI 1502
PI 1503
PI 1504
M
510-PA-CF-005 A
(DETAIL-E, NOTE-C)
510-PA-CF-005 B
(DETAIL-E, NOTE-C)
1"P-510-1514-A1A
1"P-510-1515-A1A
1"x2"
CBD 500-1151
OWS
1-1/2"(H)-WCR-510-1501- A3A
NOTE-16
1-1/2"(H)-WCR-510-1502- A3A
NOTE-16
FI 1503
FQI
FT 1503
FE-1503
BL
TO TF-23
ISOPENTANE 440-1112
3"-P-440-1288-A1A
CW SUPPLY 500-1120
2"(H)-WCS-510-1404- A3A
NOTE-16
1-1/2"(H)-WCS-510-1501- A3A
NOTE-16
TO 510-PA-CF-005A
1-1/2"(H)-WCS-510-1502- A3A
NOTE-16
TO 510-PA-CF-005B
AI 1502
AT 1502
AE 1502
AI 1503
AT 1503
AE 1503
NEAR PUMP
BCR 510-1114
2"(H)-WCR-510-1401- A3A
CW RETURN 500-1144
510-PA-CF-005A /B (1W+1S) (NOTE-15)
ISOPENTANE UNLOADING PUMPS
RATED CAPACITY: 27.5 MCF M3/HR (EACH)
DIFF. HEAD: 95.1 M

GENERAL NOTES:-

A. ALL INSTRUMENTS TAGS TO BE PREFIXED BY UNIT NO. 510.
B. FOR STANDARD SYMBOLS, NOMENCLATURE, GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-999-1191/1192.
C. FOR GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-500-1193.
D. FOR TYPICAL DETAIL REFER P&ID NO. B957-79-41-500-1194.
E. ALL THE INSTRUMENTS INCLUDING F&G DETECTOR INDICATION ALARMS / SIGNALS TO BE CONNECTED TO PLC BASED CONTROL SYSTEM IN C/R-04 AND OPERATED FROM C/R-04.

NOTES:-

1. ONE COMMON UNLOADING POINT-14 & ONE COMMON SPARE UNLOADING POINT-15 IS USED FOR UNLOADING OF FOLLOWING SERVICES :-

SERVICE	HOSE NO.
HEXANE	510-LZ-00-001A/B
HEXENE-1	510-LZ-00-002A/B
ISOPENTANE	510-LZ-00-003A/B
FLUX OIL	500-LZ-00-017A/B
WASH OIL	500-LZ-00-018A/B

2. ALL CHEMICAL UNLOADING TO BE DONE IN NITROGEN ATMOSPHERE, UTILISING NITROGEN LOADING HOSE (510-LZ-004) FOR UNLOADING POINT-14 & 15.
3. PROVIDE A SUITABLE RAMP FOR TANKERS SUCH THAT THE TANKER OUTLET NOZZLE IS AT LEAST 1.5 M ABOVE THE PUMPS' CL.
4. GLOBE VALVE TO BE LOCATED SUCH THAT THE PUMP DISCHARGE PRESSURE GAUGE IS VISIBLE FROM IT.
5. ALL PSVs/TSVs INLET & OUTLET LINE SHALL BE FREE DRAINING AWAY FROM SAFETY VALVES.
6. END BLIND SHALL BE PROVIDED AFTER TANKER UNLOADING.
7. UNLOADING PUMPING STATION CONSISTS OF 510-PA-CF-005A/B, 500-PA-CF-015A/B, 510-PA-CF-002A/B, AND 510-PA-CF-004-A/B UTILITIES OF PUMP HOUSE SHALL BE COMMON FOR ALL THE PUMPS LOCATED IN SAME PUMP HOUSE. NO. AND LOCATION OF HOSE STATION IN PUMP HOUSE TO BE DECIDED BY ENGINEERING. HOSE TO BE FLANGE TYPE FOR NITROGEN AND LP STEAM. OTHER UTILITIES TO HAVE HOSE OF QUICK COUPLING TYPE.
8. PUMP CASING VENTS TO BE ROUTED TO FLARE THROUGH COMMON LINE.
9. PUMP SUCTION LINE SHALL BE AS SHORT AS POSSIBLE WITH MIN. NO. OF BENDS AND NO POCKET.
10. START/STOP OF PUMPS TO BE PROVIDED IN FIELD AND STOP FROM C/R-04. RUNNING INDICATION TO BE AVAILABLE IN C/R-04.
11. DRAIN POT SHALL BE MADE WITH 20" DIA., 150# CS PIPE OF 2M HEIGHT.
12. ALL ISOLATION VALVES PROVIDED IN FLARE LINES SHALL HAVE STEM EITHER IN HORIZONTAL OR VERTICALLY DOWNWARDS DIRECTION.
13. POINT GAS DETECTORS TO BE LOCATED NEAR EACH UNLOADING POINT/TRUCK, AND AT EACH PUMP.
14. DELETED.
15. FOR PCMF VENT/DRAIN/BLEEDER CONNECTION DETAILS REFER P&ID NO. B957-79-41-500-1152.
16. LINE SIZES SHALL BE FINALIZED UPON RECEIPT OF PUMP VENDOR INPUT DURING DETAIL ENGINEERING.
17. TANKER EARTHING CONNECTION TO BE PROVIDED UNLOADING SHOULD START ONLY WHEN THE TANKER IS EARTHED.

REV.	DATE	REVISIONS	DRN.	BY	CHKD	APPD.
1	28.11.25	ISSUED FOR HAZOP	PD	AC	PP	MS
0	31.07.25	ISSUED FOR ENGINEERING	MD	AC	PP	MS
A	15.07.25	ISSUED FOR COMMENTS	AN	AC	PP	MS

ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)
भारत पेट्रोलियम कॉर्पोरेशन लिमिटेड
BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमेन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM

ISOPENTANE UNLOADING SYSTEM

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	ज़ारेख संख्या DWG. No.	संशो REV.
NTS	B957	79	41	510	1115	1

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500-PA-CF-006 A/B/C (2W+1S)
PROPYLENE TRANSFER PUMPS

RATED CAPACITY - 400M^3/HR (EACH)
DIFF. HEAD - 466.2M

FOR GENERAL NOTES AND NOTES REFER P&ID B957-79-41-500-1117-1

LP FLARE 500-1117-3 → 38"-FL-500-1701-A4A → LP FLARE 500-1118

LP FLARE 500-1117-3 → 3"-FL-500-1712-A4A → LP FLARE 500-1118

2"-FL-500-1723-A4A, 2"-FL-500-1722-A4A, 2"-FL-500-1721-A4A, 2"-FL-500-1720-A4A, 2"-FL-500-1727-A4A — TWO PHASE — 1:500

TSV 1717 | TSV 1716 | TSV 1715 | TSV 1714 | TSV 1721

1"-P-500-17115-D9A | 1"-P-500-17112-D9A | 1"-P-500-1793-D9A

PROPYLENE 500-1117-3 → PUMP MINIMUM FLOW HEADER → 6"(H)-P-500-1832-D9A → PROPYLENE 500-1118

PROPYLENE 500-1117-3 → PUMP SUCTION HEADER → 12"-P-500-1723-B9A-HC → PROPYLENE 500-1118

NOTE-10

8"-P-500-1781-D9A

1"-FL-500-1728-A4A

TI 1712 | PI 1715 | TT 1712 | FI 1702 | FAH | FAL | FT 1702 | PT 1715 | TE 1712 | FE-1702 | NOTE-25

8"-P-440-1216-D9A → TO PPU → PROPYLENE 440-1112

6"-P-500-1784-D9A → TO ECU → PROPYLENE 440-1112

6"-P-440-1218-D9A → 3"-P-500-1785-D9A → TO LLDPE/HDPE → PROPYLENE 440-1112

3"-P-440-1280-D9A → TO DCU/LPGTU OUTLET TREATED LPG → PROPYLENE 440-1112 → 4"-P-440-1278-D9A

4"-P-500-1786-D9A → TO PETCHEM GANTRY → PROPYLENE 440-1112 → 6"-P-440-1251-D9A

10"-P-500-1773-B9A-HC

6"-P-500-1774-D9A | 6"-P-500-1775-D9A | 6"-P-500-1776-D9A | 6"-P-500-1780-D9A | 6"-P-500-1783-D9A

1"-P-500-1787-A4A | 1"-P-500-1788-A4A | 1"-P-500-1789-A4A

NOTE-13,14 | NOTE-24 | NOTE-7 | NOTE-29

LAL 1716 | XL 1701 | PAH 1717 | HS 1701 | PI 1708 | PI 1709 | PI 1707

LAL 1717 | XL 1702 | PAH 1718 | HS 1702 | PI 1710 | PI 1711

LAL 1718 | XL 1703 | PAH 1719 | HS 1703 | PI 1712

FE 1701 | FT 1701 | FIC 1701 | FAL | FV 1701 | FO

10"-P-500-1779-B9A-HC

500-PA-CF-006 A (DETAIL-E, NOTE-C) NOTE-15

500-PA-CF-006 B (DETAIL-E, NOTE-C) NOTE-15

500-PA-CF-006 C (DETAIL-E, NOTE-C) NOTE-15

NEAR 500-PA-CF-006A HC | NEAR 500-PA-CF-006B HC | NEAR 500-PA-CF-006C HC

AE 1737 | AT 1737 | AI 1737 | AE 1738 | AT 1738 | AI 1738 | AE 1719 | AT 1719 | AI 1719

AAHH | AAH

NOTE-4

3"-WCS-441-1218-A3A → CW SUPPLY 441-1112 → PI 1725 | PT 1726 | PI 1726 → 3"(H)-WCS-500-1701-A3A FOR PUMPS (NOTE-11)

1-1/2"-WCS-500-1702-A3A TO 500-PA-CF-006A

1-1/2"-WCS-500-1703-A3A TO 500-PA-CF-006B

1-1/2"-WCS-500-1704-A3A TO 500-PA-CF-006C

1-1/2"-WCS-500-1707-A3A TO 500-PA-CF-007A

1-1/2"-WCS-500-1708-A3A TO 500-PA-CF-007B

3"(H)-BCR-441-1208-A3A → BCR 441-1112 → 3"(H)-BCR-500-1701-A3A DETAIL-H NOTE-D

1-1/2"-BCR-500-1707-A3A FROM 500-PA-CF-007A

1-1/2"-BCR-500-1708-A3A FROM 500-PA-CF-007B

1-1/2"-BCR-500-1702-A3A FROM 500-PA-CF-006A

1-1/2"-BCR-500-1703-A3A FROM 500-PA-CF-006B

1-1/2"-BCR-500-1704-A3A FROM 500-PA-CF-006C

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
1	28.11.25	ISSUED FOR HAZOP	PD	SA	PP	MS
0	31.07.25	ISSUED FOR COMMENTS	PD	SA	PP	MS
A	24.03.25	ISSUED FOR COMMENTS	RS	SA	PP	MS

इंजीनियर्स इंडिया लिमिटेड (भारत सरकार का उपक्रम) ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

भारत पैट्रोलियम कॉर्पोरेशन लिमिटेड
BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमैन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
PROPYLENE STORAGE AND TRANSFER

SHEET 04 OF 04

SCALE	JOB NO.	DEPT.	SECTN.	UNIT	DWG. No.	REV.
NTS	B957	79	41	500	1117-4	1

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500-PA-CF-009A/B/C (2W+1S)
BUTENE-1 TRANSFER PUMPS
RATED CAPACITY: 15.0 m³/hr (EACH)
DIFF. HEAD: 175.8 M

FOR GENERAL NOTES, NOTES, INTERLOCK DETAILS REFER P&ID B957-79-41-1122-2

SHEET 1OF2 — LP FLARE 500-1122 -1 — 20"-FL-500-2207-A11A — 1:500 — B/L — 18"-FL-441-2416-A11A — LP FLARE 441-1124

SHEET 01 OF 02 — LP FLARE 500-1122 -1 — 3"-FL-500-2206-A11A — 1:500

3"-FL-500-2221-A11A — 1:500

SP-2201
20" DIA. PIPE 2m LONG

2"-FL-500-2216-A11A — 1:500 TWO PHASE
2"-FL-500-2217-A11A — 1:500 TWO PHASE
2"-FL-500-2223-A11A — 1:500 TWO PHASE

1"D2" 20 TSV 2209
1"D2" 20 TSV 2210
1"D2" 20 TSV 2212

LG 2208 M — GWR LT 2207 — LI 2207 A — LI 2207 — LAH — NOTE-6
NOTE-8
UC 1"
3/4"-FL-500-2214-A11A
3/4"-P-500-2214-A11A
OWS
1"-P-500-2259-B1A

2"-AP-441-1626-A3A — PLANT AIR 441-1116 — B/L — 2"-AP-500-2201-A3A — PI 2221 — 1" HS — NOTE-11,12

1"-FL-500-2222-A11A
2"(H)-P-500-2222- B1A — PUMP MINIMUM FLOW HEADER
TO 500-TT-00-006A/B SHEET 1OF2 — BUTENE-1 500-1122 -1

SHEET 1OF2 — PUMP SUCTION 500-1122 -1
6"-P-500-2213-A1A — NOTE-10
4"-P-500-2256-B1A
1"-FL-500-2212-A11A

FI 6820 FAH FAL — FT 2206 — PT 2215 — PI 2215 — FE-2206
TO LLDPE/HDPE — BUTENE-1 LIQUID 440-1111 — 4"-P-440-1213- B1A
TO BUTENE-1 UNIT — BUTENE-1 LIQUID 440-1112 — 4"-P-440-1214-B1A
TO LOADING GANTRY — BUTENE 440-1112 — 4"-P-440-1250-B1A
B/L

FE 2201 — FT 2201 — FIC 2201 FAL — FV 2201 — FO NOTE-30
TE 2205 — TT 2205 — TI 2205 — 1" NOTE-25

4"-P-500-2214-A11A — NOTE-13 — NOTE-24 — LAL 2209 — XL 2201 — STOP HS 2201 — PAH 2204 — PI 2207 — M — PI 2208 — AAHH AAH — AI 2217 — AE 2217 HC NEAR 500-PA-CF-009A — AT 2217 — 3/4" NOTE-7 — 1"-P-500-2217-B1A — 1"-P-500-2244-A11A
500-PA-CF-009 A (DETAIL-E, NOTE-C) NOTE-15 — NOTE-4

4"-P-500-2215-A11A — NOTE-13 — NOTE-24 — LAL 2210 — XL 2202 — STOP HS 2202 — PAH 2205 — PI 2209 — M — PI 2210 — AAHH AAH — AI 2218 — AE 2218 HC NEAR 500-PA-CF-009B — AT 2218 — 3/4" NOTE-7 — 1"-P-500-2218-B1A — 1"-P-500-2245-A11A
500-PA-CF-009 B (DETAIL-E, NOTE-C) NOTE-15 — NOTE-4

4"-P-500-2216-A11A — NOTE-13 — NOTE-24 — LAL 2211 — XL 2203 — STOP HS 2203 — PAH 2206 — PI 2211 — M — PI 2212 — AAHH AAH — AI 2219 — AE 2219 HC NEAR 500-PA-CF-009C — AT 2219 — 3/4" NOTE-7 — 1"-P-500-2219-B1A — 1"-P-500-2255-A11A
500-PA-CF-009 C (DETAIL-E, NOTE-C) NOTE-15 — NOTE-4

2"-SL-441-2213- A2A-IH — LP STEAM 441-1122 — B/L — 2"-SL-500-2201- A2A-IH — NOTE-11 — 1" HS

NOTE-11 — PI 2223
2"-WS-441-1468-A1A — SERVICE WATER 441-1114 — 2"-WS-500-2201-A1A — NOTE-11 — 1" HS NOTE-12

2"-WCS-441-1252-A3A — CW SUPPLY 441-1112 — 2"(H)-WCS-500-2201- A3A FOR PUMPS (NOTE-11) NOTE-14 — PI 2213 — PT 2214 — PI 2214
1-1/2"-WCS-500-2202-A3A TO 500-PA-CF-009A
1-1/2"-WCS-500-2203-A3A TO 500-PA-CF-009B
1-1/2"-WCS-500-2204-A3A TO 500-PA-CF-009C

2"(H)-BCR-441-1216- A3A — BCR 441-1112 — 2"(H)-BCR-500-2201- A3A
1-1/2"-BCR-500-2202-A3A FROM 500-PA-CF-009A
1-1/2"-BCR-500-2203-A3A FROM 500-PA-CF-009B
1-1/2"-BCR-500-2204-A3A FROM 500-PA-CF-009C

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
1	28.11.25	ISSUED FOR HAZOP	PD	SA	PP	MS
0	31.07.25	ISSUED FOR ENGG.	PD	SA	PP	MS
A	24.03.25	ISSUED FOR COMMENTS	GR	SA	PP	MS

इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

भारत पैट्रोलियम कॉर्पोरेशन लिमिटेड
BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमैन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
BUTENE-1 STORAGE AND TRANSFER
SHEET 02 OF 02

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	आरेख संख्या DWG. No.	रेवीं REV.
	B957	79	41	500	1122-2	1

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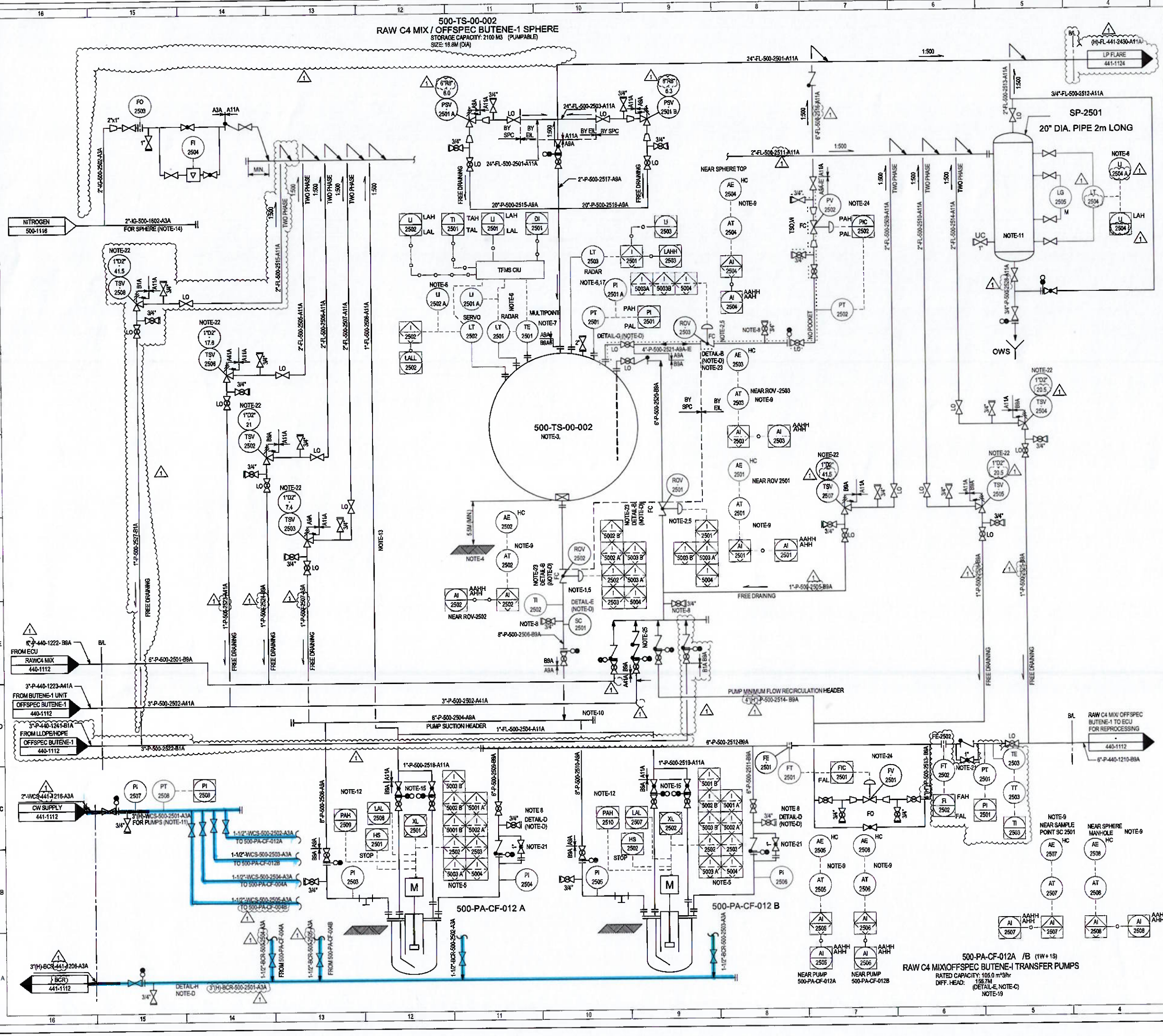
500-TS-00-002
RAW C4 MIX / OFFSPEC BUTENE-1 SPHERE

STORAGE CAPACITY: 2100 M3 (PUMPABLE)
SIZE: 18.8M (DIA)



GENERAL NOTES:

A. ALL INSTRUMENTS TAGS TO BE PREFIXED BY UNIT NO. 500.
B. FOR STANDARD SYMBOLS, NOMENCLATURE, GENERAL NOTES FOR TYPICAL DETAIL REFER P&ID NO. B957-79-41-999-1191/1192.
C. FOR GENERAL NOTES AND TYPICAL DETAILS, REFER P&ID NO. B957-79-41-500-1193.
D. FOR TYPICAL DETAIL REFER P&ID NO. B957-79-41-500-1194.
E. ALL THE INSTRUMENTS INDICATIONS/ALARMS/SIGNALS TO BE CONNECTED TO SRR #104 AND SIGNALS TO BE REPEATED IN PETCHEM MCR.
F. ALL INSTRUMENTS MARKED AS TFMS SHALL BE ROUTED TO TANK FARM MANAGEMENT CIU WITH REPEAT INDICATION IN PETCHEM MCR.
G. ALL PSV'S, ROV &INSTRUMENTS MOUNTED ON SPHERE ARE IN EIL SCOPE OF SUPPLY.

NOTES:-

1. ROV 2502 SHALL BE THE FIRST BREAK FLANGE LOCATED OUTSIDE THE SHADOW OF THE SPHERE AND SHALL BE FIRE SAFE. FIRE SAFE ACTUATOR PIPING LAYOUT SHALL BE SUCH THAT IN THE EVENT OF LEAK OF ITS FLANGE ON THE STORAGE SIDE WITH POSSIBILITY OF FIRE THE STORAGE VESSEL DOES NOT COME IN THE LINE OF JET FLAME.
2. ROV SHALL BE OUTSIDE THE KERB WALL OF THE SPHERE. ROV'S OF ONE SPHERE TO BE LOCATED CLOSE TOGETHER.
3. HORTON SPHERE SHALL BE FIRE PROOFED AND ALL LINES INCLUDING PIPING UP TO FIRST ROV'S WILL BE FIRE PROOFED.
4. SPHERE BOTTOM GRADE LEVEL SHALL BE PROVIDED WITH SLOPE TO FACILITATE DRAINING OF SPHERE FLANGE OF THE OUTLET NOZZLE SHOUD BE MINIMUM 3M AWAY FROM THE SHADOW OF THE SPHERE.
5. FOR OTHER INTERLOCKS AND SAFETY DIAGRAM REFER P&ID NO. B957-79-41-500-1150
6. ALL INSTRUMENTS LOCAL INDICATION PROVIDED ON SPHERE TO BE READABLE FROM GRADE.
7. MULTIPOINT TEMPERATURE INDICATOR FOR AVERAGE TEMPERATURE OF SPHERES.
8. ALL LIQUID BLEEDS TO BE ROUTED TO FLARE REFER DETAIL-D OF P&ID NO. B957-79-41-500-1194.
9. PONT GAS DETECTORS TO BE LOCATED NEAR EACH ROV, NEAR EACH SPHERE TOP, NEAR MANHOLE COVER, AT SAMPLING POINT AND NEAR EACH PUMP.
10. PUMP SUCTION LINE SHALL BE AS SHORT AS POSSIBLE WITH MIN. NO. OF BENDS AND NO POCKET.
11. DRAIN POT SHALL BE MADE WITH 20"DIA, 150# CS PIPE OF 2M HEIGHT.
12. ALL PUMPS SEAL FAILURE ALARMS LAL AND PAH TO BE AVAILABLE IN PETCHEM MCR.
13. PUMP CASING VENTS TO BE ROUTED TO FLARE THROUGH COMMON LINE.
14. THIS UTILITIES IS PROVIDED FOR SPHERE 500-TS-00-001, 500-TS-00-002.
15. GLOBE VALVE TO BE ANTIFREEZE TYPE.
16. ALL DRAIN AND SAMPLE POINT FIRST ISOLATION VALVE SHALL BE OF QUICK CLOSING AND TIGHT SHUT OFF TYPE.
17. PWG NOZZLE ON THE SPHERE TO HAVE TWO ISOLATION VALVES AND ONE EXCESS FLOW CHECK VALVE.
18. ALL FREE DRAINING LINES WITH NO POCKETS (1:1000).
19. SPHERE PUMPING STATION CONSISTS OF 500-PA-CF-012AB, 500-PA-CF-004AB . UTILITIES OF PUMP HOUSE SHALL BECOMMON FOR ALL THE PUMPS LOCATED IN SAME PUMP HOUSE. NUMBER AND LOCATION OF HOSE STATION IN PUMP HOUSE TO BE DECIDED BY ENGINEERING . HOSE TO BE FLANGE TYPE FOR NITROGEN AND LP STEAM, OTHER UTILITIES TO HAVE HOSE OF QUICK COUPLING TYPE.
20. PUMP STATUS (RUNNING/STOP) INDICATION TO BE AVAILABLE IN PETCHEM MCR. PROVISION FOR START/STOP SHALL BE GIVEN FROM FIELD AND STOP FROM CR.
21. 1" BYPASS VALVE IS PROVIDED WHICH SHALL BE KEPT OPEN WHEN DOWNSTREAM VALVE IS IN CLOSED POSITION, TO AVOID OVER PRESSURIZATION DUE TO THERMAL EXPANSION OF LIQUID IN THE LINE.
22. THESE TSV'S ARE FOR THERMAL RELIEF. TSV'S SHOULD BE LOCATED AT ONE PLACE AND COMMON DISCHARGE SHOULD BE CONNECTED TO FLARE HEADER VIA DRAIN POT.
23. TRIPLE OFFSET BUTTER FLY VALVE.
24. FOR CONTROL VALVE VENT, DRAIN DETAILS P&ID B957-79-41-500-1140.
25. TWO NRVS OF DIFFERENT TYPE.

INTERLOCK	ACTUATED BY	ACTION UPON
I-2501	LT/LAHH-2503	CLOSE ROV-2501
I-2502	LT/LALL-2502	TRIP PUMP 500-PA-CF-012A/B & CLOSE ROV-2502
I-2503	NON ZSH-2502 (CLOSING OF ROV-2502)	TRIP PUMP 500-PA-CF-012A/B

SPC: SPHERE PACKAGE CONTRACTOR

REV.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
1	28.11.25	ISSUED FOR HAZOP	AN	SA	PP	MS
0	31.07.25	ISSUED FOR ENGG.	PD	SA	PP	MS
A	28.03.25	ISSUED FOR COMMENTS	GR	SA	PP	MS

ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)
भारत पैट्रोलियम कॉर्पोरेशन लिमिटेड
BHARAT PETROLEUM CORPORATION LTD.
BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)

पाइपिंग एण्ड इंस्ट्रूमैन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
RAW C4 MIX/OFFSPEC BUTENE-I
STORAGE AND TRANSFER

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	आरेख संख्या DWG. No.	संशो REV.
	B957	79	41	500	1125	1

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B957-999-16-51-00812_B

PLANT MAGN. NORTH
TRUE NORTH
CONST. ENTRY (BPREP)

WIND ROSE BASED OF NEERI

TO REFINERY

INSTRUMENT DUCT 800W x 300H

INSTRUMENT CABLE TRAY 300W

1 NO. NEW MCT 6+6X40 (REFER MCT DETAILS)

INSTRUMENT DUCT 800W x 300H

1 NO. NEW MCT 6+6X40 (REFER MCT DETAILS)

INSTRUMENT DUCT 1200W x 400H

INSTRUMENT DUCT 1200W x 400H

BURRIED ROUTE 1 MTR (D) X 0.3 MTR (W)

BPCL PIPE LINE ALIGNMENT

TANK WAGON ROOM

EXISTING SOLAR PLANT

HILL AREA

POND

NALA

"200' M WIDE GREEN BELT"

"COMPOUND WALL"

"CONTOUR FOR PROPOSED ROAD"

"TBM-18"

TBM-1 TO TBM-15

HAZARDOUS WASTE STORAGE (SIZE HOLD)

NAPHTHA UNLOADING

RAIL LOADING PL ROOM/SRR

ETP

BOC SUMP 10x10x5

DG SHED

FUEL TANK FOR DG'S OF HSD, SKO, TANK

MS EURO-III

MS EURO-IV

HSD EURO-III

HSD EURO-IV

SKO

ATF

NAPHTHA

PUMP HOUSE

4M WIDE ROAD ALL AROUND SAMPLE RETENTION ROOM

MAIN ENTRY

POL EMERGENCY GATE

LPG EMERGENCY GATE

PARKING

STORAGE AREA (SHEDS)

9.0 MLD ETP

PRODUCT PIPELINE FROM REFINERY

FOR CONTINUATION B957-999-61-51-00501

84"-WCN (CONSTRUCTION WATER LINE FROM REFINERY) (REFER NOTE-6)

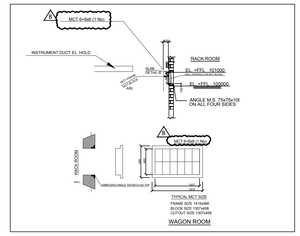
EXISTING OVERHEAD ELECT. CABLES (TO BE REMOVED)

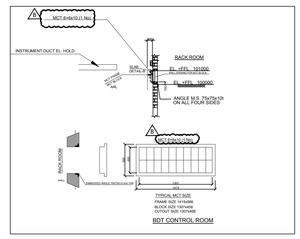
BHARAT OMAN REFINERY (B.O.R.L.)

LIST OF STORAGE TANKS UNDER JOB NO. B957

SNO.	TANK NO.	PRODUCT	NUMBER OF TANKS	NOM.CAP. (M3)	STORED.CAP. (M3)	TYPE OF TANKS	DIA (M)	HEIGHT (M)	CLASS	FLASH POINT °C	TANK FARM NO.
1	500-TT-CR-012 A/B	PYROLYSIS FUEL OIL(PFO)	2	5600	5250	CR	21	16.2	C	>66	TF-14
2	500-TT-FR-009 A/B/C	BENZENE	3	5150	4895	IFR	22	17.1	A	<23	TF-13
3	500-TT-FR-010 A/B	TOLUENE	2	4100	3924	IFR	19	17	A	<23	TF-13
4	500-TT-FR-011 A/B	MIXED XYLENE	2	2400	2302	IFR	16.4	13.9	A	<23	TF-13

COMPLETE SITE DETAILS OF BINA DESPATCH TERMINAL AT BHARAT OMAN REFINERIES LIMITED — BINA.	
SURVEY NO.	519,529,530,1309,1310,507,509,510,511,512,513,514, 516,517,518,1311,1312,1313,1314,1314/1327,1315,4, 6/1,6/1,6/2,6/3,6/4,6/5,6/6,6/7,6/8,6/9,6/10,6/11,6/12, 25,34,2,3,7,8,9,10,19,20,23,24,26/1,11,1,506/2,545, 549,562,565,501,502,504,505,507,509,511,512,513, 514,515,516,524,525,526,543,544,556,557,561,563, 564,1313,1314,1315,1316,6/1,34,59,11,12,13,57,17, 18,19,20,21,22,26/1,28,26/2,35,38,61,48,49,50,52,53, 54,67,55,60,68,36,549/1,550,553,564,573,567,568, 605,613,614,572,582,585,586,587,589,588,592,593, 594,595,596,597,603,604,606/1,615,96,127,128,130, 132,14,15,16,17,18,21,195,768,776,777,781,782,783, 784,852,853,855,857,776/875,498,499,500,501,502, 503,504,507,528,771,773,772,774,775,1223,1224, 1225,1226,1239,1242,1240,1241,1246
LOCATION/VILLAGE	AGASODE/KATHA/BELA/KALRAUN/MANAU/ DEHRI
TEHSIL	BINA
POLICE STATION	AGASODE POLICE THANA
RAILWAY STATION	MADHAVKHERI
DISTRICT	SAGAR
STATE	MADHYA PRADESH
LANDMARK	SITUATED AT 13 KMs. FROM BINA RAILWAY STATION, ON BINA – MANGAOLI ROAD





TOTAL STORAGE

S.NO.	PRODUCT CLASS	NO. OF TANKS AG	NO. OF TANKS UG	TOTAL CAPACITY (m3)
1	CLASS A	18	6	172366
2	CLASS B	26	4	295960
	TOTAL	44	10	468326

PROPOSED KGPL FACILITIES		
S.NO.	FACILITIES	NOS
32	PUMP SHED	1
33	SCRAPPER LAUNCHING BARREL	1
34	SCRAPPER RECEIVING BARREL	1
35	CONTROL BUILDING (BLAST RESISTANT)	1
36	HT/LT/VFD/TR BUILDING	1
37	COLD FLARE	1
38	DELUGE VALVE	2
39	BASKET STRAINER	4
40	METERING SYSTEM	4
41	FLOW CONTROL VALVE	3
42	PIPELINE MANIFOLD	1
43	DG SET	1

LIST OF STORAGE TANKS

S.NO.	TANK NO.	PRODUCT	NUMBER OF TANKS	CAP. (M3) LIQUID STORED	MOC	TYPE OF TANKS	DIA (M)	HEIGHT (M)	CLASS	FLASH POINT °C	TANK FARM NO.	REMARKS
1	70-TT-CR-01 A/B/C/D/E	HSD EURO III(STORAGE)	5	15000	CS	CR	34	18	B	55–66	8,6	4 IN TF–8 1 IN TF–6
2	70-TT-CR-01 F	HSD EURO III(DESPATCH)	1	15000	CS	CR	34	18	B	55–66	6	
3	70-TT-CR-02 A/B/C/D/E	HSD EURO IV(STORAGE)	5	15000	CS	CR	34	18	B	55–66	6, 7	2 IN TF–6 3 IN TF–7
4	70-TT-CR-02 F	HSD EURO IV(DESPATCH)	1	6660	CS	CR	26	14.5	B	55–66	7	
5	70-TT-FR-03 A/B/C/D/E	MS EURO III(STORAGE)	5	13000	CS	FR	34	16	A	<10	10,11	4 IN TF–10 1 IN TF–11
6	70-TT-FR-03 F	MS EURO III(DESPATCH)	1	6660	CS	FR	26	14.5	A	<10	11	
7	70-TT-FR-04 A/B/C/D/E	MS EURO IV(STORAGE)	5	13000	CS	FR	34	16	A	<10	9,11	4 IN TF–9 1 IN TF–11
8	70-TT-FR-04 F	MS EURO IV(DESPATCH)	1	6660	CS	FR	26	14.5	A	<10	11	
9	70-TT-FR-05 A/B/C/D	SKO (STORAGE)	4	6660	CS	FR	26	14.5	B	35	3, 4	
10	70-TT-FR-05 E	SKO (DESPATCH)	1	6660	CS	FR	26	14.5	B	35	4	
11	70-TT-CFR-06 A/B/C/D/E/G/H	ATF (STORAGE)	7	11335	CS	FIXED CUM FR	33	16	B	38	1, 2	4 IN TF–2 2 IN TF–13
12	70-TT-CFR-06 F	ATF (DESPATCH)	1	11335	CS	FIXED CUM FR	33	16	B	38	1	
13	70-TT-FR-07 A/B/C	NAPHTHA (STORAGE)	3	6660	CS	FR	26	14.5	A	<10	5	
14	70-TT-FR-07 D	NAPHTHA (DESPATCH)	1	6660	CS	FR	26	14.5	A	<10	5	
15	70-TT-CR-08 A/B	OFFSPEC SLOP	2	995	CS	CR	11	11	A	<22	12	
16	70-TT-H-01	HSD III / IV	1	15KL	CS	VERTICAL NOZ. ORIENT	2.0	5.0	B	55–66		

SCHEDULE OF LPG MOUNDED BULLETS

S.NO.	VESSEL NO.	PRODUCT	DIA (M)	NOS.	TOTAL LENGTH DISH END DISH END (M)	NOMINAL CAPACITY (CU.M.)	LIQUID STORED (CU.M.)	REMARKS
1	70-TT-TB-01 A/B/C/D/E	LPG	7.0	5	81.0	3295	2800	
2	70-TT-TB-01 F	OFFSPEC LPG	7.0	1	81.0	3295	2800	

LIST OF STORAGE VESSELS

S.NO.	VESSEL NO	PRODUCT	NOM CAP. (M3)	TYPE	NO. OF VESSELS	DIA(M)	LENGTH (M)	FLASH POINT	CLASS OF PRODUCT	REMARKS
1	70–W–001	HSD (III/IV)	95	HOR. U.G VESSEL	1	3.2	12.6	55–66	B	
2	70–W–002	MS (III/IV)	95	HOR. U.G VESSEL	1	3.2	12.6	<10	A	FLASH <10
3	70–W–003	SKO	95	HOR. U.G VESSEL	1	3.2	12.6	35	B	
4	70–W–004	ATF	95	HOR. U.G VESSEL	1	3.2	12.6	38	B	
5	70–W–005	NAPHTHA	95	HOR. U.G VESSEL	1	3.2	12.6	<10	A	NAPTHA <10
6	70–W–006 A/B	ETHANOL	95	HOR. U.G VESSEL	2	3.2	12.6	<10	A	FLASH <10
7	70–W–007	SLOP	20	HOR. U.G VESSEL	1	2.0	6.8	<22	A	
8	079–TT–101	SLOP	15.7	HOR. U.G VESSEL	1	2.0	6.0	<10	A	FLASH <10
9	DU?S–ATF	ATF	20	HOR. U.G VESSEL	1	2.0	6.723	38	B	
10	70–W–008	SLOP	20	HOR. U.G VESSEL	1	2.0	6.8	<22	A	BPPL SUMP TANK

AREA CHART –	
TOTAL AREA	241.28 HECTARE
PLANT AREA INCLUDING FUTURE & OPEN AREA	132.38 HECTARE
GREEN BELT AREA PROVIDED	92.05 HECTARE
GREEN BELT REQUIRED (33%)	79.62 HECTARE
ADDITIONAL GREEN BELT COMPENSATED FOR BINA COMPLEX	12.43 HECTARE

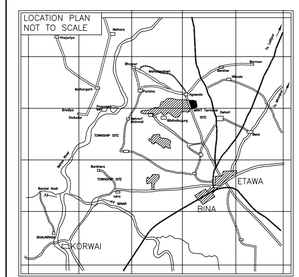
REF. DWG. NO.	REFERENCE DRAWING TITLE
6893-000-16-47-0-001	OVERALL PLOT PLAN

NOTES :-

1. ALL CO-ORDINATES ARE IN METERS. ALL OTHER DIMENSIONS, DUCT/TRENCH SIZES AND ELEVATIONS ARE IN MM.
2. FOR INSTRUMENT DUCT FABRICATION DETAILS REFER STANDARD 7-52-0254 (31 Sheets).
3. INSTRUMENT DUCT/TRAY SHALL BE SUPPORTED ON CONTINUOUS MEMBERS (BY STRUCTURE) RUNNING BELOW THE SAME INCLUDING VERTICAL DROPPING OF THE DUCT.SLEEPERS TO BE PROVIDED FOR THE DUCTS INDICATED.
4. INSTRUMENT CABLE DUCT/ TRAY SHALL NOT BE ROUTED IN PARALLEL WITH ELECTRICAL CABLES. IF UNAVOIDABLE , TYPICAL GAP OF 1000 mm (w.r.t. HT CABLES) SHALL BE ENSURED.
5. BOTTOM OF INSTRUMENT CABLE DUCT (BOD) ELEVATION SHALL BE SAME AS PER THE SPACE GIVEN BY PIPING ON PIPE RACK / PIPE SLEEPERS.
6. NO STEAM/HOT LINES SHALL BE ROUTED NEAR INST. CABLE DUCT.
7. MINIMUM CLEARANCE REQUIRED FROM COLUMN FACE TO INST. DUCT EDGE IS 200mm TO FIX THE CLAMPS.
8. ESTIMATED WEIGHT OF DUCT INCLUDING CABLES PER METER RUN. 1200w X 400H = 800Kg/m 800w X 300H = 400Kg/m 400w X 200H = 200Kg/m
9. OFFSITES DUCT INDICATED IN THIS DOCUMENT ARE NOT BEING FIREPROOFED.
10. DUCT / TRAYS SHOWN IN THIS DRAWING ARE IN THE SCOPE OF EPCM-1 PART B FIELD CONTRACTOR.

LEGEND :–

- 800MM INSTRUMENT CABLE DUCT
- 1200MM INSTRUMENT CABLE DUCT
- 300 W INSTRUMENT CABLE TRAY
- INSTRUMENT TRENCH
- IRC



LOCATION PLAN

REV.	DATE	DESCRIPTION	BY	CHKD	APPD	PEM
B	24-02-26	ISSUED FOR COMMENTS	KP	JJ	AR	

इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

BHARAT_PETROLEUM_CORP._LTD.

BINA_PETROCHEMICAL_&REFINERY_EXPANSION PROJECT_(BPREP)

OVERALL INSTRUMENT CABLE DUCT/TRENCH LAYOUT

SCALE	JOB NO.	UNIT	DIVN.	DEPT.	DWG. NO.	REV.
1:2500	B957	999	16	51	00812	B

A0-1189 x 841

यह ड्राइंग/डिज़ाइन एवं इसमें दिखाए गए विवरण इंजीनियर्स इंडिया लिमिटेड की संपत्ति है। यह बिना अनुमति के न तो पूरा या आंशिक रूप से प्रयोग किया जाएगा, न प्रकाशित किया जाएगा और न ही किसी अन्य प्रयोजन के लिए प्रयोग किया जाएगा। इसका प्रयोग केवल उस सीमा तक किया जा सकता है जिसके लिए इसे उधार पर लिया गया है और इसे उधार देने वाले द्वारा लिखित रूप में दी गई अनुमति के अनुसार ही किया जा सकता है।
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Page 2268 of 5446 B957-T-570008 DOC-B957-999-16-41-PC-1-0001 Rev. A

B957-999-16-51-00801

PLANT NORTH 173°30' TRUE NORTH

WIND ROSE BASED OF NEERI

COMPLETE SITE DETAILS OF BHARAT PETROLEUM CORPORATION LTD. BINA REFINERY, BINA	
SURVEY NO.	2,3,4,5/1,7/2,2,6/1,2,3/1,5,6/1,8/1,2,8,3,8,4,8/1,5,9/1; 2/2,9/1,10/1,11/2,10/3,12,13,15,16,17,18,19,20,21/1; 21/4/21/2,22/3/2,23/1/2,25/1/2,25/2/1,27/1,5+22/4+25/6; 21/3+22/2+25/2,23/2/1,27/1,11,14, 5/2,1,2/1,2/2,3,21, 22,23,24,26/1,26/2,27,28,29,30,31,32,33,34,35,35/69,36, 39,40,41,42,44,47,48,49,50/2,53,54,56,57,60,61,62,63,14/2, 15,17,18,19,21,27,28,43,44,45,46,47,48,49,50,51,52,53,54, 55,156,157,160,161/2,1,7,8,9,11,12,13,14,15,16,17,18,19, 20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,152, 153,154, 325/2,326/2,327/2,328/2,329/2,330/2,276,277,278,279,297,302, 323/5,324/3,326,330/3, 85/2,86,87/1, 3,4,5/2,7/2,26,27, 47,56,65,66,67,68,94/2,178/2,167,168,170,1327,1328,1229, 1230,1231/1,1231/2,1232,1233,1234/1,1234/2,1235,1236, 1237,1238,1247,1248,1249,1250/2,1251/2,1253,1254,1255, 1256,1257,1258,1260,498/2,499/2,500/2,501/2,502/2, 503/2,504/2,505/2,507/2,509/2,511/2,512/2,513/2,514/2, 515,516,524/2,525/2,526/2,528/2,543/2,544/2,556/2, 557/2,561/2,562/2,564/2,771,772,773,774/2,775/2,1223,2, 1224,1225,1226,1239,1240,1241,1242,1246/2,1313/2, 1314/2,1315,1316/2,764,765,766,769/1259,1261,1262,1263, 1264,1265,1266,1267/1,1267/2,1267/3,1267/4,1267/5, 1267/6,1268,1269,1270,1271,1272,1273,1274,1275,1276, 1277,1278,1280,1281,1307,1308
LOCATION/VILLAGE	BICHHOCH, TADK,CHHANI, AGASOD,DOMAKHH,/BILOHAN BIJJURG/BHAKRAI/MUNDARI/NEHRONE,/AGASOD

REF. DWG. NO.	REFERENCE DRAWING TITLE
B957_999-81-45-00001	OVERALL PLOT PLAN

NOTES :-

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8. ESTIMATED WEIGHT OF DUCT INCLUDING CABLES PER METER RUN. 1200w X 400H = 800Kg/m 800w X 300H = 400Kg/m 400w X 200H = 200Kg/m
9. OFFSITES DUCT INDICATED IN THIS DOCUMENT ARE NOT BEING FIREPROOFED.
10. DUCT / TRAYS SHOWN IN THIS DRAWING ARE IN THE SCOPE OF RESPECTIVE (EPCM-1 PART A, EPCM-1 PART B & EPCM-2 PART C) FIELD CONTRACTOR UNLESS OTHERWISE STATED.

LEGENDS :-

- 400MM INSTRUMENT CABLE DUCT
- 800MM INSTRUMENT CABLE DUCT
- 1200MM INSTRUMENT CABLE DUCT
- IRC
- INSTRUMENT CABLE DUCT DROP
- INSTRUMENT CABLE TRAY
- BURRIED ROUTE 1 MTR (D) X 0.3 MTR (W)

EPCM-1 PART-A (NOTE-10)

EPCM-1 PART-B (NOTE-10)

EPCM-2 PART-C (NOTE-10)

GREEN BELT 200.0 M WIDE

INSTRUMENT DUCT 800W x 300H

INSTRUMENT DUCT 400W x 200H

INSTRUMENT DUCT 1200W x 400H

BURIED ROUTE 1 MTR (D) X 0.3 MTR(W)

INSTRUMENT CABLE TRAY 300W ROUTING ON THE BOUNDARY WALL

INSTRUMENT CABLE TRAY 300W (FOR ROUTING OFC CABLES TO BOT OR)

INSTRUMENT CABLE TRAY 300W

POLYMER TRUCK ENTRY/ EXIT

BOUNDARY WALL

MAIN ENTRY

POND

MARKETING TERMINAL (BPCL)

LEGEND :-

BARRED WIRE FENCING & PROPERTY LINE	BPREP FACILITY UNDER PWC-1 (B925)
CHAIN LINK FENCING	BPREP FACILITY UNDER PWC-2
COMPOUND WALL	NEW BOUNDARY WALL
CONTOURS	PIPE RACK
TENTATIVE FGL	PIPE SLEEPER
PRESENT TANKS	PIPE SLEEPER(FUTURE)
FUTURE TANKS	HEAVY LIFT CRANE APPROACH
WATCH TOWER	FEEDER PILLARS
RCC RETAINING WALL	CONSTRUCTION POWER SUB-STATION
RAILWAY TRACK	FLOOD LIGHT MASTS
TRESTLE	WATCH TOWER
CHAIN LINK FENCING	SANITARY SUMP & P.STN. NO.-3
	NEW FACILITIES PITCHEM (B957)
	NEW FACILITIES REFINERY (B933)
	REVAMP (B933 REFINERY AREA)
	REVAMP (B957 PITCHEM AREA)

REV.	DATE	DESCRIPTION	BY	CHKD	APPD	PEM
1	09.03.26	ISSUED FOR CONSTRUCTION	KP	JJ	AR	
A	20.11.25	ISSUED FOR COMMENTS	KP	JJ	AR	

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BHARAT_PETROLEUM_CORP._LTD.

BINA_PETROCHEMICAL_& REFINERY_EXPANSION PROJECT_(BPREP)

OVERALL INSTRUMENT CABLE DUCT/TRENCH LAYOUT

SCALE	JOB NO.	UNIT	DIVN.	DEPT.	DWG. NO.	REV.
1:5000	B957	999	16	51	00801	1

SHEET- 1 OF 2

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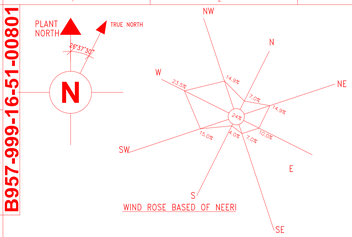
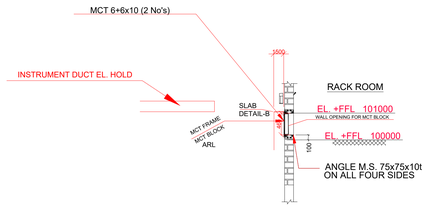
B957-999-16-51-00801

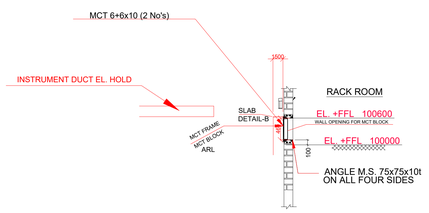


REF. DWG. NO.	REFERENCE DRAWING TITLE



TYPICAL MCT SIZE
FRAME SIZE 1415x566
BLOCK SIZE 1307x458
CUTOUT SIZE 1307x458

PETCHEM MCR



TYPICAL MCT SIZE
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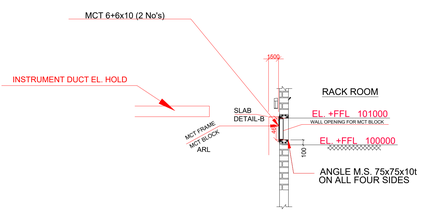
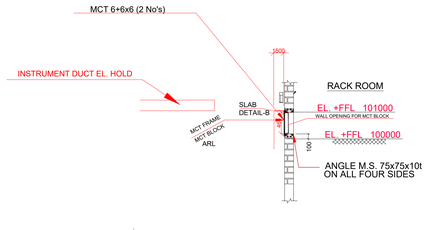
BLOCK SIZE 1307x458
CUTOUT SIZE 1307x458

EXISTING SRR-2



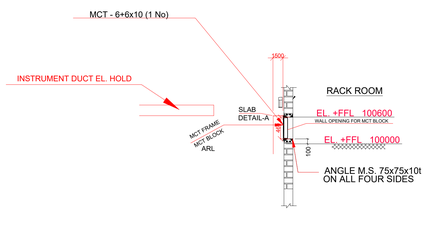
TYPICAL MCT SIZE
FRAME SIZE 1415x566
BLOCK SIZE 1307x458
CUTOUT SIZE 1307x458

CR-04



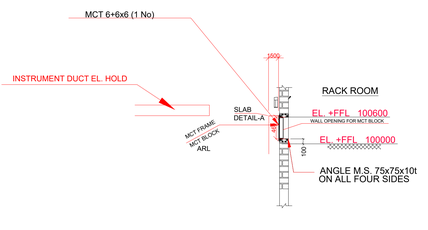
TYPICAL MCT SIZE
FRAME SIZE 1415x566
BLOCK SIZE 1307x458
CUTOUT SIZE 1307x458

CR-05



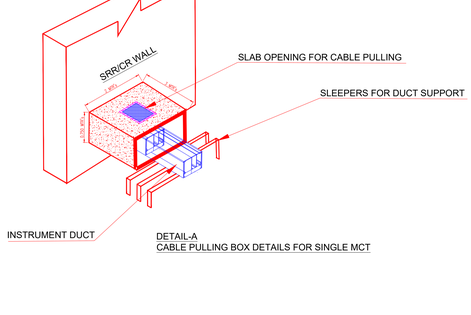
TYPICAL MCT SIZE
FRAME SIZE 1415x566
BLOCK SIZE 1307x458
CUTOUT SIZE 1307x458

EXISTING SRR-4

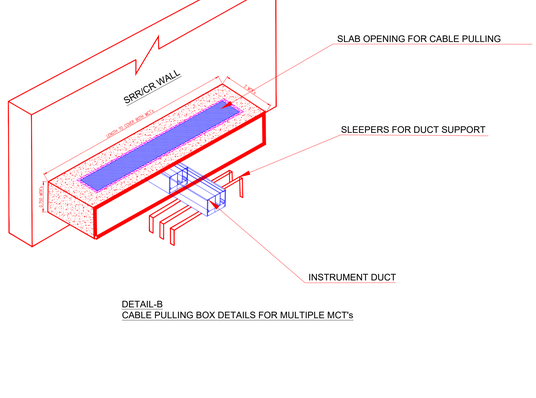


TYPICAL MCT SIZE
FRAME SIZE 1415x566
BLOCK SIZE 1307x458
CUTOUT SIZE 1307x458

EXISTING SRR-5



DETAIL-A
CABLE PULLING BOX DETAILS FOR SINGLE MCT



DETAIL-B
CABLE PULLING BOX DETAILS FOR MULTIPLE MCT's

REV.	DATE	DESCRIPTION	BY	CHKD	APPD	PEM
1	09.03.26	ISSUED FOR CONSTRUCTION	KP	JJ	AR	
A	20.11.25	ISSUED FOR COMMENTS	KP	JJ	AR	

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(A Govt. of India Undertaking)

BHARAT_PETROLEUM_CORP._LTD.

BINA_PETROCHEMICAL_& REFINERY_EXPANSION PROJECT_(BPREP)

OVERALL INSTRUMENT CABLE DUCT/TRENCH LAYOUT

SCALE	JOB NO.	UNIT	DIVN.	DEPT.	DWG. NO.	REV.
1:5000	B957	999	16	51	00801	1

Idtcr ek$k oa bieva tdpr fNt+kbu bathLu;k;z baMk jfe%kM dh lkeiRkr gSA ;s ek=e m/Ak| fo; x.k gS fd u fks mUgsa lq;ksx esjnzr fd;k tk;sxk ;k ugh dh tk;sxh vkSj u gh Lkh=er vkSj u gh Lkh=er vkSj fuh; ;k fdlh vU; mn~ns'; ds fy;s fd;k tk;sxk ;fn ;s ek=e m/Ak| fo; x.k gS fd u fks mUgsa lq;ksx
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PROJECT BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (CLIENT BHARAT PETROLEUM CORPORATION LTD.
UNIT OFFSITE JOB NO. B957 UNIT NO. 999

GENERAL		
CODES		IS 5290 AND EIL SPEC. 6-66-0012
LOCATION		OUTDOOR
TYPE		REFER NOTE 1
OPERATING CONDITIONS		
FLUID HANDLED		FRESH WATER
TEMPERATURE		AMBIENT
WORKING PRESSURE		
MAX.	Kg/cm2g	13.5
MIN.	Kg/cm2g	7
FLOW RATE	lpm	900 lpm PER VALVE 7 kg/cm2 g
HEIGHT OF HORIZONTAL ARMS	mm	AS PER DRAWING
DESIGN FEATURES		
VERTICAL POST DIAMETER	mm	100
HOR. HYDRANT ARM DIAMETER	mm	75
HOSE CONNECTOR		
COUPLING		INSTANTANEOUS, FEMALE, 63 MM AS PER IS 903
VALVE		TYPE A, IS5290,75 MM SIZE (2 VALVES PER HYDRANT POST)
MATERIALS		
HYDRANT VERTICAL POST AND ARMS		AS PER PIPING MATERIAL SPECIFICATION CLASS
FLANGE		
BASE		AS PER PIPING MATERIAL SPECIFICATION CLASS
ARM		ANSI B 16.5, S.O., RF, 150 (ASTM A-105)
LANDING VALVES		STAINLESS STEEL, GRADE IV AS PER IS 3444
HOSE CONNECTOR		STAINLESS STEEL, GRADE IV AS PER IS 3444
CAP		STAINLESS STEEL, GRADE IV AS PER IS 3444
CHAIN		STAINLESS STEEL, GRADE IV AS PER IS 3444
TEST & INSPECTION		
DIMENSION & WORKMANSHIP		YES
HYDROSTATIC TEST PRESSURE	Kg/cm2g	21
FLOW		YES, 900 lpm PER VALVE 7 Kg/cm2g
PAINTING		
STAND POST & ITS ARMS		
OUTSIDE		REFER NOTE 3
INTERNAL SURFACE		REFER NOTE 4

APPROVED

NOTES

1 WET BARREL, VERTICAL STAND POST, WITH TYPE-A LANDING VALVES AS PER IS 5290, DOUBLE HEADED (2 VALVES (75 MM) PER HYDRANT POST) WITH / WITHOUT PUMPER CONNECTION.
2 VALVE PAINTING SHALL BE AS PER IS 5290
3 THE OUTSIDE SURFACE OF STAND POST SHALL BE PAINTED WITH THREE COATS OF ANTI-CORROSIVE FIRE RED PAINT AS PER IS2932 CONFORMING TO SHADE NO. 536 TO IS5 OVER 2 COATS OF RED OXIDE ZINC CHROMATE PRIMER OR A SINGLE COAT OF ALUMINUM PAINT.
THE HANDWHEEL SHALL BE PAINTED BLACK. PAINTS SHALL CONFORM TO IS 2932.
4 THE INTERNAL SURFACE SHALL BE PAINTED WITH THREE COATS OF CHLORINATED RUBBER BASED RESIN PAINT OVER 2 COATS OF RED OXIDE ZINC CHROMATE PRIMER OR A SINGLE COAT OF ALUMINUM PAINT.
5 FOR DETAILED SPECIFICATION, REFER EIL SPEC. NO. 6-66-0012.
6 IN CASE OF ANY CONFLICT BETWEEN DATA GIVEN HERE WITH DATA GIVEN IN THE STD. SPEC. NO. 6-66-0012, DATA SHEET SHALL BE GIVEN PREFERENCE.
7 HYDRANTS SHALL BE BIS MARKED AND APPROVED. VENDOR SHALL SUBMIT THE ISI CERTIFICATE.

Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By
0	26-MAR-2025	Issued For Engineering	SB	SB	AK
A	07-MAR-2025	Issued For Comments	SB	SB	AK

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8 EACH HYDRANT SHALL BE CLEARLY AND PERMANENTLY MARKED WITH THE FOLLOWING A) MANUFACTURERS NAME OR TRADE MARK. B) YEAR OF MANUFACTURE. C) PURCHASER NAME. D) BIS CERTIFICATION MARKING ON LANDING VALVE AND COUPLINGS.

APPROVED

Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By
0	26-MAR-2025	Issued For Engineering	SB	SB	AK
A	07-MAR-2025	Issued For Comments	SB	SB	AK

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DATA SHEET FOR FIRST AID HOSE REEL (HORIZONTAL, STAND MOUNTING)

PROJECT	BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)	CLIENT	M/S BHARAT PETROLEUM CORPORATION LTD.		
PLANT	BINA PETROCHEMICAL COMPLEX	JOB NO	B957	UNIT	999

GENERAL			
CODES			IS: 884
LOCATION			INDOOR / OUTDOOR
TYPE			HORIZONTAL, STAND MOUNTING
OPERATING CONDITIONS			
FLUID HANDLED			FRESH WATER
TEMPERATURE			AMBIENT
PRESSURE		MAX.	13.5KG/CM^{2}g
		MIN.	7.0 KG/CM^{2}g
DESIGN FEATURES			
BODY		OPERATION TYPE	MANUAL.
		INLET CONNECTION	25MM (1") FLANGED END CONNECTION, DRILLING STANDARD AS PER ASME B 16.5 150#, RF / AS PER PMS OF A94A (ABOVE GROUND)
		OUTLET CONNECTION	THREADS AS PER IS: 2643 (PART I).
PERFORMANCE		NOZZEL PRESSURE	7.0 KG/CM^{2}g.
		FLOW RATE	SHALL NOT BE LESS THAN 24 LPM AT REEL INLET PRESSURE OF 7 KG/CM^2 g
		MIN. DISCHARGE RANGE	SHALL NOT BE LESS THAN 6m AT 7 KG/CM^{2}g.
MATERIALS			
SIDES			M.S. IS: 513
DETACHABLE HANDLE			M.S.
STAND			M.S. ANGLE
HOSE REEL TUBING			BRAIDED RUBBER CONFORMING TO IS:444, Type-II
STRAIGHT JET TYPE NOZZLE WITH BRANCH PIPE AND COUPLING			SS 316
STOP VALVE			IS: 778
TEST & INSPECTION			
DIMENSION & WORKMANSHIP			AS PER IS:884
PERFORMANCE TEST			AS PER IS:884
HYDROSTATIC TEST PRESSURE FOR HOSE			7 KG/CM^{2}g FOR 5 MINUTES WITHOUT ANY LEAKAGE.
BURSTING PRESSURE FOR HOSE			30 KG/CM^{2}g.
PAINTING			
BODY (ABOVE GROUND)			FIRE RED PAINT AS PER IS: 2932 (CONFORMING TO SHADE NO. 536 OF IS: 5), OVER 2 COATS OF RED OXIDE ZINC CHROMATE PRIMER OR SINGLE COAT OF ALUMINIUM PAINT& SHALL BE SUITABLE FOR CORROSIVE ENVIRONMENT.
MARKING			EACH HOSE REEL SHALL BE CLEARLY & PERMANENTLY MARKED WITH THE FOLLOWING INFORMATION ALONG WITH PURCHASER'S NAME: a) MANUFACTURER'S NAME OR TRADEMARK b) YEAR OF MANUFACTURE c) LENGTH & SIZE OF TUBE CARRIED ON HOSE REEL d) TYPE OF HOSE REEL e) BIS CERTIFICATION MARK ON HOSE REEL TUBING

NOTES:

1. FOR DETAILED SPECIFICATION, REFER EIL SPEC. NO. 6-66-0018.
2. IN CASE OF ANY CONFLICT BETWEEN DATA GIVEN HERE WITH DATA GIVEN IN THE STD. SPEC. NO. 6-66-0018, DATA SHEET SHALL BE GIVEN PREFERENCE.
3. HOSE REEL MOUNTING DRUM SHOULD BE SELF LOCKING TYPE (FRICTION BRAKES) TO AVOID OVER RUN WHILE OPENING OF HOSE REEL.
4. SUITABLE FIXING ARRANGEMENT ALONG WITH NUTS, BOLTS, ANCHOR BOLTS ETC. TO BE SUPPLIED WITH HOSE REEL ASSEMBLY.

REV.	DATE	REVISION	BY	CHK	APP.
0	27.01.2026	ISSUED FOR BIDS	BP	SB	AK

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PROJECT	BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)	CLIENT	M/S BHARAT PETROLEUM CORPORATION LTD.		
PLANT	BINA PETROCHEMICAL COMPLEX	JOB NO	B957	UNIT NO	999

GENERAL	
TYPE	SAND BUCKET (STAND MOUNTED)
LOCATION	OUTDOOR
REFERENCE STANDARD	IS: 2546
QUANTITY	AS PER APPROVED DRAWING
EXTINGUISHER AGENT	SAND
MATERIALS OF CONSTRUCTION	
BODY	MS GALVANIZED AS PER IS : 2546
BOTTOM	ROUND BOTTOM
TECHNICAL DATA	
CAPACITY	9 – 10 LIT. (SET OF 3 BUCKET)
MOUNTING	STAND MOUNTED (MS WITH WEATHER SHED)
TOTAL FILLED WEIGHT	*
TESTING	AS PER IS: 2546
ADDITIONAL INFORMATION	
PAINTING	FIRE BUCKET FIRE RED, SHADE 536 AS PER IS:5 FOR BODY HANDLE-BLACK “FIRE” WORD ON BODY OF BUCKET. SAND BUCKET STAND- FIRE RED, SHADE536 AS PER IS:5 (110MICRON)
MARKING	1. MANUFACTURER’S NAME OR TRADEMARK OR BOTH 2. YEAR OF MANUFACTURE & CAPACITY

NOTES:

1. (*) DATA TO BE FURNISH BY THE VENDOR.

NO	DATE	REVISION	BY	CHK.	APP.
0	26.03.2025	ISSUED FOR ENGINEERING	NS	SB	AK
A	07.03.2025	ISSUED FOR COMMENTS	NS	SB	AK

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LONG RANGE WATER CUM FOAM MONITOR

PROJECT BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT | CLIENT BHARAT PETROLEUM CORPORATION LTD.
UNIT OFFSITE | JOB NO. B957 | UNIT NO. 999

GENERAL		
CODES		EIL SPEC. 6-66-0027
LOCATION		OUTDOOR
TYPE		STAND POST TYPE (FIXED)
FLOW RATE	USGPM	1000-2000
OPERATING CONDITIONS		
FLUID HANDELED		FRESH WATER
TEMPERATURE		AMBIENT
PRESSURE		
MAX.	Kg/cm2g	13.0
MIN.	Kg/cm2g	7
DESIGN FEATURES		
MONITOR BODY		
OPERATION TYPE		MANUALLY OPERATED
MOVEMENT	Deg	HORIZONTALLY-340 DEG; VERTICALLY-125 DEG (+80,-45)
INLET CONNECTION	Inch	6, ANSI B 16.5, S.O., RF, 150# (ASTM A 105)
OUTLET CONNECTION		BY VENDOR
NOZZLE		
TYPE		AQUA FOG/FOAM NON-ASPIRATING TYPE WITH JET/SPRAY ARRANGEMENT
CONNECTION		BY VENDOR
SIZE	mm	BY VENDOR
FINISH		YELLOW EPOXY PAINTED
FOAM INDUCTION		THROUGH AQUA POWERED FOAM INDUCTOR(JRCP) FROM A MAX. DISTANCE OF 60M
FOAM EXPANSION RATIO		1:3 TO 1:4
FOAM INDUCTION RATE		3%
PERFORMANCE		
NOZZLE PRESSURE	Kg/cm2g	7
MIN. DISCHARGE THROW RANGE IN STILL AIR		
HORIZONTAL (WATER) AT 30 DEG. FROM HOR.	m	AS PER EIL SPEC. 6-66-0027
HORIZONTAL (FOAM) AT 30 DEG. FROM HOR.	m	AS PER EIL SPEC. 6-66-0027
VERTICAL (WATER) AT 60 DEG. FROM HOR.	m	AS PER EIL SPEC. 6-66-0027
VERTICAL (FOAM) AT 60 DEG. FROM HOR.	m	AS PER EIL SPEC. 6-66-0027
MATERIALS		
NOZZLE		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
SWIVEL JOINT/ WORM WHEEL & GEAR		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
BODY/ ELBOWS/ BENDS		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
WATER BARREL		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
LOCKS OF HOR. & VER. ROTATION		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
HANDLE		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
PICK UP TUBE FOR JRCP(JRCP)		PVC TUBE REINFORCED WITH HIGH TENSILE STEEL WIRE HELIX AS PE
DRAIN VALVE		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
JRCP		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
TEST & INSPECTION		
DIMENSION & WORKMANSHIP		YES
FUNCTIONAL TEST FOR HOR. & VER. MOVEMENT		YES
PERFORMANCE TEST		YES
HYDROSTATIC TEST PRESSURE		AS PER EIL SPEC. 6-66-0027
APPROVAL		REFER NOTE - 1
PAINTING		
BODY (ABOVE GROUND)		AS PER EIL SPEC. 6-66-0027 & REFER NOTE - 4

APPROVED

NOTES

Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By
0	26-MAR-2025	Issued For Engineering	AK	AK	AK
A	07-MAR-2025	Issued For Comments	SB	SB	AK

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PROJECT	BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT	CLIENT	BHARAT PETROLEUM CORPORATION LTD.
UNIT	OFFSITE	JOB NO.	B957 UNIT NO. 999

1 COMPLETE MONITOR ASSEMBLY ALONG WITH NOZZLE SHALL BE BIS APPROVED / UL LISTED / FM APPROVED.

2 JRCP SHALL BE PROVIDED WITH 21/2 INCH INLET/OUTLETMALE/FEMALE COUPLING OF SS-316.

3 FOAM SOLUTION INDUCTION HOSE OF TOTAL 60M LENGTH SHALL BE SUPPLIED ALONG WITH END COUPLINGS OF SS16.THE HOSE SHALL BE MADE OF REINFORCED PVC.

4 THE HANDWHEEL SHALL BE PAINTED BLACK PAINTS SHALL CONFORM TO IS: 2932.

5 FOR DETAILS, REFER SPECIFICATION 6-66-0027.

APPROVED

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0	26-MAR-2025	Issued For Engineering	AK	AK	AK
A	07-MAR-2025	Issued For Comments	SB	SB	AK

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PROJECT BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT | CLIENT BHARAT PETROLEUM CORPORATION LTD.
UNIT OFFSITE | JOB NO. B957 | UNIT NO. 999

GENERAL		
CODES		EIL SPEC. 6-66-0027
LOCATION		OUTDOOR
TYPE		STAND POST TYPE (FIXED)
FLOW RATE	USGPM	1000-2000
OPERATING CONDITIONS		
FLUID HANDELED		FRESH WATER
TEMPERATURE		AMBIENT
PRESSURE		
MAX.	Kg/cm2g	13.0
MIN.	Kg/cm2g	7
DESIGN FEATURES		
MONITOR BODY		
OPERATION TYPE		MANUALLY OPERATED
MOVEMENT	Deg	HORIZONTALLY-340 DEG; VERTICALLY-125 DEG (+80,-45)
INLET CONNECTION	Inch	6, ANSI B 16.5, S.O., RF, 150# (ASTM A 105)
OUTLET CONNECTION		BY VENDOR
NOZZLE		
TYPE		AQUA FOG/FOAM NON-ASPIRATING TYPE WITH JET/SPRAY ARRANGEMENT
CONNECTION		BY VENDOR
SIZE	mm	BY VENDOR
FINISH		YELLOW EPOXY PAINTED
FOAM INDUCTION		
FOAM EXPANSION RATIO		NA
FOAM INDUCTION RATE		NA
PERFORMANCE		
NOZZLE PRESSURE	Kg/cm2g	7
MIN. DISCHARGE THROW RANGE IN STILL AIR		
HORIZONTAL (WATER) AT 30 DEG. FROM HOR.	m	AS PER EIL SPEC. 6-66-0027
HORIZONTAL (FOAM) AT 30 DEG. FROM HOR.	m	AS PER EIL SPEC. 6-66-0027
VERTICAL (WATER) AT 60 DEG. FROM HOR.	m	AS PER EIL SPEC. 6-66-0027
VERTICAL (FOAM) AT 60 DEG. FROM HOR.	m	AS PER EIL SPEC. 6-66-0027
MATERIALS		
NOZZLE		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
SWIVEL JOINT/ WORM WHEEL & GEAR		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
BODY/ ELBOWS/ BENDS		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
WATER BARREL		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
LOCKS OF HOR. & VER. ROTATION		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
HANDLE		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
PICK UP TUBE FOR JRCP(JRCP)		NA
DRAIN VALVE		SS 316 OR STAINLESS STEEL, GRADE IV as per IS:3444
JRCP		NA
TEST & INSPECTION		
DIMENSION & WORKMANSHIP		YES
FUNCTIONAL TEST FOR HOR. & VER. MOVEMENT		YES
PERFORMANCE TEST		YES
HYDROSTATIC TEST PRESSURE		AS PER EIL SPEC. 6-66-0027
APPROVAL		REFER NOTE - 1
PAINTING		
BODY (ABOVE GROUND)		AS PER EIL SPEC. 6-66-0027 & REFER NOTE - 3

NOTES

Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By
0	27-MAR-2025	Issued For Engineering	AK	AK	AK
A	07-MAR-2025	Issued For Comments	SB	SB	AK

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PROJECT	BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT	CLIENT	BHARAT PETROLEUM CORPORATION LTD.
UNIT	OFFSITE	JOB NO.	B957 UNIT NO. 999

1 COMPLETE MONITOR ASSEMBLY ALONG WITH NOZZLE SHALL BE BIS APPROVED / UL LISTED / FM APPROVED.

2 IN CASE OF ANY CONFLICT BETWEEN DATA GIVEN HERE WITH DATA GIVEN IN THE STD. SPECIFICATIONS, DATA SHEET SHALL BE GIVEN PREFERENCE.

3 THE HANDWHEEL SHALL BE PAINTED BLACK PAINTS SHALL CONFORM TO IS: 2932.

4 FOR DETAILS, REFER SPECIFICATION 6-66-0027.

APPROVED

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PROJECT BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BP CLIENT BHARAT PETROLEUM CORPORATION LTD.
UNIT OFFSITE JOB NO. B957 UNIT NO. 999

GENERAL		
CODES		IS: 884
LOCATION		INDOOR / OUTDOOR
TYPE		SWINGING TYPE (WALL MOUNTED)
OPERATING CONDITIONS		
FLUID HANDELED		FRESH WATER
TEMPERATURE		AMBIENT
PRESSURE		
MAX.	Kg/cm2g	13.5
MIN.	Kg/cm2g	7.0
DESIGN FEATURES		
BODY		
OPERATION TYPE		MANUAL
MOVEMENT		SWINGING (180 deg) WALL MOUNTING TYPE
INLET CONNECTION	mm	25
OUTLET CONNECTION		THREADS AS PER IS: 2643 (PART I).
PERFORMANCE		
AT NOZZLE PRESSURE of 7 Kg/cm2g		
FLOW RATE		SHALL NOT BE LESS THAN 24 LPM
MIN. DISCHARGE RANGE		SHALL NOT BE LESS THAN 6m
MATERIALS		
HUB		M.S. IS: 513
SIDES		M.S. IS: 513
SUPPORT FRAMES		M.S. IS: 513
SWIVEL JOINT		STAINLESS STEEL, GRADE IV AS PER IS:3444
HOSE REEL TUBING		BRAIDED RUBBER (AS PER IS : 444 Type-2)
STRAIGHT JET TYPE NOZZLE WITH BRANCH PIPE AND COUPLING.		STAINLESS STEEL, GRADE IV AS PER IS:3444
STOP VALVE		IS: 778
TEST & INSPECTION		
DIMENSION & WORKMANSHIP		AS PER IS:884
PERFORMANCE TEST		AS PER IS:884
HYDROSTATIC TEST PRESSURE		7 kg/cm2g FOR 5 MINUTES WITHOUT ANY LEAKAGE
BURSTING PRESSURE FOR HOSE	Kg/cm2g	30
PAINTING		
OUTSIDE		REFER NOTE 2
COLOUR		FIRE RED PAINT AS PER IS: 2932 & CONFORMING TO SHADE NO. 536 OF IS:5

APPROVED

NOTES

1 HOSE REEL TUBING LENGTH SHALL BE 40M WITH INTERNAL BORE 25MM.

2 THREE COATS OF ANTI-CORROSIVE FIRE RED PAINT AS PER IS:2932 CONFORMING TO SHADE NO. 536 TO IS:5 OVER 2 COATS OF RED OXIDE ZINC CHROMATE PRIMER OR A SINGLE COAT OF ALUMINUM PAINT.

3 FIXING ARRANGEMENT (BRACKET) ALONG WITH SUITABLE ANCHOR FASTENERS MADE OF M.S. GALVANIZED SHALL ALSO BE SUPPLIED ALONG WITH HOSE REEL FOR FIXING.

4 IN CASE OF ANY CONTRADICTION IN THE DATA GIVEN IN THE SPECIFICATION 6-66-0018 VS DATASHEET, DATA GIVEN IN THE DATASHEET SHALL BE FOLLOWED.

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HOSE CABINET

Document No. B957-999-81-45-DS-8004
Rev. No. 0

PROJECT BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (CLIENT BHARAT PETROLEUM CORPORATION LTD.
UNIT OFFSITE JOB NO. B957 UNIT NO. 999

GENERAL		
TYPE		TYPE-II
LOCATION		INDOOR, OUTDOOR
MECHANICAL DATA		
DELIVERY HOSE SIZE	mm	63
LENGTH OF HOSE	m	15m x 2 NOS.
MATERIALS		
BODY		18 GAUGE M.S.SHEET AS PER IS 513
DOORS		M.S.FRAME WITH GLASS DOORS (3 MM THICK)
HAMMERS		MILD STEEL
CHAIN		G.I.
UNIVERSAL BRANCH PIPE		SS 316
END COUPLING/JET NOZZLE/BRANCH PIPE		SS 316
DELIVERY HOSE		2 NOS. AS PER IS : 636 Type-3
STANDARD HANDLE TYPE LOCKS		MORTISE LOCK SET
DELIVERY COUPLINGS		SS 316
PAINTING		
INSIDE		REFER NOTE-8
OUTSIDE		REFER NOTE-8
UNIT WEIGHT		
EMPTY	Kg	BY VENDOR
TOTAL	Kg	BY VENDOR

APPROVED

NOTES

1 HOSE CABINET SHALL BE OF SELF-SUPPORTING TYPE, SUITABLE FOR OUTSIDE INSTALLATION. NECESSARY HANGERS AND BRACKETS FOR HOSES, BRANCH PIPE AND UNIVERSAL BRANCH PIPE SHALL BE PROVIDED WITHIN THE CABINET. BREAK GLASS RECESS FOR KEY SHALL ALSO BE PROVIDED.

2 TYPE-II HOSE CABINET SHALL BE SUPPLIED WITH TWO DELIVERY HOSES WITH END COUPLINGS, ONE NOZZLE (JET/SPRAY) WITH BRANCH PIPE OF SS316 AS PER IS903 & ONE UNIVERSAL BRANCH PIPE OF SS316 AS PER IS 2871, SELF SUPPORTING TYPE, NECESSARY HANGERS AND BRACKET FOR HOSE, NOZZLE AND BRANCH PIPE WITH WITH DOUBLE PANEL GLASS DOOR.

3 HOSES AND COUPLINGS SHALL BE ISI MARKED

4 DELIVERY COUPLINGS SHALL BE 63 MM DIAMETER WITH REDUCED SHANK.

5 DELIVERY COUPLINGS SHALL BE INSTANTANEOUS SPRING LOCK TYPE AS PER IS 903

6 DELIVERY COUPLINGS SHALL BE INSTANTANEOUS SPRING LOCK TYPE AS PER IS 903

7 EACH CABINET SHALL BE CLEARLY AND PERMANENTLY MARKED WITH THE FOLLOWING.
A) THE WORDS HOSE CABINET-TYPE II
B) INSTRUCTIONS FOR USE.

8 THREE COATS OF ANTI-CORROSIVE FIRE RED PAINT AS PER IS:2932 CONFORMING TO SHADE NO. 536 TO IS:5 FROM OUTSIDE AND WHITE PAINT FROM INSIDE OVER 2 COATS OF RED OXIDE ZINC CHROMATE PRIMER OR A SINGLE COAT OF ALUMINUM PAINT. SURFACE PREPARATION & PRE-ERECTION/ SHOP PRIMER SHALL BE AS PER JOB SPECIFICATION.

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PROJECT	BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (BPREP)	CLIENT	M/S BHARAT PETROLEUM CORPORATION LTD.		
PLANT	BINA PETROCHEMICAL COMPLEX	JOB NO	B957	UNIT	999

GENERAL	
CODES	AS PER MANUFACTURER STANDARD
WORKING PRESSURE	7.0 KG/CM^2 G
INLET CONNECTION	1" (MALE, NPT THREADED)
MATERIAL OF CONSTRUCTION	
BODY	STAINLESS STEEL, GRADE IV AS PER IS: 3444
BALL & 'O'- RING	RUBBER CONFORMING TO IS: 937
TEST & INSPECTION	
SHAPE, DIMENSION & WORKMANSHIP	AS PER MANUFACTURER STANDARD
HYDROSTATIC TEST FOR EACH ASSEMBLED UNIT	21 KG/CM^2 G FOR 2 ½ MINUTE (SHALL SHOW NO SIGN OF LEAKAGE)
MARKING	EACH AIR RELEASE VALVE SHALL BE CLEARLY MARKED ON ITS BODY WITH FOLLOWING INFORMATION ALONG WITH THE PURCHASER'S NAME 1. MANUFACTURER'S NAME OR TRADEMARK 2. YEAR OF MANUFACTURE

NOTES:

1. CLIENT OR ITS AUTHORIZED REPRESENTATIVE SHALL ALWAYS HAVE ACCESS TO THE MANUFACTURER'S WORK IN WHICH THE AIR RELEASE VALVES ARE MANUFACTURED, ASSEMBLED AND/OR TESTED. INSPECTION OF EQUIPMENT SHALL BE AS PER APPROVED QAP.
2. HYDROSTATIC PRESSURE TEST CERTIFICATES OF AIR RELEASE VALVE SHALL BE SUBMITTED AT THE TIME OF DELIVERY OF MATERIAL.

REV.	DATE	REVISION	PREPD	CHKD	APPD
0	26.03.2025	ISSUED FOR ENGINEERING	NS	SB	AK
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PROJECT BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (CLIENT BHARAT PETROLEUM CORPORATION LTD.
UNIT OFFSITE JOB NO. B957 UNIT NO. 999

GENERAL		
MODEL		DETECTION BY HYDRAULIC/PNEUMATIC
TYPE OF ACTUATION		THROUGH QBD
SIZE	mm	AS PER P&ID
END CONNECTION		AS PER PMS
OPERATING CONDITIONS		
WORKING PRESSURE		
MAX.	Kg/cm2g	13.0 KG/CM2G
MIN.	Kg/cm2g	7.0 KG/CM2G TO 12 KG/CM2G
HYDRO TEST PRESSURE	Kg/cm2g	BODY 25.0KG/CM2G, SEAT 18.0 KG/CM2G
MATERIAL		
BODY/HOUSING & COVER		DUCTILE IRON
SEAT, CLAPPER, CLAMP RING		BRONZE
DIAPHRAGM SEAT RUBBER		NEOPRENE/ EPDM
BOLTS (INTERNAL)		SS 304
BOLTS (EXTERNAL)		STEEL
ACCESSORIES		
TEST STRAINERS, DRAIN VALVE & NRV		YES
WATER MOTER CONG		YES
CAPABLE OF RESETTING MANUALLY		YES
INSTRUMENTS (PRESSURE GAUGE, SOV ETC)		YES
TEST AND ALARM TRIM		YES
PAINTING		
OUTSIDE		REFER NOTE 6
INTERNAL SURFACE		(*)
COLOUR		REFER NOTE 6
APPROVAL		UL / FM / Vds / LPCB APPROVED
TEST & INSPECTION		AS PER EIL SECIFICATION 6--66-0048
MARKING ON EQUIPMENT		AS PER EIL SECIFICATION 6--66-0048

APPROVED

NOTES

1 FOR DETAILED SPECIFICATION, REFER SPEC. NO. 6-66-0048
2 IN CASE OF ANY CONFLICTION BETWEEN DATA GIVEN HERE WITH DATA GIVEN IN THE SPEC. NO. 6-66-0048
3 PNEUMATICALLY BY INSTRUMENT AIR (DRY TRIM)/HYDRAUCALLY BY WATER (WET TRIM)/ELECTRIC OPERATED (ELECTRIC TRIM) (REFER MR DESCRIPTION FOR TRIM TYPE)
4 MANUFACTURER NAME, YEAR OF MANUFACTURE, SERIAL NO.,SIZE AND MODEL, UL LISTED MARK, DESIGN AND TEST PRESSURE
5 SURFACE PREPARATION & PRE-ERECTION /SHOP PRIMER SHALL BE AS PER SPEC NO-6-79-0020
6 2 COATS OF ANTI-COROSIVE FIRE RED PAINT AS PER IS: 2932 AND CONFORMING TO SHADE NO. 536 OF IS: 5, OVER 2 COATS OF RED OXIDE ZINC CHROMATE PRIMER OR SINGLE COAT OF ALUMINIUM PAINT.
7 (*) VENDOR TO FURNISH

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PROJECT BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT CLIENT BHARAT PETROLEUM CORPORATION LTD.
UNIT OFFSITE JOB NO. B957 UNIT NO. 999

GENERAL		
CODES		*
TYPE		PENDENT TYPE QUARTZOID BULB
FLUID HANDELED		WATER/PNEUMATIC
DESIGN REQUIREMENT		
DEFLECTOR TYPE		QUARTZOID BULB
ACTUATION		BY TEMPERATURE RISE TO 79 DEG. C
MATERIAL OF CONSTRUCTION		
BODY		BRASS
COUPLING		BRASS
END CONNECTION	Inch	1/2" NPT
DEFLECTOR		*
BULB COLOR		YELLOW COLOUR
TEST & INSPECTION		YES
APPROVAL		UL/FM APPROVED

NOTES

1 * INDICATES DATA TO BE FILLED BY VENDOR
2 FOR SELECTION OF DRY/WET SYSTEM, REFER MR ITEM DESCRIPTION.

APPROVED

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SPRAY NOZZLES (MEDIUM VELOCITY)

PROJECT BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (I CLIENT BHARAT PETROLEUM CORPORATION LTD.
UNIT OFFSITE JOB NO. B957 UNIT NO. 999

GENERAL		
TYPE		MEDIUM VELOCITY, OPEN, NON CLOG TYPE
SERVICE		FIRE WATER
FLUID		FRESH WATER
STATE		LIQUID
DESIGN REQUIREMENT		
CAPACITY	LPM	REFER NOTE - 3 & 5
PRESSURE AT INLET	KG/CM2 G	1.4 - 3.5
K-FACTOR		REFER NOTE - 3 & 5
DISCHARGE PATTERN		120 DEGREE ANGLE,UNIFORM FULL CONE SPRAY PATTERN
SIZE	Inch	1/2" NPT
LIQUID PROPERTIES		
SPECIFIC GRAVITY		1.000
VISCOSITY	CP	1
MATERIAL OF CONSTRUCTION		
BODY		SS 316
DEFLECTOR		SS 316
MS FULL COUPLING		3000 lbs RATING AS PER ANSI B 16.11
ACCESSORIES		
FORGED STEEL SPANNERS FOR FIXING THE NOZZLES TO FULL COUPLING		YES
TESTING AND INSPECTION		YES
APPROVAL		REFER NOTE - 1
MARKING		REFER NOTE - 4

APPROVED

Notes

1 SPRAY NOZZLES SHALL BE UL / FM / Vds / LPCB APPROVED.
2 SPRAY NOZZLES SHALL BE SUPPLIED ALONG WITH 3000 lbs RATING FEMALE COUPLING
3 REFER MR/SOR FOR K FACTOR.
4 MANUFACTURER NAME, YEAR OF MANUFACTURE, UL/FM MARK, K- FACTOR, SPRAY ANGLE.
5 FOR DETAIL SPECIFICATION, REFER EIL SPEC NO. 6-66-0046

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WATER CUM FOAM MONITOR
AQUA FOG TYPE

PROJECT BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT CLIENT BHARAT PETROLEUM CORPORATION LTD.
UNIT OFFSITE JOB NO. B957 UNIT NO. 999

GENERAL		
CODES		AS PER EIL SPECIFICATION NO. 6-66-0027
LOCATION		OUTDOOR
TYPE		STAND POST TYPE (FIXED), SINGLE BARREL, LEVER OPERATED, NON-ASPIRATING AQUA FOG/FOAM TYPE
FLOW RATE	USGPM	500-1000
OPERATING CONDITIONS		
FLUID HANDELED		FRESH WATER
TEMPERATURE		AMBIENT
PRESSURE		
MAX.	Kg/cm2g	13.5
MIN.	Kg/cm2g	7.0
DESIGN FEATURES		
MONITOR BODY		
OPERATION TYPE		MANUALLY OPERATED
MOVEMENT	Deg	HORIZONTALLY- 340°; VERTICALLY- 135° (+90°, -45°).
INLET CONNECTION	Inch	4, ANSI B 16.5, S.O., RF, 150# (ASTM A 105)
OUTLET CONNECTION		BY VENDOR
NOZZLE		
TYPE		REFER NOTE - 1
CONNECTION		BY VENDOR
SIZE	mm	BY VENDOR
FINISH		YELLOW EPOXY PAINTED
FOAM INDUCTION		
FOAM EXPANSION RATIO		NA
FOAM INDUCTION RATE		NA
PERFORMANCE		
AT NOZZLE PRESSURE OF 7 Kg/cm2g		
MIN. DISCHARGE THROW RANGE IN STILL AIR		500-1000 USGPM
HORIZONTAL (WATER) AT 30 DEG. FROM HOR.	m	AS PER EIL SPECIFICATION NO. 6-66-0027
HORIZONTAL (FOAM) AT 30 DEG. FROM HOR.	m	AS PER EIL SPECIFICATION NO. 6-66-0027
VERTICAL (WATER) AT 60 DEG. FROM HOR.	m	AS PER EIL SPECIFICATION NO. 6-66-0027
VERTICAL (FOAM) AT 60 DEG. FROM HOR.	m	AS PER EIL SPECIFICATION NO. 6-66-0027
MATERIALS		
NOZZLE		SS 316 OR STAINLESSS SEEL GRADE IV as per IS:3444
SWIVEL JOINT/ WORM WHEEL & GEAR		SS 316 OR STAINLESSS SEEL GRADE IV as per IS:3444
BODY/ ELBOWS/ BENDS		SS 316 OR STAINLESSS SEEL GRADE IV as per IS:3444
WATER BARREL		SS 316 OR STAINLESSS SEEL GRADE IV as per IS:3444
LOCKS OF HOR. & VER. ROTATION		SS 316 OR STAINLESSS SEEL GRADE IV as per IS:3444
HANDLE		SS 316 OR STAINLESSS SEEL GRADE IV as per IS:3444
DRAIN VALVE		STAINLESS STEEL
JRCP		NA
PICK UP TUBE		PVC TUBE REINFORCED WITH HIGH TENSILE STEEL WIRE HELIX AS PER ASTM D1785 SCH. 80 (3-4 METER LENGTH) WITH SS 316 STRAINER.
TEST & INSPECTION		
DIMENSION & WORKMANSHIP		YES
PERFORMANCE TEST		YES
HYDROSTATIC TEST PRESSURE		AS PER EIL SPECIFICATION NO. 6-66-0027
FUNCTIONAL TEST FOR HOR. & VER. MOVEMENT		YES
APPROVAL		REFER NOTE - 3
PAINTING		

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PROJECT	BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT	CLIENT	BHARAT PETROLEUM CORPORATION LTD.
UNIT	OFFSITE	JOB NO.	B957 UNIT NO. 999
BODY (ABOVE GROUND)		AS PER EIL SPECIFICATION NO. 6-66-0027	

NOTES

1 MONITOR SHALL BE NON-ASPIRATING TYPE WITH ARRANGEMENT OF JET AND SPRAY (AQUA FOG).

2 IN CASE OF ANY CONFLICTION BETWEEN DATA GIVEN HERE WITH DATA GIVEN IN THE STD.SPEC. NO. 6-65-0027, DATA SHEET SHALL BE GIVEN PREFERENCE.

3 ALL THE MONITORS SHALL BE BIS APPROVED/UL LISTED/FM APPROVED AND MULTIPURPOSE COMBINATION NOZZLES FOR JET SPRAY AND FOG ARRANGEMENT.

4 FOR DETAILED SPECIFICATION, REFER EIL SPEC. NO. 6-66-0027.

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LANDING VALVE (STAND POST TYPE)

PROJECT BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (B CLIENT BHARAT PETROLEUM CORPORATION LTD.
UNIT OFFSITE JOB NO. B957 UNIT NO. 999

GENERAL		
CODES		IS: 5290
LOCATION		INDOOR / OUTDOOR
TYPE		REFER NOTE-1
OPERATING CONDITIONS		
FLUID HANDELED		FRESH WATER
TEMPERATURE		AMBIENT
PRESSURE		
MAX.	Kg/cm2g	13.5
MIN.	Kg/cm2g	7.0
FLOW RATE	lpm	900 lpm PER VALVE @7 kg/cm2 g
DESIGN FEATURES		
HOSE CONNECTOR		
COUPLING		INSTANTANEOUS, FEMALE, 63 MM AS PER IS:903.
VALVE		TYPE A, IS:5290, 75 MM SIZE (2 VALVES PER LANDING VALVE POST)
MATERIALS		
FLANGE		
BASE		AS PER PMS
ARM		ANSI B16.5, S.O.,RF, 150# (ASTM A-105)
LANDING VALVES		STAINLESS STEEL, GRADE IV AS PER IS 3444
HOSE CONNECTOR		STAINLESS STEEL, GRADE IV AS PER IS 3444
CAP		STAINLESS STEEL, GRADE IV AS PER IS 3444
CHAIN		STAINLESS STEEL, GRADE IV AS PER IS 3444
TEST & INSPECTION		
DIMENSION & WORKMANSHIP		YES
HYDROSTATIC TEST PRESSURE	Kg/cm2g	21
FLOW		YES, 900 lpm PER VALVE @ 7 KG/CM2g.
PAINTING		REFER NOTE 2, 3, 4, 5, 6
COLOR		FIRE RED PAINT AS PER IS: 2932 & CONFORMING TO SHADE NO. 536 OF IS:5

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NOTES

1. WET BARREL, VERTICAL STAND POST OF 100 MM DIA SHALL BE PROVIDED WITH 2 NOS. OF TYPE-A LANDING VALVES AS PER IS:5290, ONE ON EACH ARM OF 75 MM DIA
2. VALVE PAINTING SHALL BE AS PER IS 5290
3. SURFACE PREPARATION & PRE-ERECTION/ SHOP PRIMER SHALL BE AS PER JOB SPECIFICATION FOR PAINITNG.
4. THE HANDWHEEL SHALL BE PAINTED WITH 2 COATS OF BLACK PAINT OVER EPOXY BASED PRIMER.
5. THE OUTSIDE SURFACE OF STAND POST SHALL BE PAINTED WITH THREE COATS OF ANTI-CORROSIVE FIRE RED PAINT AS PER IS 2932 CONFORMING TO SHADE NO. 536 TO IS5 OVER 2 COATS OF RED OXIDE ZINC CHROMATE PRIMER OR A SINGLE COAT OF ALUMINUM PAINT
6. THE INTERNAL SURFACE SHALL BE PAINTED WITH THREE COATS OF CHLORINATED RUBBER BASED RESIN PAINT OVER 2 COATS OF RED OXIDE ZINC CHROMATE PRIMER OR A SINGLE COAT OF ALUMINUM PAINT.
7. EACH LANDING VALVE SHALL BE CLEARLY AND PERMANENTLY MARKED WITH THE FOLLOWING: A) MANUFACTURERS NAME OR
TRADE MARK. B) YEAR OF MANUFACTURE. C) PURCHASER NAME. D) BIS CERTIFICATION MARKING ON LANDING VALVE AND COUPLINGS.
8. LANDING VALVE SHALL BE BIS MARKED AND APPROVED. VENDOR SHALL SUBMIT THE ISI CERTIFICATE.

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PROJECT BINA PETROCHEMICAL AND REFINERY EXPANSION PROJECT (B CLIENT BHARAT PETROLEUM CORPORATION LTD.
UNIT OFFSITE JOB NO. B957 UNIT NO. 999

9 RO SHALL BE PROVIDED AT THE INLET OF EACH LANDING VALVE AS PER THE GAD ATTACHED WITH THE TENDER/ MR. THE SIZE OF RO SHALL BE AS PER THE DATA SHEET ATTACHED WITH THE TENDER/MR.

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PDS B957-500-79-41-DS-1208 REV.0

NOZZLES AND CONNECTIONS (नोजल व कनैक्शन)

MARK मार्क	QTY क्वान्टिटी	NOM. DIA नामिनल डांया	SCH./THK. शड्ल व थिकनैस	FLANGES CLASS क्लास	FLANGES TYPE टाईप	FLANGES FACING फेसिग	PROJECTION NOTE-4 प्रोजेक्शन	PAD W x T पैड	SERVICE सर्विस
F	1	150	120	300	WN	RF	SEE DWG.	85 X T	FEED
V	1	50	160	300	WN	RF	SEE DWG.	-	VENT
UC	1	50	160	300	WN	RF	SEE DWG.	-	UTILITY CONNECTION
LI 1-2	2	150 (H)	120	300	WN	RF	SEE DWG.	70XT	LEVEL INSTRUMENT + STILL WELL
TI1	1	50	160	300	WN	RF	SEE DWG.	-	TEMPERATURE INSTRUMENT
TI2	1	50	160	300	WN	RF	SEE DWG.	-	TEMPERATURE INSTRUMENT + STILL WELL
MH	1	600	14 THK.	150	WN	RF	SEE DWG.	250X T	MANHOLE+BF+GASKET+BOLTING+HINGE
PD 1-2	2	(H)	BY PUMP VENDOR						PUMP DISCHARGE
P 1-2	2	600 (H)	14 THK.	150	WN	RF	SEE DWG.	250X T	PUMP NOZZLE
FL	1	80(H)	160	300	WN	RF	SEE DWG.	-	FLARE
V1	1	150	120	150	WN	RF	SEE DWG.	70XT	VENTILATION + BF GASKET + BOLTING
S1	1	500	14 THK.	150	WN	RF	SEE DWG.	215xT	MOUNTING NOZZLE BF + GASKET + BOLTING FOR UC, TI1
S2	1	450	14 THK.	150	WN	RF	SEE DWG.	195xT	MOUNTING NOZZLE BF + GASKET + BOLTING FOR FL, TI2

T' DENOTES CORRESPONDING SHELL/DISH END NOMINAL THICKNESS

H' DENOTES (HOLD)

LICENSOR'S SPECIFICATION
लाईसेन्सर स्पेसिफिकेशन

FOUNDATION LOADING DATA (OPERATING CONDITION)
फॉउन्डेशन लोडिगं डाटा (ऑपरेटिंग कनडिशन)

TYPE	MAX MOMENT AT BASE (M) (kgm)	MAX. SHEAR FORCE AT BASE (H) (kg)
SEISMIC (DB)	-	-
WIND	-	-

GENERAL NOTES (जनरल नोट्स)

UNLESS STATED OTHER WISE

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. ~~ALL ANCHOR BOLT HOLES TO STRADDLE N/S CENTRE LINE.~~
3. NORTH DIRECTION WHEREVER SHOWN IS WITH RESPECT TO PLAN VIEW.
4 (A). ~~FOR NOZZLES ON SHELL PROJECTIONS ARE REFERRED FROM VESSEL CENTER LINE TO FLANGE CONTACT FACE.~~
4 (B). ~~FOR NOZZLES ON HEAD PROJECTIONS ARE REFERRED FROM HEAD T.L TO FLANGE CONTACT FACE.~~
5. THE INDICATED THICKNESS IS THE MINIMUM ACCEPTABLE AFTER CONSTRUCTION.
6. FLANGE GASKET FACE SHALL HAVE 125 AARH FINISH.
7. DIMENSIONS OF FLANGES FOR NOZZLES UPTO 600NB SHALL BE AS PER ASME B16.5 AND FOR NOZZLE ABOVE 600NB SHALL BE AS PER ASME B16.47 SERIES-B UNLESS SPECIFIED OTHERWISE.
8. ID OF WELD NECK FLANGES SHALL MATCH WITH CORRESPONDING ID OF NOZZLE PIPE/SHELL.
9. NOZZLES SHALL BE STIFFENED WITH 4 NOS. 100 x 10 THK FLATS AT 90 DEG.APART. MANHOLE,PUMP NOZZLE AND MOUNTING NOZZLES SHALL BE STIFFENED WITH 8 NOS 10THKx R.F PAD WIDE FLATS EQUISPACED.
10. ALL FABRICATED NOZZLES SHALL BE 100% RADIOGRAPHED.
11. NOZZLES SHOWN WITH BLIND FLANGES / REDUCING FLANGES SHALL BE PROVIDED WITH BOLTS/NUTS AND GASKETS.
12. SURFACE PREPARATION, SHOP PRIMER & FINISH PAINT AS PER JOB SPECIFICATION FOR SURFACE PREPARATION AND PROTECTIVE COATING IS IN VENDOR'S SCOPE. EXTERNAL COATING SHALL BE AS PER TABLE 10.2 OF JOB SPECIFICATION.
13. THE VESSEL SHALL BE LOCATED IN RCC PIT AND SAND PACKED WITH VIBRO COMPRESSION WITH 100mm THK OF LEAN CONCRETE ON TOP (BY OTHERS).
14 (a). SIZE OF SUMP1-2 & NOZZLE P1-2 IS UNDER HOLD & SHALL BE AS CONFIRMED BY PUMP VENDOR.
14 (b). PUMP NOZZLE COVER / BLIND FLANGE WITH PUMP ASSEMBLY, NOZZLES PD1-2,BOLTING & GASKET SHALL BE SUPPLIED BY PUMP SUPPLIER.
15. CATHODIC PROTECTION IS BY OTHERS. HOWEVER,CLIP FOR THE SAME TO BE PROVIDED BY VENDOR.
16. UNLESS OTHERWISE SPECIFIED MINIMUM THICKNESS OF WELDED/BOLTED CS INTERNAL SHALL BE 12mm. IN CASE OF PIPE AND PIPE FITTINGS SCHEDULE TO BE SELECTED ACCORDINGLY.
17. VESSEL SHALL BE SUBJECTED TO STEAM OUT CONDITIONS OF 0.5 Kg/Cm²(g) AT 190 ºC.
18. LIFTING LUG FOR HANDLING OF VESSEL SHALL BE DESIGNED (CONSIDERING IMPACT FACTOR 1.5) AND PROVIDED BY VENDOR. INDICATIVE DETAILS ARE FURNISHED ON SHEET-3.

SPECIFICATIONS (स्पेसिफिकेशन्स)

X	DENOTES APPLICABLITY	
X	GENERAL SPEC. FOR PRESSURE VESSELS	6-12-0001
X	STD. SPEC. FOR CS VESSELS	6-12-0002
X	STD. SPEC. FOR BQCS PLATE	6-12-0011
X	SPEC. FOR SURFACE PREPARATION & PROTECTIVE COATING	B957-000-06-42-PLS-01

STANDARDS (स्टैण्डर्डस)

X	VESSEL TOLERANCES	7-12-0001
	SUPPORT FOR HORIZONTAL VESSEL	7-12-0002
	WOODEN PILLOWS FOR SADDLE SUPPORT	7-12-0003
	SKIRT BASE DETAILS	7-12-0004
	SKIRT OPENING DETAILS	7-12-0005
	ANGLE LEG SUPPORT	7-12-0006
	PIPE LEG SUPPORT	7-12-0007
	BRACKET SUPPORT FOR VERTICAL VESSEL	7-12-0008
X	MANHOLE WITH HINGED COVER	7-12-0009
	MANHOLE WITH DAVIT	7-12-0010
	LADDER RUNGS FOR MANHOLE/DEMISTER	7-12-0011
	RETAINING PLATE	7-12-0012
X	NOZZLE REINFORCEMENT AND PROJECTION	7-12-0013
	PAD NOZZLES FOR VESSELS	7-12-0014
X	STANDARD BOLT HOLE ORIENTATION	7-12-0015
	ALLOY LINER DETAILS	7-12-0016
	SIGHT GLASSES FOR PRESSURE VESSELS	7-12-0017
	INTERNAL FLANGES	7-12-0018
	VORTEX BREAKERS	7-12-0019
	INLET DEFLECTOR BAFFLE	7-12-0020
	SUPPORT RING AND BOLTING BAR	7-12-0021
	SUPPORT RING SIZES FOR PACKED TOWERS	7-12-0022
	PIPE DAVIT	7-12-0023
	LIFTING LUG TOP HEAD TYPE	7-12-0024
	FIRE PROOFING AND INSULATION SUPPORTS	7-12-0025
X	EARTHING LUG	7-12-0026
X	NAME PLATE	7-12-0027
X	MANUFACTURER NAME PLATE	7-12-0028
X	BRACKET FOR NAME PLATE	7-12-0029
	NAME PLATE FOR SMALL EQUIPMENT	7-12-0030
	DETAILS OF FORGED NOZZLES	7-12-0031
X	SUPPORTS FOR INTERNAL FEED PIPE	7-12-0032
	HOT INSULATION SUPPORT FOR HORIZONTAL VESSEL	7-12-0033
	PIPE DAVIT SUPPORT FOR COLD INS. VESSELS	7-12-0034
	TYP. DETAILS OF WIRE MESH DEMISTER SUPPORTS	7-12-0036
	S.R NOZZLE NECK	7-12-0037
X	ALLOWABLE NOZZLE LOADS	7-12-0038
X	STILL WELL FOR LEVEL TRANSMITTER (RADAR TYPE) FOR BURIED VESSEL	7-12-0039

REFERENCE DRAWINGS(रेफरेन्स डाईग)

NOZZLE ORIENTATIONS	
LADDERS/PLATFORM CLEATS	NOT APPLICABLE
PIPE SUPPORT CLEATS	NOT APPLICABLE
TRAY SUPPORT AND BOLTING BARS	NOT APPLICABLE
DEMISTER DATA SHEET	NOT APPLICABLE

HOLD UPS (होल्ड अप्स)

X	NOZZLE ORIENTATIONS	X	SIZE OF NOZZLES (AS MARKED)
X	NOZZLE ELEVATIONS (AS MARKED)		PIPE SUPPORT CLEATS
	SUPPORT HEIGHT		LADDER/PLATFORM CLEATS
	DETAILS OF INTERNALS		TRAY SUPPORT/BOLTING BARS
X	STILL WELL FOR LI 1-2 & TI2		PIPE DAVIT
X	SUMP DIAMETER, LENGTH		PACKING SUPPORT
X	BURIED HEIGHT		

DESIGN DATA (डिजाइन डाटा)

CODE	ASME SEC.-VIII DIV.-1 EDITION 2023
WORKING PRESSURE (kg/cm²g)	0.1-1.7
DESIGN PRESSURE (kg/cm²g)	INT. 3.5 EXT. -
WORKING TEMPERATURE (°C)	AMB.
DESIGN TEMPERATURE (°C)	150
MDMT (°C)	1.1
CORROSION ALLLOWANCE (MM)	SHELL:3.0 BOOT:6.0
TYPE OF HEAD	2:1 ELLIPSOIDAL
JOINT EFFICIENCY	SHELL 0.85 HEAD 1
RADIOGRAPHY	SHELL SPOT HEAD FULL
POST WELD HEAT TREATMENT	AS PER CODE/SPEC.
HEAT TREATMENT	HEAD: AS PER CODE /SPEC.
OPERATING MEDIUM	HYDROCARBON
SP. GRAVITY	0.635 TO 0.930
WIND SPECIFICATION	IS 875
SEISMIC	IS 1893 + SITE SPECTRA
CAPACITY (M³)	60
PAINTING/CLEANING	REFER AS PER JOB SPEC.
INSULATION THICKNESS (mm)	NIL ☐ HOT ☐ COLD
FIRE PROOFING CLEATS	☐ YES ☒ NO
HYDROSTATIC TEST (kg/cm2g)	HORIZONTAL / ~~VERTICAL~~ (AT TOP)
PRESSURE (NEW & COLD)	4.55
INSPECTION BY	☒ EIL ☐ CIB ☐ TPIA

MATERIAL OF CONSTRUCTION (मैटिरियल ऑफ कन्सट्रक्शन)

(AS PER ASME / IS ~~OR EQUIVALENT~~)

SHELL/BOOT	SA 516 Gr.70
REINFORCEMENT PAD	SA 516 Gr.70
HEADS	SA 516 Gr.70
SHELL FLANGES	-
NOZZLE FLANGES / BLIND FLANGE	SA 105
NOZZLE NECK UPTO 250 NB	SA 106 GR. B
NOZZLE NECK ABOVE 250 NB	SA 516 Gr.70
PIPE FITTINGS	SA 234 GR. WPB
GASKET EXTERNAL	SPIRAL WOUND GASKET WITH SS 304
	METAL WINDING AND GRAFOIL FILLER
	MATERIAL WITH CS OUTER & SS 304
	INNER RING AS PER ASME B 16.20.
GASKET INTERNAL	-
EXTERNAL STUDS/BOLTS/NUTS	SA 193 GR.B7 / SA 194 GR.2H
INTERNAL STUDS/BOLTS/NUTS	-
SUPPORT	SA 516 Gr.70
SUPPORT BASE	-
INTERNAL PARTS (WELDED)	SA 516 Gr.70 / SA 106 GR.B
INTERNAL PARTS (BOLTED)	-
CLIPS & ATTACHMENTS (EXTERNAL)	SA 516 Gr.70
WRAPPER PLATE	SA 516 Gr.70
DEMISTER/GRID	-
PAD FOR EXTERNAL ATTACHMENTS	SA 516 Gr.70
LIFTING LUG	SA 516 Gr.70
STIFFENER	SA 516 Gr.70
STILL WELL FOR LI1 & LI2	SS304L

CATHODIC PROTECTION REQUIRED

@ WITHOUT PUMP ASSEMBLY

SPECIAL SERVICE : --

STATUTORY REGULATIONS (स्टैचुअरी रेगुलेशन्स)

INDIAN BOILER REGULATIONS (IBR)

DEPARTMENT OF EXPLOSIVES, NAGPUR (CCOE)

APPROXIMATE WEIGHT (kgs) (PER ITEM) (एपरौक्सिमेंट वजन)

ERECTION	26000@	OPERATING	70600@
HYDROTEST(SHOP)	86100@	HYDROTEST (FIELD)	86100@
NUMBER OF ITEMS :	ONE		

ENGINEERS INDIA LIMITED
NEW DELHI
इंजीनियर्स इंडिया लिमिटेड
(भारत सरकार का उपक्रम)

BHARAT PETROLEUM CORP. LTD.
BINA PETROCHEMICAL & REFINERY EXPANSION PROJECT (BPREP)

REV	DATE	REVISION	BY	CHECKED	APPROVED
A	09.10.2025	ISSUED FOR BIDS/ENGG.	AS	RR/VIVEK	PB

DESIGN DATA	डिजाइन डाटा	DRAWING NUMBER / डाईग नम्बर	REV
CLOSED BLOWDOWN VESSEL	क्लोज्ड ब्लो डाउन वेसल	B957-500-80-42-DS-3203	A
ITEM NO. 500-VV-HI-003	आइटम नम्बर 500-वीवी-एचआइ-003	SHEET 1 OF 3	

FORMAT NO.3-8042-0501 REV.0 [28.02.2024] A3-420 X 297

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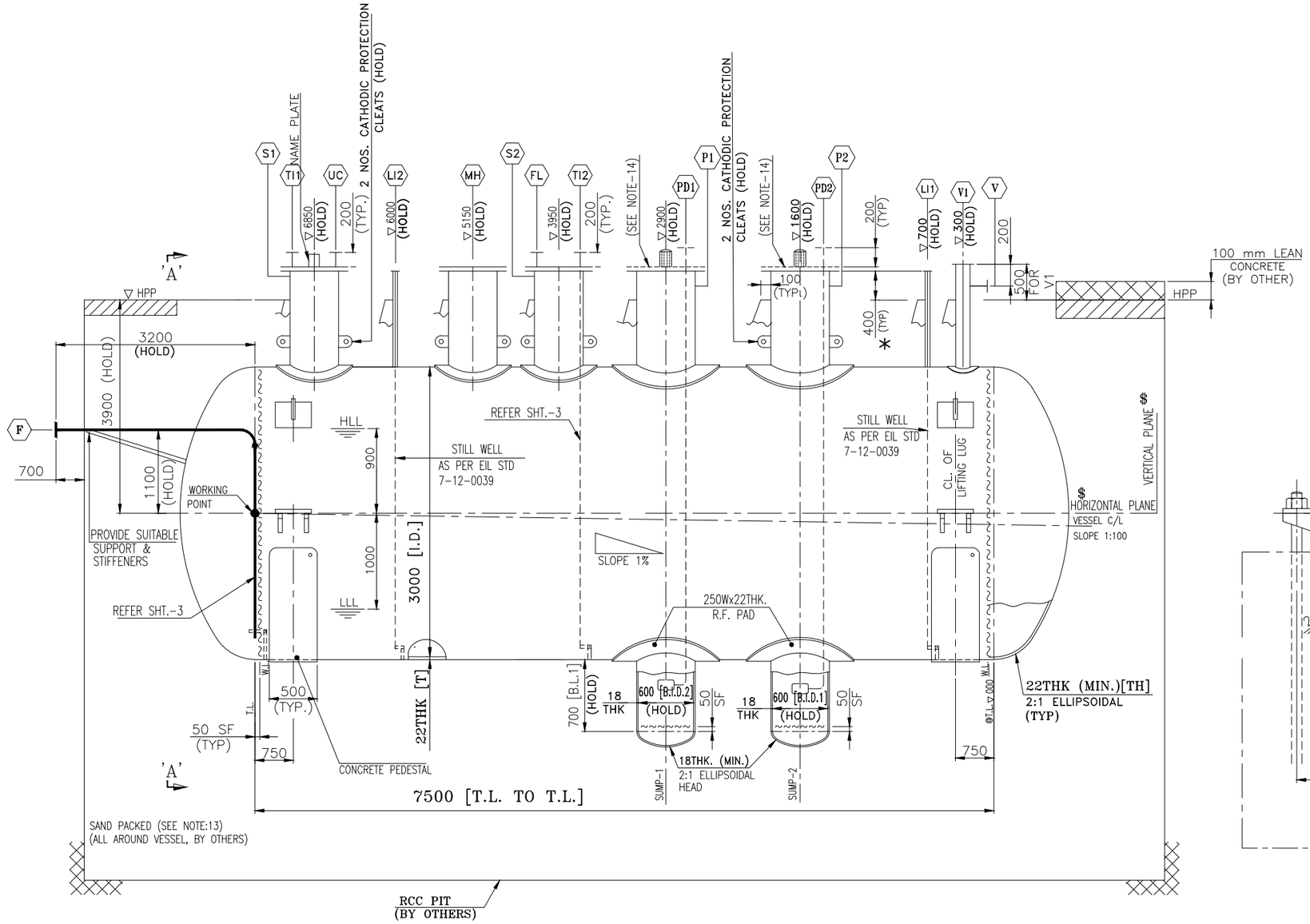
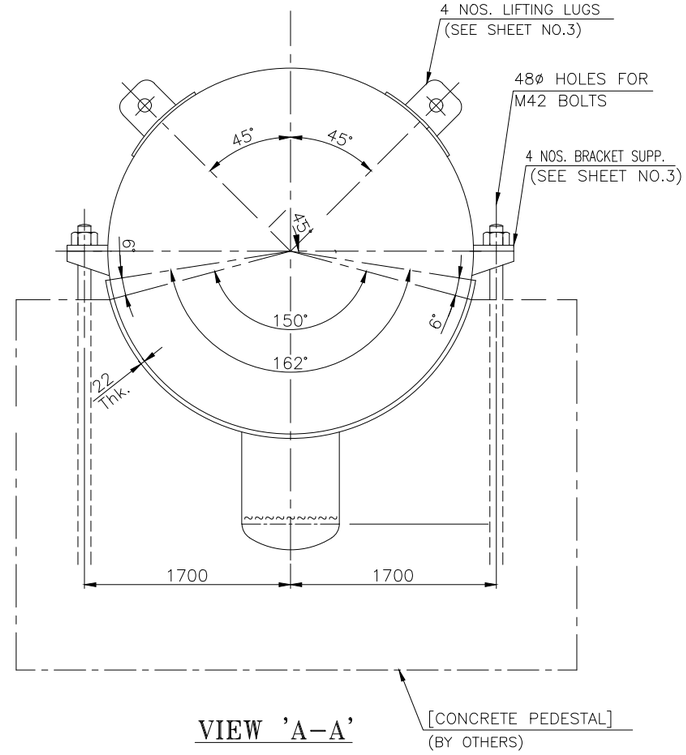
STRUCTURE SHALL NOTE THAT VESSEL HAS SLOPE OF 1% (1 IN 100) CONCRETE SADDLE HEIGHT SHALL BE MAINTAINED SUCH THAT THE ABOVE SLOPE IS ACHIEVED WHEN VESSEL IS INSTALLED ON CONCRETE SADDLE. FOUNDATION BOLTS (IN SADDLE) SHALL BE PARALLEL TO VERTICAL PLANE.

$ NOZZLES AND GASKET FACE OF FLANGES SHALL BE PARALLEL TO VERTICAL PLANE/HORIZONTAL PLANE. TOP SURFACE OF SUPPORT BRACKET SHALL BE PARALLEL TO HORIZONTAL PLANE.

* NOZZLES MAY BE SUITABLY CUT WITH WELD EDGE PREPARATION (WITH SUITABLE COVER)FOR TRANSPORTATION. SUITABLE CUTTING ALLOWANCE IN NOZZLES SHALL BE CONSIDERED TO MAINTAIN THE GIVEN PROJECTION.FINAL ASSEMBLY OF NOZZLES AT SITE SHALL BE BY OTHERS (NOT BY VESSEL FABRICATOR)

@ NOZZLE/SUMP LOCATION ONE WITH RESPECT TO VERTICAL PLANE





VIEW 'A-A'

ENGINEERS INDIA LIMITED
NEW DELHI

BHARAT PETROLEUM CORP. LTD.
BINA PETROCHEMICAL & REFINERY EXPANSION PROJECT (BPREP)

REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED
A	09.10.2025	ISSUED FOR BIDS/ENGG.	AS	RR/VIVEK	PB	

VESSEL DESIGN DATA
CLOSED BLOW DOWN VESSEL
ITEM NO. 500-VV-HI-003

वेसेल डिजाइन डाटा
क्लोज्ड ब्लो डाउन वेसल
आइटम नम्बर 500-वीवी-एचआइ-003

DRAWING NO. B957-500-80-42-DS-3203
REV. A
SHEET 2 OF 3

1-1641-0503 REV.0 A3-420x297

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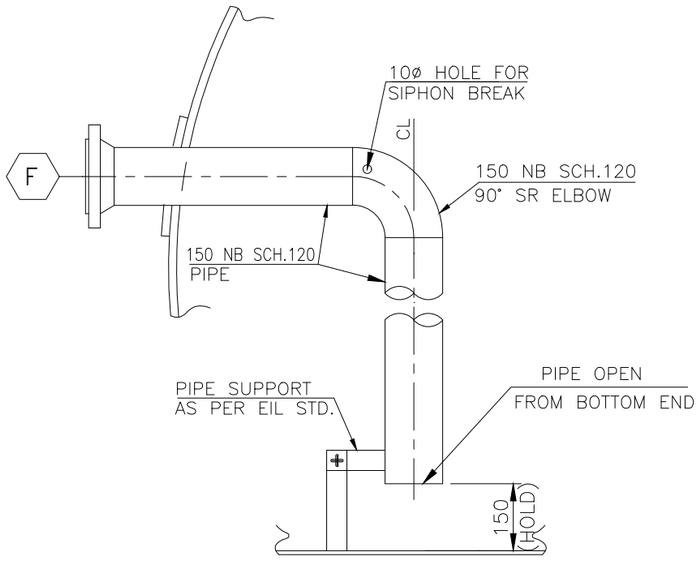
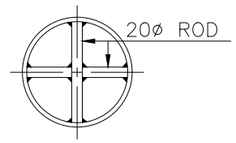
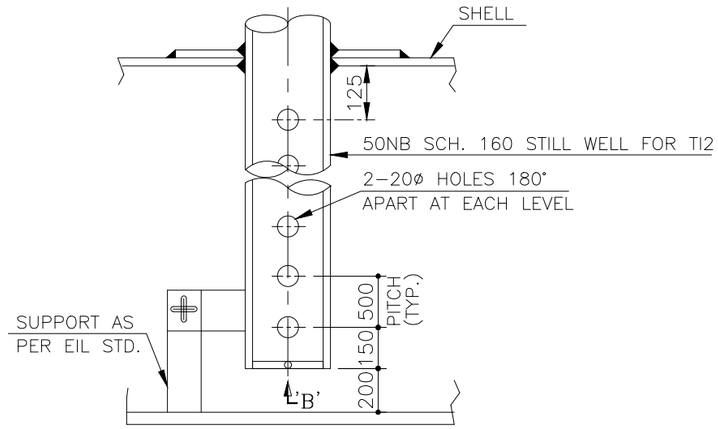


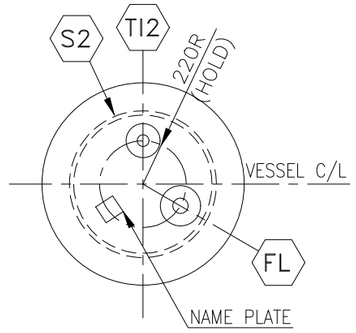
DETAIL OF NOZZLE–F



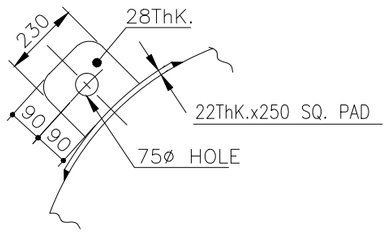
VIEW 'B'
(TYP)



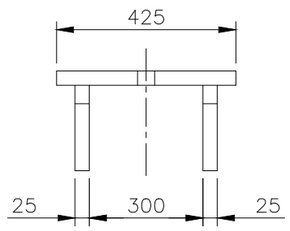
DETAIL OF NOZZLE TI2
(HOLD)



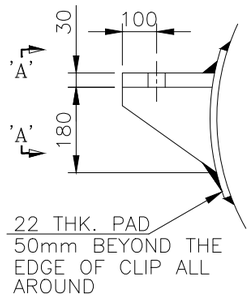
PLAN FOR
MOUNTING NOZZLE S2 (HOLD)
(FOLLOW AS PER NOZZLE ORIENTATION)



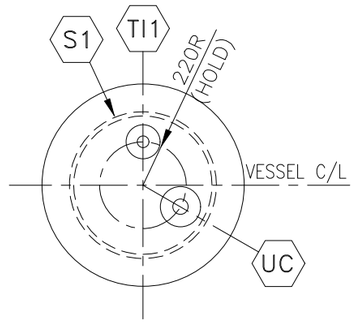
DETAIL OF LIFTING LUG (TYP)



VIEW 'A–A'



DETAIL OF BRACKET SUPPORT (TYP)



PLAN FOR
MOUNTING NOZZLE S1 (HOLD)
(FOLLOW AS PER NOZZLE ORIENTATION)

ENGINEERS INDIA LIMITED
NEW DELHI

BHARAT PETROLEUM CORP. LTD.
BINA PETROCHEMICAL & REFINERY EXPANSION PROJECT (BPREP)

REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED
A	09.10.2025	ISSUED FOR BIDS/ENGG.	AS	RR/VIVEK	PB	

VESSEL DESIGN DATA
CLOSED BLOW DOWN VESSEL
ITEM NO. 500-VV-HI-003

वेसेल डिजाइन डाटा
क्लोज्ड ब्लो डाउन वेसल
आइटम नम्बर 500-वीवी-एचआइ-003

DRAWING NO. B957-500-80-42-DS-3203
REV. A
SHEET 3 OF 3

1-1641-0503 REV:0 A3-420x297

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NOZZLES AND CONNECTIONS (नोजल व कनैक्शन)

MARK	QTY	NOM. DIA	SCH./THK.	FLANGES			PROJECTION NOTE-4	PAD W x T	SERVICE
		नामिनल	शड्यूल व	CLASS	TYPE	FACING			
मार्क	क्वान्टिटी	डांया	थिकनैस	क्लास	टाईप	फेसिग	प्रोजेशन	पैड	सर्विस
F	1	150	80	300	WN	RF	720	70X T	FEED
T	1	150	80	300	WN	RF	SEE DWG.	85xT	TOP OUTLET
B	1	50	160	600	WN	RF	SEE DWG.	-	BOTTOM OUTLET
V	1	50	160	600	WN	RF	SEE DWG.	-	VENT
UC	1	50	160	300	WN	RF	670	-	UTILITY CONNECTION
SP 1-2	2	50	160	300	WN	RF	670	-	STAND PIPE
LT 1-2	2	50	160	300	WN	RF	670	-	LEVEL INSTRUMENT
SV	1	50 (H)	160	600 (H)	WN	RF	670	-	SAFETY VALVE
MH	1	500	14 THK.	300	WN	RF	820	215X T C	MANHOLE + BF + HINGED
PI	1	50	160	300	WN	RF	670	-	PRESSURE INSTRUMENT

T' DENOTES CORRESPONDING SHELL/DISH END NOMINAL THICKNESS

LICENSOR'S SPECIFICATION
लाईसेन्सर स्पेसिफिकेशन

FOUNDATION LOADING DATA (OPERATING CONDITION)(HOLD) फॉउडेशन लाडिगं डाटा (ऑपरटिंग कनडिशन)		
TYPE	MAX MOMENT AT BASE (M) (kgm)	MAX. SHEAR FORCE AT BASE (H) (kg)
SEISMIC	-	-
WIND	-	-

PDS B957-500-79-41-DS-1204 REV.0

GENERAL NOTES (जनरल नोट्स)

UNLESS STATED OTHER WISE

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. ALL ANCHOR BOLT HOLES TO STRADDLE N/S CENTRE LINE.
3. NORTH DIRECTION WHEREVER SHOWN IS WITH RESPECT TO PLAN VIEW.
4 (A). FOR NOZZLES ON SHELL PROJECTIONS ARE REFERRED FROM VESSEL CENTER LINE TO FLANGE CONTACT FACE.
4 (B). FOR NOZZLES ON HEAD PROJECTIONS ARE REFERRED FROM HEAD T.L TO FLANGE CONTACT FACE.
5. THE INDICATED THICKNESS IS THE MINIMUM ACCEPTABLE AFTER CONSTRUCTION.
6. FLANGE GASKET FACE SHALL HAVE 125 AARH FINISH.
7. DIMENSIONS OF FLANGES FOR NOZZLES UPTO 600NB SHALL BE AS PER ASME B16.5 AND FOR NOZZLE ABOVE 600NB SHALL BE AS PER ASME B16.47 SERIES B UNLESS SPECIFIED OTHERWISE.
8. ID OF WELD NECK FLANGES SHALL MATCH WITH CORRESPONDING ID OF NOZZLE PIPE/SHELL.
9. NOZZLES 50NB AND BELOW SHALL BE STIFFENED WITH 2 NOS. 40 x 6 THK FLATS 90º APART.
10. SURFACE PREPARATION, SHOP PRIMER & FINISH PAINT AS PER JOB SPECIFICATION FOR SURFACE PREPARATION AND PROTECTIVE COATING IS IN VENDOR'S SCOPE. C
11. ALL FABRICATED NOZZLES SHALL BE 100% RADIOGRAPHED.
12. NOZZLE SHOWN WITH BLIND FLANGES SHALL BE PROVIDED WITH BOLTS/NUTS AND GASKET.
13. ALL PLATES AND WELDS INCLUDING HAZ SHALL BE IMPACT TESTED AT (-)47ºC WITH MIN. ENERGY VALUE AS PER FIG. U.G. 84.1 OF ASME SEC.VIII DIV.1.
14. VESSEL SHALL BE SUBJECTED TO STEAM OUT CONDITIONS OF 0.5 Kg/Cm²(g) AT 190ºC
15. REFER CL. 3.2 (b) OF 6-12-0011 CEQ SHALL BE READ AS 0.47 (MAX.).
16. VENDOR TO PROVIDE WOODEN BLOCK FOR PIPE DAVIT SUPPORT AS PER EIL STD. 7-12-0034.

SPECIFICATIONS (स्पेसिफिकेशन्स)

X	DENOTES APPLICABLITY	
X	GENERAL SPEC. FOR PRESSURE VESSELS	6-12-0001
X	SUPP. SPEC. FOR CS VESSELS	6-12-0002
X	STD. SPEC. FOR BQCS PLATE	6-12-0011
X	STD. SPEC. FOR STRUCTRAL QUALITY PLATES	6-12-0014
X	SPEC.FOR SURFACE PREPARATION&PROTECTIVE COATING	B957-000-06-42-PLS-01

STANDARDS (स्टैण्डर्डस)

X	VESSEL TOLERANCES	7-12-0001
	SUPPORT FOR HORIZONTAL VESSEL	7-12-0002
	WOODEN PILLOWS FOR SADDLE SUPPORT	7-12-0003
	SKIRT BASE DETAILS	7-12-0004
	SKIRT OPENING DETAILS	7-12-0005
	ANGLE LEG SUPPORT	7-12-0006
X	PIPE LEG SUPPORT	7-12-0007
	BRACKET SUPPORT FOR VERTICAL VESSEL	7-12-0008
X	MANHOLE WITH HINGED COVER	7-12-0009
C	MANHOLE WITH DAVIT	7-12-0010
X	LADDER RUNGS FOR MANHOLE/DEMISTER	7-12-0011
	RETAINING PLATE	7-12-0012
X	NOZZLE REINFORCEMENT AND PROJECTION	7-12-0013
	PAD NOZZLES FOR VESSELS	7-12-0014
X	STANDARD BOLT HOLE ORIENTATION	7-12-0015
	ALLOY LINER DETAILS	7-12-0016
	SIGHT GLASSES FOR PRESSURE VESSELS	7-12-0017
	INTERNAL FLANGES	7-12-0018
	VORTEX BREAKERS	7-12-0019
X	INLET DEFLECTOR BAFFLE	7-12-0020
	SUPPORT RING AND BOLTING BAR	7-12-0021
	SUPPORT RING SIZES FOR PACKED TOWERS	7-12-0022
X	PIPE DAVIT	7-12-0023
X	LIFTING LUG TOP HEAD TYPE	7-12-0024
X	FIRE PROOFING AND INSULATION SUPPORTS	7-12-0025
X	EARTHING LUG	7-12-0026
X	NAME PLATE	7-12-0027
X	MANUFACTURER NAME PLATE	7-12-0028
X	BRACKET FOR NAME PLATE	7-12-0029
	NAME PLATE FOR SMALL EQUIPMENT	7-12-0030
	DETAILS OF FORGED NOZZLES	7-12-0031
	SUPPORTS FOR INTERNAL FEED PIPE	7-12-0032
	HOT INSULATION SUPPORT FOR HORIZONTAL VESSEL	7-12-0033
X	PIPE DAVIT SUPPORT FOR COLD INS. VESSELS	7-12-0034
X	TYP. DETAILS OF WIRE MESH DEMISTER SUPPORTS	7-12-0036
	S.R NOZZLE NECK	7-12-0037
X	ALLOWABLE NOZZLE LOADS	7-12-0038

REFERENCE DRAWINGS(रेफरेन्स डाईग)

	NOZZLE ORIENTATIONS	
	LADDERS/PLATFORM CLEATS	
	PIPE SUPPORT CLEATS	
	TRAY SUPPORT AND BOLTING BARS	NOT APPLICABLE
X	DEMISTER DATA SHEET	B957-500-79-41-DS-1907

HOLD UPS (होल्ड अप्स)

X	NOZZLE ORIENTATIONS	X	SIZE OF NOZZLES (AS MARKED)
X	NOZZLE ELEVATIONS (AS MARKED)		PIPE SUPPORT CLEATS
X	SUPPORT HEIGHT		LADDER/PLATFORM CLEATS
	DETAILS OF INTERNALS		TRAY SUPPORT/BOLTING BARS
			PIPE DAVIT
			PACKING SUPPORT

DESIGN DATA (डिजाइन डाटा)

CODE	ASME SECTION VIII DIV-1 ED.2023
WORKING PRESSURE (kg/cm²g)	5-17.8
DESIGN PRESSURE (kg/cm²g)	INT. 22.5 EXT. -
WORKING TEMPERATURE (°C)	1.1-45.6
DESIGN TEMPERATURE (°C)	(-)47/65
MDMT (°C)	(-)47
CORROSION ALLOWANCE (mm)	3
TYPE OF HEAD	2:1 ELLIPSOIDAL
JOINT EFFICIENCY	SHELL 0.85 HEAD 1
RADIOGRAPHY	SHELL SPOT HEAD FULL
POST WELD HEAT TREATMENT	AS PER CODE / SPEC.
HEAT TREATMENT	HEAD: AS PER CODE / SPEC.
OPERATING MEDIUM	PROPYLENE
SP. GRAVITY	0.554
WIND SPECIFICATION	IS-875
SEISMIC	SITE SPECTRA + IS-1893
CAPACITY (M^3)	2.93
PAINTING/CLEANING	AS PER JOB SPECIFICATION (REFER NOTE-10)
INSULATION THICKNESS (mm) (IC)	NIL ☐ HOT ☐ COLD
FIRE PROOFING CLEATS	☒ YES ☐ NO
HYDROSTATIC TEST (kg/cm2g)	HORIZONTAL / VERTICAL (AT TOP)
PRESSURE (NEW & COLD)	29.25
INSPECTION BY	☒ EIL ☐ CIB ☐ TPIA

MATERIAL OF CONSTRUCTION (मैटिरियल ऑफ कन्सट्रक्शन)

(AS PER ASME / IS ~~OR EQUIVALENT~~)

SHELL	SA 537 CL.1 (#)
REINFORCEMENT PAD	SA 537 CL.1 (#)
HEADS	SA 537 CL.1 (#)
SHELL FLANGES	-
NOZZLE FLANGES / LWN	SA 350 GR.LF3
NOZZLE NECK UPTO 250 NB	SA 333 GR.3
NOZZLE NECK ABOVE 250 NB	SA 537 CL.1 (#)
PIPE FITTINGS	SA 420 GR. WPL3
GASKET EXTERNAL	SPIRAL WOUND GASKET WITH SS 304
	METAL WINDING AND GRAFOIL FILLER
	MATERIAL WITH CS OUTER & SS 304
	INNER RING AS PER ASME B 16.20.
GASKET INTERNAL	-
EXTERNAL STUDS/BOLTS/NUTS	SA 320 Gr.L7/ SA 194 GR.7
INTERNAL STUDS/BOLTS/NUTS	SS 304L
~~SKIRT~~/SUPPORT	SA 106 GR.B
~~SKIRT~~/SUPPRT BASE	IS 2062 GR. E 250 QUALITY BR/B0
INTERNAL PARTS (WELDED)	SA 537 CL.1 (#)
INTERNAL PARTS (BOLTED)	SS 304L
CLIPS & ATTACHMENTS (EXTERNAL) DIRECTLY WELDED OVER VESSEL	SA 537 CL.1 (#)
CLIPS & ATTACHMENTS (EXTERNAL) WELDED OVER PAD	SA 537 CL.1 (#)
WRAPPER PLATE	-
DEMISTER/GRID	SS 304L
PAD FOR EXTERNAL ATTACHMENTS	SA 537 CL.1 (#)
LIFTING LUG	SA 537 CL.1 (#)

PLATFORM OR PIPE CLIP NOT TO BE SUPPORTED ON THE EQUIPMENT.

 # MATERIAL SHALL BE IMPACT TESTED AS PER SPEC./CODE.

SPECIAL SERVICE : -

STATUTORY REGULATIONS (स्टैचुअरी रेगुलेशन्स)

- **INDIAN BOILER REGULATIONS (IBR)**
- **DEPARTMENT OF EXPLOSIVES, NAGPUR (CCOE)**

APPROXIMATE WEIGHT (kgs) (PER ITEM) (एपरौक्सिमेंट वजन) (HOLD)

ERECTION	5100	OPERATING	6100
HYDROTEST(SHOP)	8100	HYDROTEST (FIELD)	8100
NUMBER OF ITEMS :	ONE		

REV	DATE	REVISION	BY	CHECKED	APPROVED
C	21.11.2025	REVISED & REISSUED FOR BIDS / ENGG.	AS	SM/VIVEK	PB
B	31.10.2025	REVISED & REISSUED FOR BIDS / ENGG.	AS	SM/VIVEK	PB
A	23.10.2025	ISSUED FOR BIDS / ENGG.	AS	SM/VIVEK	PB

ENGINEERS INDIA LIMITED
NEW DELHI
इंजीनियर्स इंडिया लिमिटेड
(भारत सरकार का उपक्रम)

BHARAT PETROLEUM CORP. LTD.
BINA PETROCHEMICAL & REFINERY EXPANSION PROJECT (BPREP)

DESIGN DATA	PROPYLENE UNLOADING COMP. SUCTION KOD
ITEM NO.	500-VV-VI-004
डिजाइन डाटा	प्रोपाइलीन अनलोडिंग कंप. सक्शन कोड
आइटम नम्बर	500-वीवी-वीआई-004
DRAWING NUMBER डाईग नम्बर	**B957-500-80-42-DS-3204** REV C
	SHEET 1 OF 2

FORMAT NO.3-8042-0501 REV.0 (28.02.2024) A3-420 X 297

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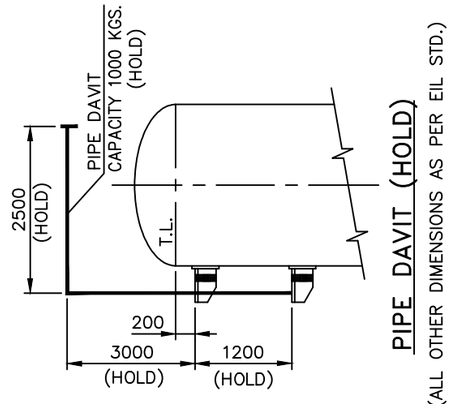
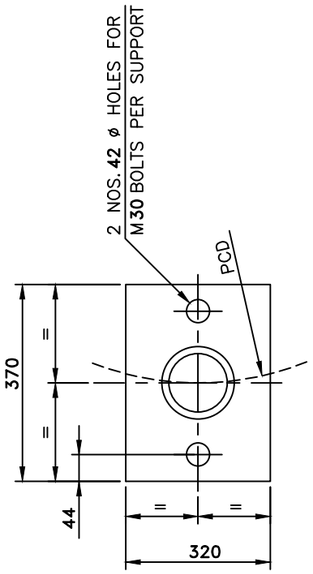


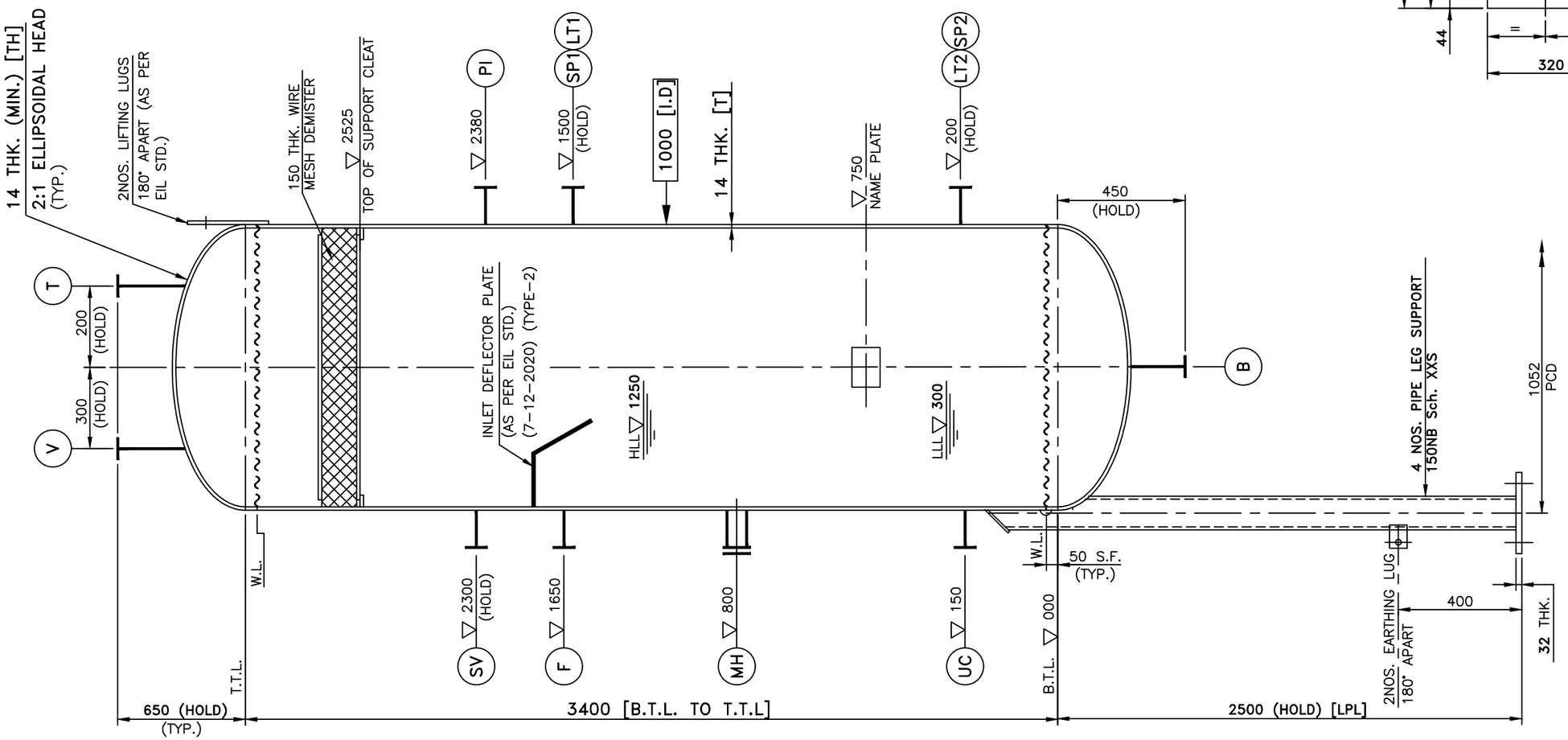
PIPE DAVIT (HOLD)

(ALL OTHER DIMENSIONS AS PER EIL STD.)



DETAIL OF BASE PLATE

(ALL OTHER DIMENSIONS AS PER EIL STD.)



ENGINEERS INDIA LIMITED
NEW DELHI

BHARAT PETROLEUM CORP. LTD.
BINA PETROCHEMICAL &
REFINERY EXPANSION
PROJECT (BPREP)

REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED
C	21.11.2025	REVISED & REISSUED FOR BIDS/ENGG.	AS	SM/VIVEK	PB	
B	31.10.2025	REVISED & REISSUED FOR BIDS/ENGG.	AS	SM/VIVEK	PB	
A	23.10.2025	ISSUED FOR BIDS/ENGG.	AS	SM/VIVEK	PB	

VESSEL DESIGN DATA
PROPYLENE
UNLOADING COMP.
SUCTION KOD
ITEM NO. 500-VV-VI-004

वेसेल डिजाइन डाटा
प्रोपाइलीन अनलोडिंग
कंप. सक्शन कोड
आइटम नम्बर 500-वीवी-वीआई-004

DRAWING NO. B957-500-80-42-DS-3204 | REV. C

SHEET 2 OF 2

1-1641-0503 REV.0 A3-420x297

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PDS B957-500-79-41-DS-1210 REV.0

NOZZLES AND CONNECTIONS (नोजल व कनैक्शन)

MARK	QTY	NOM. DIA	SCH./THK.	FLANGES			PROJECTION NOTE-4	PAD W x T	SERVICE
		नामिनल	शड्यूल व	CLASS	TYPE	FACING			
मार्क	क्वान्टिटी	डांया	थिकनैस	क्लास	टाईप	फेसिग	प्रोजेक्शन	पैड	सर्विस
F	1	150	120	300	WN	RF	SEE DWG.	85 X T	FEED
V	1	50	160	300	WN	RF	SEE DWG.	-	VENT
UC	1	50	160	300	WN	RF	SEE DWG.	-	UTILITY CONNECTION
LI 1-2	2	150 (H)	120	300	WN	RF	SEE DWG.	70XT	LEVEL INSTRUMENT + STILL WELL
TI1	1	50	160	300	WN	RF	SEE DWG.	-	TEMPERATURE INSTRUMENT
TI2	1	50	160	300	WN	RF	SEE DWG.	-	TEMPERATURE INSTRUMENT + STILL WELL
MH	1	600	14 THK.	150	WN	RF	SEE DWG.	250X T	MANHOLE+BF+GASKET+BOLTING+HINGE
PD 1-2	2	(H)	BY PUMP VENDOR						PUMP DISCHARGE
P 1-2	2	600 (H)	14 THK.	150	WN	RF	SEE DWG.	250X T	PUMP NOZZLE
FL	1	50(H)	160	300	WN	RF	SEE DWG.	-	FLARE
V1	1	150	120	150	WN	RF	SEE DWG.	70XT	VENTILATION + BF GASKET + BOLTING
S1	1	500	14 THK.	150	WN	RF	SEE DWG.	215xT	MOUNTING NOZZLE BF + GASKET + BOLTING FOR UC, TI1
S2	1	450	14 THK.	150	WN	RF	SEE DWG.	195xT	MOUNTING NOZZLE BF + GASKET + BOLTING FOR FL, TI2

T' DENOTES CORRESPONDING SHELL/DISH END NOMINAL THICKNESS

H' DENOTES (HOLD)

LICENSOR'S SPECIFICATION
लाईसेन्सर स्पेसिफिकशन्स

FOUNDATION LOADING DATA (OPERATING CONDITION)
फॉऊडशन लोडिगं डाटा (ऑपरेटिंग कनडिशन)

TYPE	MAX MOMENT AT BASE (M) (kgm)	MAX. SHEAR FORCE AT BASE (H) (kg)
SEISMIC (DB)	-	-
WIND	-	-

GENERAL NOTES (जनरल नोट्स)

UNLESS STATED OTHER WISE

1 ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2 ~~ALL ANCHOR BOLT HOLES TO STRADDLE N/S CENTRE LINE.~~
3 NORTH DIRECTION WHEREVER SHOWN IS WITH RESPECT TO PLAN VIEW.
4 (A) ~~FOR NOZZLES ON SHELL PROJECTIONS ARE REFERRED FROM VESSEL CENTER LINE TO FLANGE CONTACT FACE.~~
4 (B) ~~FOR NOZZLES ON HEAD PROJECTIONS ARE REFERRED FROM HEAD T.L TO FLANGE CONTACT FACE.~~
5 THE INDICATED THICKNESS IS THE MINIMUM ACCEPTABLE AFTER CONSTRUCTION.
6 FLANGE GASKET FACE SHALL HAVE 125 AARH FINISH.
7 DIMENSIONS OF FLANGES FOR NOZZLES UPTO 600NB SHALL BE AS PER ASME B16.5 AND FOR NOZZLE ABOVE 600NB SHALL BE AS PER ASME B16.47 SERIES-B UNLESS SPECIFIED OTHERWISE.
8 ID OF WELD NECK FLANGES SHALL MATCH WITH CORRESPONDING ID OF NOZZLE PIPE/SHELL.
9 NOZZLES SHALL BE STIFFENED WITH 4 NOS. 100 x 10 THK FLATS AT 90 DEG.APART. MANHOLE,PUMP NOZZLE AND MOUNTING NOZZLES SHALL BE STIFFENED WITH 8 NOS 10THKx R.F PAD WIDE FLATS EQUISPACED.
10 ALL FABRICATED NOZZLES SHALL BE 100% RADIOGRAPHED.
11 NOZZLES SHOWN WITH BLIND FLANGES / REDUCING FLANGES SHALL BE PROVIDED WITH BOLTS/NUTS AND GASKETS.
12 SURFACE PREPARATION, SHOP PRIMER & FINISH PAINT AS PER JOB SPECIFICATION FOR SURFACE PREPARATION AND PROTECTIVE COATING IS IN VENDOR'S SCOPE. EXTERNAL COATING SHALL BE AS PER TABLE 10.2 OF JOB SPECIFICATION.
13 THE VESSEL SHALL BE LOCATED IN RCC PIT AND SAND PACKED WITH VIBRO COMPRESSION WITH 100mm THK OF LEAN CONCRETE ON TOP (BY OTHERS).
14 (a) SIZE OF SUMP1-2 & NOZZLE P1-2 IS UNDER HOLD & SHALL BE AS CONFIRMED BY PUMP VENDOR.
14 (b) PUMP NOZZLE COVER / BLIND FLANGE WITH PUMP ASSEMBLY, NOZZLES PD1-2,BOLTING & GASKET SHALL BE SUPPLIED BY PUMP SUPPLIER.
15 CATHODIC PROTECTION IS BY OTHERS. HOWEVER,CLIP FOR THE SAME TO BE PROVIDED BY VENDOR.
16 UNLESS OTHERWISE SPECIFIED MINIMUM THICKNESS OF WELDED/BOLTED CS INTERNAL SHALL BE 12mm. IN CASE OF PIPE AND PIPE FITTINGS SCHEDULE TO BE SELECTED ACCORDINGLY.
17 VESSEL SHALL BE SUBJECTED TO STEAM OUT CONDITIONS OF 0.5 Kg/Cm²(g) AT 190 ºC.
18 LIFTING LUG FOR HANDLING OF VESSEL SHALL BE DESIGNED (CONSIDERING IMPACT FACTOR 1.5) AND PROVIDED BY VENDOR. INDICATIVE DETAILS ARE FURNISHED ON SHEET-3.
19 VESSEL CONTAIN BENZENE, TOLUENE AND XYLENE.
20 COMPLETE EQUIPMENT SHALL BE POST WELD HEAT TREATED. HARDNESS OF BASE METAL, WELDS AND HAZ AFTER PWHT SHALL BE LIMITED TO VALUES SPECIFIED IN 6-15-0091.
21 ALL BUTT WELD (CIRCUMFERENTIAL AND LONGITUDINAL SEAMS) IN PRESSURE PART INCLUDING NOZZLE NECK TO FLANGE, PIPE TO PIPE, PIPE TO PIPE FITTING SHALL BE 100% RADIOGRAPHED.

SPECIFICATIONS (स्पेसिफिकेशन्स)

X	DENOTES APPLICABLITY	
X	GENERAL SPEC. FOR PRESSURE VESSELS	6-12-0001
X	STD. SPEC. FOR CS VESSELS	6-12-0002
X	STD. SPEC. FOR BQCS PLATE	6-12-0011
X	STD. SPEC. FOR HARDNESS REQUIREMENT OF STATIC EQUIPMENTS.	6-15-0091
X	SPEC. FOR SURFACE PREPARATION & PROTECTIVE COATING	B957-000-06-42-PLS-01

STANDARDS (स्टैण्डर्डस)

X	VESSEL TOLERANCES	7-12-0001
	SUPPORT FOR HORIZONTAL VESSEL	7-12-0002
	WOODEN PILLOWS FOR SADDLE SUPPORT	7-12-0003
	SKIRT BASE DETAILS	7-12-0004
	SKIRT OPENING DETAILS	7-12-0005
	ANGLE LEG SUPPORT	7-12-0006
	PIPE LEG SUPPORT	7-12-0007
	BRACKET SUPPORT FOR VERTICAL VESSEL	7-12-0008
X	MANHOLE WITH HINGED COVER	7-12-0009
	MANHOLE WITH DAVIT	7-12-0010
	LADDER RUNGS FOR MANHOLE/DEMISTER	7-12-0011
	RETAINING PLATE	7-12-0012
X	NOZZLE REINFORCEMENT AND PROJECTION	7-12-0013
	PAD NOZZLES FOR VESSELS	7-12-0014
X	STANDARD BOLT HOLE ORIENTATION	7-12-0015
	ALLOY LINER DETAILS	7-12-0016
	SIGHT GLASSES FOR PRESSURE VESSELS	7-12-0017
	INTERNAL FLANGES	7-12-0018
	VORTEX BREAKERS	7-12-0019
	INLET DEFLECTOR BAFFLE	7-12-0020
	SUPPORT RING AND BOLTING BAR	7-12-0021
	SUPPORT RING SIZES FOR PACKED TOWERS	7-12-0022
	PIPE DAVIT	7-12-0023
	LIFTING LUG TOP HEAD TYPE	7-12-0024
	FIRE PROOFING AND INSULATION SUPPORTS	7-12-0025
X	EARTHING LUG	7-12-0026
X	NAME PLATE	7-12-0027
X	MANUFACTURER NAME PLATE	7-12-0028
X	BRACKET FOR NAME PLATE	7-12-0029
	NAME PLATE FOR SMALL EQUIPMENT	7-12-0030
	DETAILS OF FORGED NOZZLES	7-12-0031
X	SUPPORTS FOR INTERNAL FEED PIPE	7-12-0032
	HOT INSULATION SUPPORT FOR HORIZONTAL VESSEL	7-12-0033
	PIPE DAVIT SUPPORT FOR COLD INS. VESSELS	7-12-0034
	TYP. DETAILS OF WIRE MESH DEMISTER SUPPORTS	7-12-0036
	S.R NOZZLE NECK	7-12-0037
X	ALLOWABLE NOZZLE LOADS	7-12-0038
X	STILL WELL FOR LEVEL TRANSMITTER (RADAR TYPE) FOR BURIED VESSEL	7-12-0039

REFERENCE DRAWINGS(रेफरेन्स डाईग)

	NOZZLE ORIENTATIONS	
	LADDERS/PLATFORM CLEATS	NOT APPLICABLE
	PIPE SUPPORT CLEATS	NOT APPLICABLE
	TRAY SUPPORT AND BOLTING BARS	NOT APPLICABLE
	DEMISTER DATA SHEET	NOT APPLICABLE

HOLD UPS (होल्ड अप्स)

X	NOZZLE ORIENTATIONS	X	SIZE OF NOZZLES (AS MARKED)
X	NOZZLE ELEVATIONS (AS MARKED)		PIPE SUPPORT CLEATS
	SUPPORT HEIGHT		LADDER/PLATFORM CLEATS
	DETAILS OF INTERNALS		TRAY SUPPORT/BOLTING BARS
X	STILL WELL FOR LI 1-2 & TI2		PIPE DAVIT
X	SUMP DIAMETER, LENGTH		PACKING SUPPORT
X	BURIED HEIGHT		

DESIGN DATA (डिजाइन डाटा)

CODE	ASME SEC.-VIII DIV.-1 EDITION 2023
WORKING PRESSURE (kg/cm²g)	0.1-1.7 (HOLD)
DESIGN PRESSURE (kg/cm²g)	INT. 3.5 EXT. -
WORKING TEMPERATURE (°C)	AMB.-45
DESIGN TEMPERATURE (°C)	150
MDMT (°C)	1.1
CORROSION ALLLOWANCE (MM)	SHELL:3.0 BOOT:6.0
TYPE OF HEAD	2:1 ELLIPSOIDAL
JOINT EFFICIENCY	SHELL 1 HEAD 1
RADIOGRAPHY	SHELL FULL HEAD FULL
POST WELD HEAT TREATMENT	YES (NOTE-20)
HEAT TREATMENT	HEAD: AS PER CODE /SPEC.
OPERATING MEDIUM	AROMATIC HYDROCARBON (NOTE-19)
SP. GRAVITY	0.830 TO 0.860
WIND SPECIFICATION	IS 875
SEISMIC	IS 1893 + SITE SPECTRA
CAPACITY (M^3)	60
PAINTING/CLEANING	REFER AS PER JOB SPEC.
INSULATION THICKNESS (mm)	NIL ☐ HOT ☐ COLD
FIRE PROOFING CLEATS	☐ YES ☒ NO
HYDROSTATIC TEST (kg/cm2g)	HORIZONTAL /~~VERTICAL~~ (AT TOP)
PRESSURE (NEW & COLD)	4.55
INSPECTION BY	☒ EIL ☐ CIB ☐ TPIA

MATERIAL OF CONSTRUCTION (मैटिरियल ऑफ कन्सट्रक्शन)

(AS PER ASME / IS ~~OR EQUIVALENT~~)

SHELL/BOOT	SA 516 Gr.70
REINFORCEMENT PAD	SA 516 Gr.70
HEADS	SA 516 Gr.70
SHELL FLANGES	-
NOZZLE FLANGES / BLIND FLANGE	SA 105
NOZZLE NECK UPTO 250 NB	SA 106 GR. B
NOZZLE NECK ABOVE 250 NB	SA 516 Gr.70
PIPE FITTINGS	SA 234 GR. WPB
GASKET EXTERNAL	SPIRAL WOUND GASKET WITH SS 304
	METAL WINDING AND GRAFOIL FILLER
	MATERIAL WITH CS OUTER & SS 304
	INNER RING AS PER ASME B 16.20.
GASKET INTERNAL	-
EXTERNAL STUDS/BOLTS/NUTS	SA 193 GR.B7 / SA 194 GR.2H
INTERNAL STUDS/BOLTS/NUTS	-
SUPPORT	SA 516 Gr.70
SUPPORT BASE	-
INTERNAL PARTS (WELDED)	SA 516 Gr.70 / SA 106 GR.B
INTERNAL PARTS (BOLTED)	-
CLIPS & ATTACHMENTS (EXTERNAL)	SA 516 Gr.70
WRAPPER PLATE	SA 516 Gr.70
DEMISTER/GRID	-
PAD FOR EXTERNAL ATTACHMENTS	SA 516 Gr.70
LIFTING LUG	SA 516 Gr.70
STIFFENER	SA 516 Gr.70
STILL WELL FOR LI1 & LI2	SS304L

CATHODIC PROTECTION REQUIRED

@ WITHOUT PUMP ASSEMBLY

SPECIAL SERVICE : BENZENE, TOLUENE, XYLENE

STATUTORY REGULATIONS (स्टैचुअरी रेगुलेशन्स)

INDIAN BOILER REGULATIONS (IBR)

DEPARTMENT OF EXPLOSIVES, NAGPUR (CCOE)

APPROXIMATE WEIGHT (kgs) (PER ITEM) (एपरौक्सिमेंट वजन)

ERECTION	26000@	OPERATING	70600@
HYDROTEST(SHOP)	86100@	HYDROTEST (FIELD)	86100@
NUMBER OF ITEMS :	ONE		

A	08.10.2025	ISSUED FOR BIDS/ENGG.	AS	RR/VIVEK	PB		
REV	DATE	REVISION	BY	CHECKED	APPROVED		

ENGINEERS INDIA LIMITED
NEW DELHI
इंजीनियर्स इंडिया लिमिटेड
(भारत सरकार का उपक्रम)

BHARAT PETROLEUM CORP. LTD.
BINA PETROCHEMICAL &
REFINERY EXPANSION
PROJECT (BPREP)

DESIGN DATA	डिजाइन डाटा	DRAWING NUMBER / डाईग नम्बर	REV
AROMATIC BLOWDOWN VESSEL-III	एरोमैटिक ब्लोडाउन वेसल-III	B957-500-80-42-DS-3207	A
ITEM NO. 500-VV-HI-007	आइटम नम्बर 500-वीवी-एचआइ-007	SHEET 1 OF 3	

FORMAT NO.3-8042-0501 REV.0 (28.02.2024) A3-420 X 297

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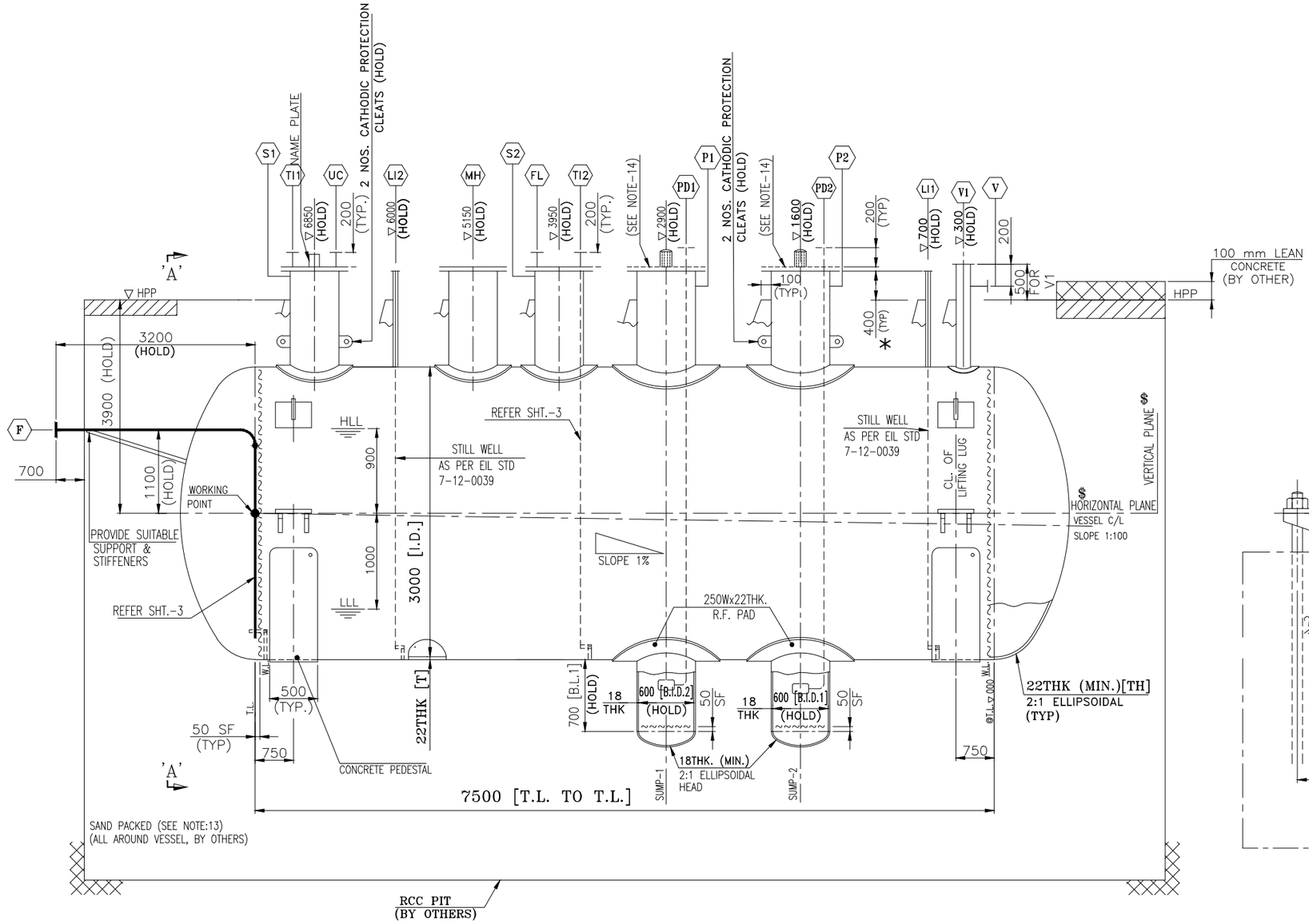
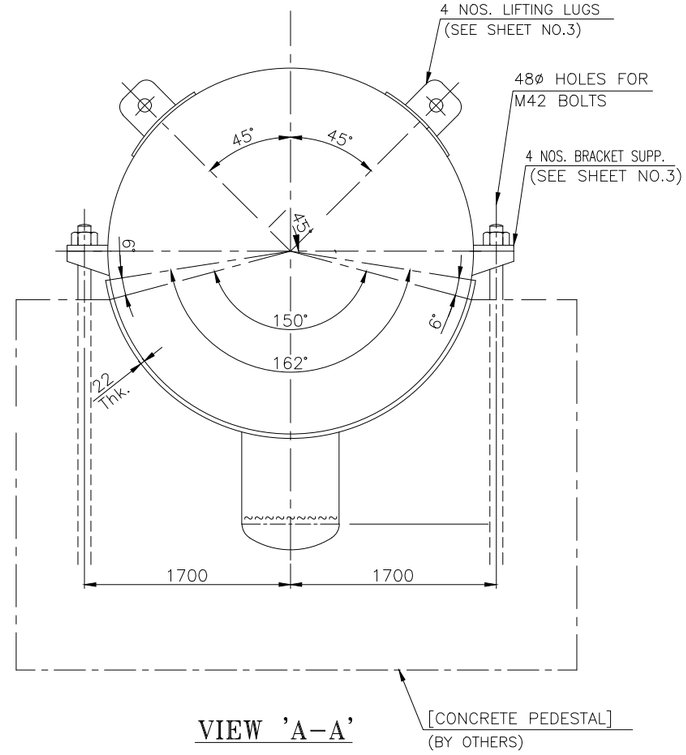
STRUCTURE SHALL NOTE THAT VESSEL HAS SLOPE OF 1% (1 IN 100) CONCRETE SADDLE HEIGHT SHALL BE MAINTAINED SUCH THAT THE ABOVE SLOPE IS ACHIEVED WHEN VESSEL IS INSTALLED ON CONCRETE SADDLE. FOUNDATION BOLTS (IN SADDLE) SHALL BE PARALLEL TO VERTICAL PLANE.

$ NOZZLES AND GASKET FACE OF FLANGES SHALL BE PARALLEL TO VERTICAL PLANE/HORIZONTAL PLANE. TOP SURFACE OF SUPPORT BRACKET SHALL BE PARALLEL TO HORIZONTAL PLANE.

* NOZZLES MAY BE SUITABLY CUT WITH WELD EDGE PREPARATION (WITH SUITABLE COVER)FOR TRANSPORTATION. SUITABLE CUTTING ALLOWANCE IN NOZZLES SHALL BE CONSIDERED TO MAINTAIN THE GIVEN PROJECTION.FINAL ASSEMBLY OF NOZZLES AT SITE SHALL BE BY OTHERS (NOT BY VESSEL FABRICATOR)

@ NOZZLE/SUMP LOCATION ONE WITH RESPECT TO VERTICAL PLANE





ENGINEERS INDIA LIMITED
NEW DELHI

BHARAT PETROLEUM CORP. LTD.
BINA PETROCHEMICAL & REFINERY EXPANSION PROJECT (BPREP)

REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED
A	07.10.2025	ISSUED FOR BIDS/ENGG.	AS	RR/VIVEK	PB	

VESSEL DESIGN DATA
AROMATIC BLOWDOWN VESSEL-III
ITEM NO. 500-VV-HI-007

वेसेल डिजाइन डाटा
एरोमैटिक ब्लोडाउन वेसल-III
आइटम नम्बर 500-वीवी-एचआइ-007

DRAWING NO. B957-500-80-42-DS-3207
REV. A
SHEET 2 OF 3

1-1641-0503 REV.0 A3-420x297

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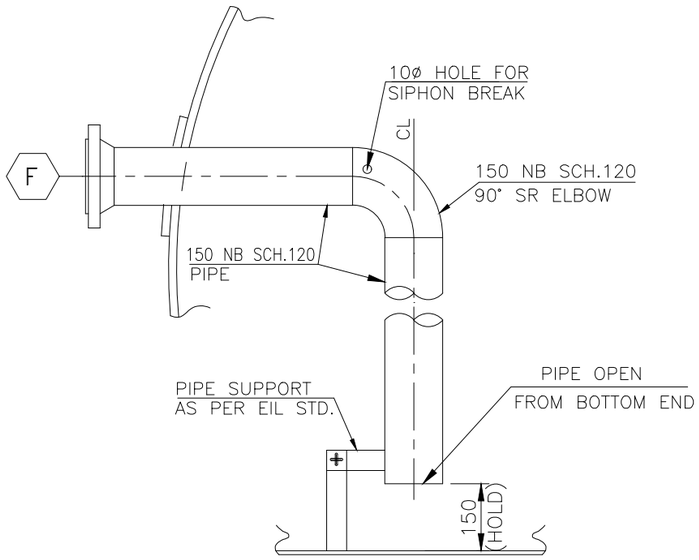
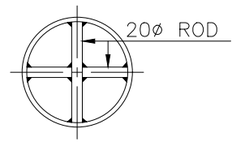
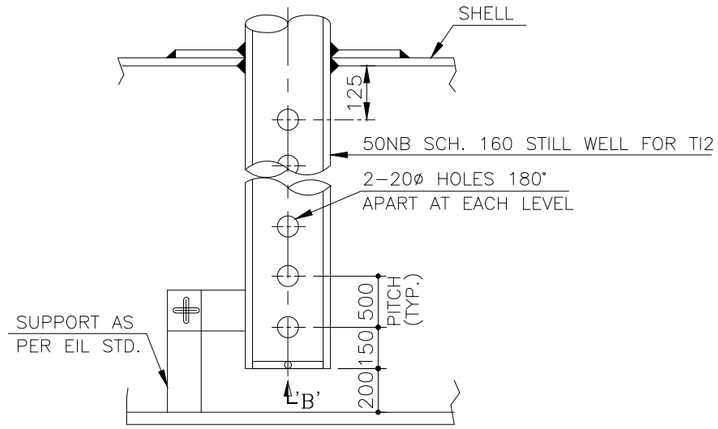


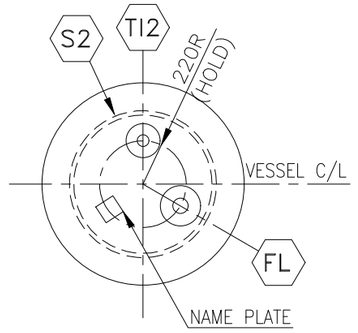
DETAIL OF NOZZLE–F



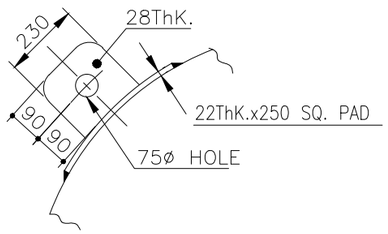
VIEW 'B' (TYP)



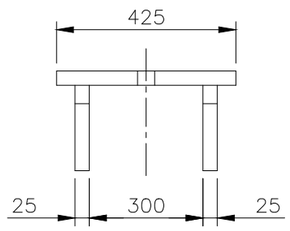
DETAIL OF NOZZLE TI2 (HOLD)



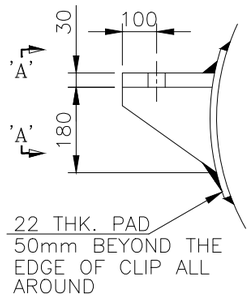
PLAN FOR MOUNTING NOZZLE S2 (HOLD)
(FOLLOW AS PER NOZZLE ORIENTATION)



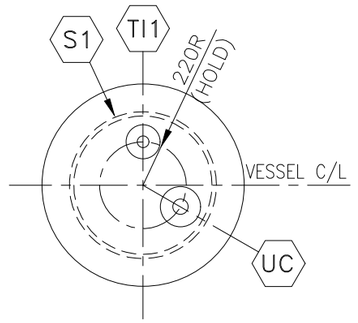
DETAIL OF LIFTING LUG (TYP)



VIEW 'A–A'



DETAIL OF BRACKET SUPPORT (TYP)



PLAN FOR MOUNTING NOZZLE S1 (HOLD)
(FOLLOW AS PER NOZZLE ORIENTATION)

ENGINEERS INDIA LIMITED
NEW DELHI

BHARAT PETROLEUM CORP. LTD.
BINA PETROCHEMICAL & REFINERY EXPANSION PROJECT (BPREP)

REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED
A	09.10.2025	ISSUED FOR BIDS/ENGG.	AS	RR/VIVEK	PB	

VESSEL DESIGN DATA
AROMATIC BLOWDOWN VESSEL–III
ITEM NO. 500–VV–HI–007

वेसेल डिजाइन डाटा
एरोमैटिक ब्लोडाउन वेसल–III
आइटम नम्बर 500–वीवी–एचआइ–007

DRAWING NO. B957–500–80–42–DS–3207
REV. A
SHEET 3 OF 3

1–1641–0503 REV.0 A3–420x297

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PDS REV.0

NOZZLES AND CONNECTIONS (नोजल व कनैक्शन)

MARK / मार्क	QTY / क्वान्टिटी	NOM. DIA नामिनल डांया	SCH./THK. शड्ल व थिकनैस	FLANGES CLASS क्लास	FLANGES TYPE टाईप	FLANGES FACING फेसिग	PROJECTION NOTE-4 / प्रोजेशन	PAD W x T / पैड	SERVICE / सर्विस
M2	1	900	20 THK.	300	WN	RF	2800	455X T	MANHOLE + BF + GASKET + BOLTING
F	1	100	120	300	WN	RF	2750	60X T	FEED INLET *
N	1	50	160	300	WN	RF	2750	-	NITRON BLANKETING
S	1	50	160	300	WN	RF	2750	-	SPARE WITH BLIND (WITH GASKET & BOLTING)
SV	1	400	20 THK	300	WN	RF	2750	200X T	SAFETY VALVE (NOTE-24)
O	1	80	160	300	WN	RTJ	2450	45X T	OUTLET (PUMP SUCTION)
M1	1	600	20THK.	300	WN	RF	2750	300X T	MANHOLE + BF + GASKET + BOLTING
LT1	1	150	80	300	WN	RF	2750	85X T	LEVEL INSTRUMENT (SERVO)*
LT2	1	200	80	300	WN	RF	2750	110X T	LEVEL INSTRUMENT (RADAR)*
LT3	1	200	80	300	WN	RF	2750	110X T	LEVEL INSTRUMENT (RADAR)*
TE	1	80	80	300	WN	RF	2750	45X T	MULTIPOINT TEMPERATURE ELEMENT*
PT	1	50	160	300	WN	RF	2750	-	PRESSURE TRANSMITTER

'T' DENOTES CORRESPONDING SHELL/DISH END NOMINAL THICKNESS

* WITH STILLL WELL

NOTE:

26 COMPLETE EQUIPMENT SHALL BE PWHT AND HARDNESS SHALL BE LIMITED AS PER 6-15-0091.

27 MATCHING FLANGE WITH ROVS ON PIPING SIDE SHALL BE RTJ TYPE BOTTOM ROV FLANGE TO BE 3 METER AWAY FROM BULLET.

28 ISOPENTANE PUMPING IN AND PUMPING OUT RATE ARE 27.5 M^3/HR AND 6.3 M^3/HR RESPECTIVELY.

LICENSOR'S SPECIFICATION
लाईसेन्सर स्पेसिफिकशन्स

FOUNDATION LOADING DATA (OPERATING CONDITION)
फॉउन्डशन लोडिगं डाटा (आपरटिंग कनडिशन)

TYPE	MAX MOMENT AT BASE (M) (kgm)	MAX. SHEAR FORCE AT BASE (H) (kg)
SEISMIC	-	-
	-	-
WIND	-	-

GENERAL NOTES (जनरल नोट्स)

UNLESS STATED OTHER WISE

1 ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.

2 ~~ALL ANCHOR BOLT HOLES TO STRADDLE N/S CENTRE LINE.~~

3 NORTH DIRECTION WHEREVER SHOWN IS WITH RESPECT TO PLAN VIEW.

4 (A) FOR NOZZLES ON SHELL PROJECTIONS ARE REFERRED FROM HORIZONTAL PLANE TO FLANGE CONTACT FACE.

4 (B) FOR NOZZLES ON HEAD PROJECTIONS ARE REFERRED FROM VERTICAL PLANE TO FLANGE CONTACT FACE.

5 THE INDICATED THICKNESS IS THE MINIMUM ACCEPTABLE AFTER CONSTRUCTION.

6 FLANGE GASKET FACE SHALL HAVE 125-250 AARH FINISH.

7 DIMENSIONS OF FLANGES FOR NOZZLES UPTO 600NB SHALL BE AS PER ASME B16.5 AND FOR NOZZLE ABOVE 600NB SHALL BE AS PER ASME B16.47 SERIES 'B' UNLESS SPECIFIED OTHERWISE.

8 ID OF WELD NECK FLANGES SHALL MATCH WITH CORRESPONDING ID OF NOZZLE PIPE/SHELL.

9 NOZZLES 50NB AND BELOW SHALL BE STIFFENED WITH 2 NOS. 40 x 6 THK FLATS 90^0 APART.

10 ALL FABRICATED NOZZLES SHALL BE FULLY RADIOGRAPHED.

11 IN CASE INTERNAL GASKETS ARE REQUIRED SAME SHALL BE FULL FACED. VENDOR TO ENSURE THAT MOC FOR INTERNAL GASKET SHALL BE SUITABLE FOR DESIGN TEMPERATURE & OPERATING FLUID.

12 NOZZLES SHOWN WITH BLIND FLANGES SHALL BE PROVIDED WITH BOLTS/NUTS AND GASKETS.

13 SPARES SHALL BE AS PER THE REQUISITION.

14 SURFACE PREPARATION & APPLICATION OF PRIMER SHALL BE CARRIED OUT AT FABRICATION SHOP BY EQUIPMENT VENDOR AS PER PAINTING SPEC. AS BELOW:-

14 (a) TWO COMPONENT INORGANIC ZINC SILICATE PRIMER (F-9) OF 65 MICRON DFT SHALL BE SHOP APPLIED BY EQUIPMENT VENDOR ON EXTERNAL SURFACE, TILL THE FIREPROOFING WORK COMMENCEMENT. FIRE-PROOFING SHALL BE DONE BY OTHERS.

14 (b) HOWEVER, COMPATIBILITY OF SHOP APPLIED PRIMER SHALL BE CONFIRMED BY FIREPROOFING MATERIAL MANUFACTURER BEFORE FIREPROOFING WORK. (BY OTHERS)

14 (c) INTERNAL COATING OF COMPLETE BULLET SHALL BE AS PER CL. 9.1.2 OF TABLE-9 OF PAINTING SPECIFICATION B957-000-06-42-PLS-01.

15 ALL REMOVABLE INTERNALS SHALL BE SIZED SO AS TO PASS THROUGH MANHOLE.

16 FULL RADIOGRAPHY WHEREVER SPECIFIED SHALL IMPLY 100% RADIOGRAPHY OF ALL BUTT WELDS.

17 ALL BUTT WELD (CIRCUMFERENTIAL AND LONGITUDINAL SEAMS) IN PRESSURE PART INCLUDING NOZZLE NECK TO FLANGE, PIPE TO PIPE, PIPE TO PIPE FITTING SHALL BE FULLY RADIOGRAPHED.

18 UNLESS OTHERWISE SPECIFIED MINIMUM THICKNESS OF WELDED INTERNAL SHALL BE 9MM. IN CASE OF PIPE AND PIPE FITTINGS SCHEDULE TO BE SELECTED ACCORDINGLY.

19 (a) DESIGN & FABRICATION REQTS. MENTIONED IN THIS MDS ARE MINIMUM. " THE STATIC AND MOBILE PRESSURE VESSELS (UNFIRED) RULES,1981 (SMPV)" ARE TO BE STRICTLY FOLLOWED BY VENDOR WITHOUT ANY PRICE & DELIVERY IMPLICATIONS.

(b) MANUFACTURER SHALL BE "PESO" APPROVED FOR MANUFACTURING THE VESSELS.

(c) "DESIGN,G.A DRGS,FABRICATION DRGS DOCS.,STAGEWISE INSPECTION AND FINAL CERTIFICATION" OF THE EQUIPMENT BY ' PESO' SHALL BE INCLUDED IN VENDOR'S SCOPE & GETTING APPROVAL FROM 'PESO' SHALL BE SOLE RESPONSIBILITY OF VENDOR. COMMENTS OF 'PESO',IF ANY, HAVE TO BE INCORPORATED WITHOUT COST & DELIVERY IMPLICATIONS.

20 VESSEL TO BE FIRED PROOF TO WITHSTAND FIRE FOR A PERIOD OF 2 HRS. ONLY CLEATS FOR FIRE PROOFING IS IN VESSEL VENDOR SCOPE.

21 ENTIRE VESSEL INCLUDING NOZZLES, SUPPORTS AND CONNECTED PIPING UPTO THE FIRST ROV SHALL BE FIREPROOFED.(FIREPROOFING AT SITE, IN-SITU, BY OTHERS). FIREPROOF ANCHORING SYSTEM (BY OTHERS) SHALL NOT BE WELDED TO THE VESSEL.

22 FIRE FIGHTING FACILITIES SHALL BE CONSIDERED BY OTHERS. CLEATS FOR THE SAME SHALL BE SUPPLIED BY VENDOR.

23 FOR 'RTJ' FACING FLANGE MAXIMUM HARDNESS VALUE OF GASKET MATERIAL SHALL BE 90 BHN & FLANGE GROOVE HARDNESS SHALL BE AT LEAST 25 BHN MORE THAN THE GASKET HARDNESS.

24 TWO NOS. OF PSV SHALL BE PROVIDED ON THE SAME NOZZLE. ONE WILL BE IN LINE AND OTHER SHALL BE SPARE.

25 EQUIPMENT SHALL BE FIRST COMPLETELY FABRICATED, HYDROTESTED & PAINTED AT SHOP. THEREAFTER IT SHALL BE CUT INTO TWO SECTIONS (TENTATIVE LOCATION MARKED & TO BE FINALISED BY VENDOR) (PROVIDE ADDITIONAL LENGTH TO TAKE CARE OF CUTTING & REJOINING ALLOWANCES) BEFORE TRANSPORTATION FROM SHOP TO SITE (WHERE FINAL C-SEAM SHALL BE CARRIED OUT). AT SITE THE CIRCUMFERENTIAL SEAM SHALL BE COMPLETED IN HORIZONTAL POSITION ON GROUND. SITE SEAMS SHALL BE 100% RADIOGRAPHED. NDT AND PWHT SHALL BE CARRIED OUT AS PER MDS. LOCAL BOX / HALF PIPE TYPE HYDROTEST SHALL BE CARRIED OUT FOR SITE CIRC. SEAM. HYDROTEST OF THE ENTIRE VESSEL AT SITE IS NOT ENVISAGED.

SPECIFICATIONS (स्पेसिफिकेशन्स)

X	DENOTES APPLICABLITY	
X	GENERAL SPEC. FOR PRESSURE VESSELS	6-12-0001
X	SUPP. SPEC. FOR CS VESSELS	6-12-0002
X	STD. SPEC. FOR BQCS PLATE	6-12-0011
X	STD. SPEC. FOR STRUCTRAL QUALITY PLATES	6-12-0014
X	STANDARD SPECIFICATION FOR HARDNESS REQUIREMENT OF STATIC EQUIPMENTS	6-15-0091
X	SPEC.FOR SURFACE PREPARATION&PROTECTIVE COATING	B957-000-06-42-PLS-01

STANDARDS (स्टैण्डर्डस)

X	VESSEL TOLERANCES	7-12-0001
X	SUPPORT FOR HORIZONTAL VESSEL	7-12-0002
	WOODEN PILLOWS FOR SADDLE SUPPORT	7-12-0003
	SKIRT BASE DETAILS	7-12-0004
	SKIRT OPENING DETAILS	7-12-0005
	ANGLE LEG SUPPORT	7-12-0006
	PIPE LEG SUPPORT	7-12-0007
	BRACKET SUPPORT FOR VERTICAL VESSEL	7-12-0008
	MANHOLE WITH HINGED COVER	7-12-0009
X	MANHOLE WITH DAVIT	7-12-0010
X	LADDER RUNGS FOR MANHOLE/DEMISTER	7-12-0011
	RETAINING PLATE	7-12-0012
X	NOZZLE REINFORCEMENT AND PROJECTION	7-12-0013
	PAD NOZZLES FOR VESSELS	7-12-0014
X	STANDARD BOLT HOLE ORIENTATION	7-12-0015
	ALLOY LINER DETAILS	7-12-0016
	SIGHT GLASSES FOR PRESSURE VESSELS	7-12-0017
X	INTERNAL FLANGES	7-12-0018
X	VORTEX BREAKERS	7-12-0019
	INLET DEFLECTOR BAFFLE	7-12-0020
	SUPPORT RING AND BOLTING BAR	7-12-0021
	SUPPORT RING SIZES FOR PACKED TOWERS	7-12-0022
	PIPE DAVIT	7-12-0023
	LIFTING LUG TOP HEAD TYPE	7-12-0024
	FIRE PROOFING AND INSULATION SUPPORTS	7-12-0025
X	EARTHING LUG	7-12-0026
X	NAME PLATE	7-12-0027
X	MANUFACTURER NAME PLATE	7-12-0028
X	BRACKET FOR NAME PLATE	7-12-0029
	NAME PLATE FOR SMALL EQUIPMENT	7-12-0030
	DETAILS OF FORGED NOZZLES	7-12-0031
X	SUPPORTS FOR INTERNAL FEED PIPE	7-12-0032
	HOT INSULATION SUPPORT FOR HORIZONTAL VESSEL	7-12-0033
	PIPE DAVIT SUPPORT FOR COLD INS. VESSELS	7-12-0034
	TYP. DETAILS OF WIRE MESH DEMISTER SUPPORTS	7-12-0036
	S.R NOZZLE NECK	7-12-0037
	ALLOWABLE NOZZLE LOADS	7-12-0038
X	STILL-WELL FOR LEVEL TRANSMITTER (RADAR TYPE) FOR MOUNDED BULLETS/SPHERES	7-12-0040

REFERENCE DRAWINGS(रेफरेन्स डाईग)

X	NOZZLE ORIENTATIONS	B957-999-16-43-NZ-4012
	LADDERS/PLATFORM CLEATS	
	PIPE SUPPORT CLEATS	
	TRAY SUPPORT AND BOLTING BARS	NOT APPLICABLE
	DEMISTER DATA SHEET	NOT APPLICABLE

HOLD UPS (होल्ड अप्स)

X	NOZZLE ORIENTATIONS		SIZE OF NOZZLES
	NOZZLE ELEVATIONS		PIPE SUPPORT CLEATS
	SUPPORT HEIGHT		LADDER/PLATFORM CLEATS
X	DETAILS OF INTERNALS		TRAY SUPPORT/BOLTING BARS
			PIPE DAVIT
			PACKING SUPPORT

DESIGN DATA (डिजाइन डाटा)

CODE			ASME SECTION VIII DIV.1 EDITION 2025
WORKING PRESSURE	(kg/cm^2g)		0.5-1.5
DESIGN PRESSURE	(kg/cm^2g)	INT. 3.5	EXT. 1.055
WORKING TEMPERATURE	(°C)		AMB.
DESIGN TEMPERATURE	(°C)		55
MDMT	(°C)		1.1
CORROSION ALLOWANCE	(mm)		1.5
TYPE OF HEAD			2:1 ELLIPTICAL
JOINT EFFICIENCY		SHELL 1	HEAD 1
RADIOGRAPHY		SHELL FULL	HEAD FULL
POST WELD HEAT TREATMENT			COMPLETE EQUIPMENT (NOTE-26)
HEAT TREATMENT			AS PER CODE / SPEC.
OPERATING MEDIUM			ISOPENTANE
SP. GRAVITY			0.582-0.645
WIND SPECIFICATION			IS-875 (PART-3)
SEISMIC			SITE SPECTRA + IS-1893 (PART-4)
CAPACITY	(M^3)		570 (NOMINAL); 500 (STORED)
PAINTING/CLEANING			AS PER JOB SPECIFICATION (REFER NOTE-14)
INSULATION THICKNESS (mm) (IH)			NIL ☐ HOT ☐ COLD
FIRE PROOFING CLEATS			☒ YES ☐ NO
HYDROSTATIC TEST	(kg/cm2g)		HORIZONTAL / VERTICAL (AT TOP)
PRESSURE (NEW & COLD)			4.55
INSPECTION BY			☒ EIL ☐ CIB ☐ TPIA

MATERIAL OF CONSTRUCTION (मैटिरियल ऑफ कन्सट्रक्शन)

(AS PER ASME / IS ~~OR EQUIVALENT~~)

SHELL / BOOT	SA 516 Gr.60
REINFORCEMENT PAD / INSERT PAD	SA 516 Gr.60
HEADS	SA 516 Gr.60
SHELL FLANGES	-
NOZZLE FLANGES / LWN	SA 105
NOZZLE NECK UPTO 250 NB	SA 106 GR. B
NOZZLE NECK ABOVE 250 NB	SA 516 Gr.60
PIPE FITTINGS	SA 234 GR. WPB (SEAMLESS)
GASKET EXTERNAL	SPIRAL WOUND GASKET WITH SS 304
	METAL WINDING AND GRAFOIL FILLER
	MATERIAL WITH CS OUTER & SS 316L
	INNER RING AS PER ASME B 16.20.
GASKET INTERNAL	COMPRESSED FIBRE ASBESTOS FREE #
EXTERNAL STUDS/BOLTS/NUTS	SA 193 GR.B7 / SA 194 GR.2H
INTERNAL STUDS/BOLTS/NUTS	SS 304
~~SKIRT~~/ SUPPORT	IS 2062 GR.E250 QUALITY BR/B0
~~SKIRT~~/ SUPPORT BASE	IS 2062 GR.E250 QUALITY BR/B0
INTERNAL PARTS (WELDED)	SA 516 GR.60/ SA 106 GR.B/SA105
INTERNAL PARTS (BOLTED)	
CLIPS & ATTACHMENTS (EXTERNAL)	SA 516 GR.60 / SA 106 GR.B / SA 105
WRAPPER PLATE	SA 516 GR.60
DEMISTER/GRID	-
PAD FOR EXTERNAL ATTACHMENTS	SA 516 GR.60
STILL WELL FOR NOZZLES	REFER SHEET-2 & 3

INTERNAL GASKETS SHALL BE SUITABLE FOR DESIGN TEMP. AND OPERATING LIQUID.

PESO APPROVAL REQUIRED

NO PIPING CLIPS & STRUCTURAL PLATFORM / LADDER SUPPORT CLIP SHALL BE WELDED TO THE VESSEL

SPECIAL SERVICE :

STATUTORY REGULATIONS (स्टैचुअरी रेगुलेशन्स)

	INDIAN BOILER REGULATIONS (IBR)
X	**DEPARTMENT OF EXPLOSIVES, NAGPUR (CCOE)/ PESO/ SMPV**

APPROXIMATE WEIGHT (kgs) (PER ITEM) (एपरौक्सिमेंट वजन)

ERECTION	210000	OPERATING	740000
HYDROTEST(SHOP)	840000	HYDROTEST (FIELD)	955000
NUMBER OF ITEMS :	TWO		

REV	DATE	REVISION	BY	CHECKED	APPROVED
0	13.03.2026	ISSUED FOR PURCHASE	ROHIT	CS	PB
B	15.10.2025	REVISED & REISSUED FOR BIDS / ENGG.	AS	CS	PB
A	29.07.2025	ISSUED FOR BIDS / ENGG.	AS	AY	PB

ENGINEERS INDIA LIMITED
NEW DELHI
इंजीनियर्स इंडिया लिमिटेड
(भारत सरकार का उपक्रम)

BHARAT PETROLEUM CORP. LTD.
BINA PETROCHEMICAL & REFINERY EXPANSION PROJECT (BPREP)

DESIGN DATA

ISOPENTANE STORAGE BULLET

ITEM NO. 510-TT-00-003 A/B (AG)

डिजाइन डाटा

आइसोपैन्टेन स्टोरेज बुलेट

आइटम नम्बर 510-टीटी-00-003 A/B(AG)

DRAWING NUMBER / डाईग नम्बर: **B957-510-80-42-DS-3001** REV: 0

SHEET 1 OF 3

FORMAT NO.3-8042-0501 REV.0 [28.02.2024] A3-420 X 297

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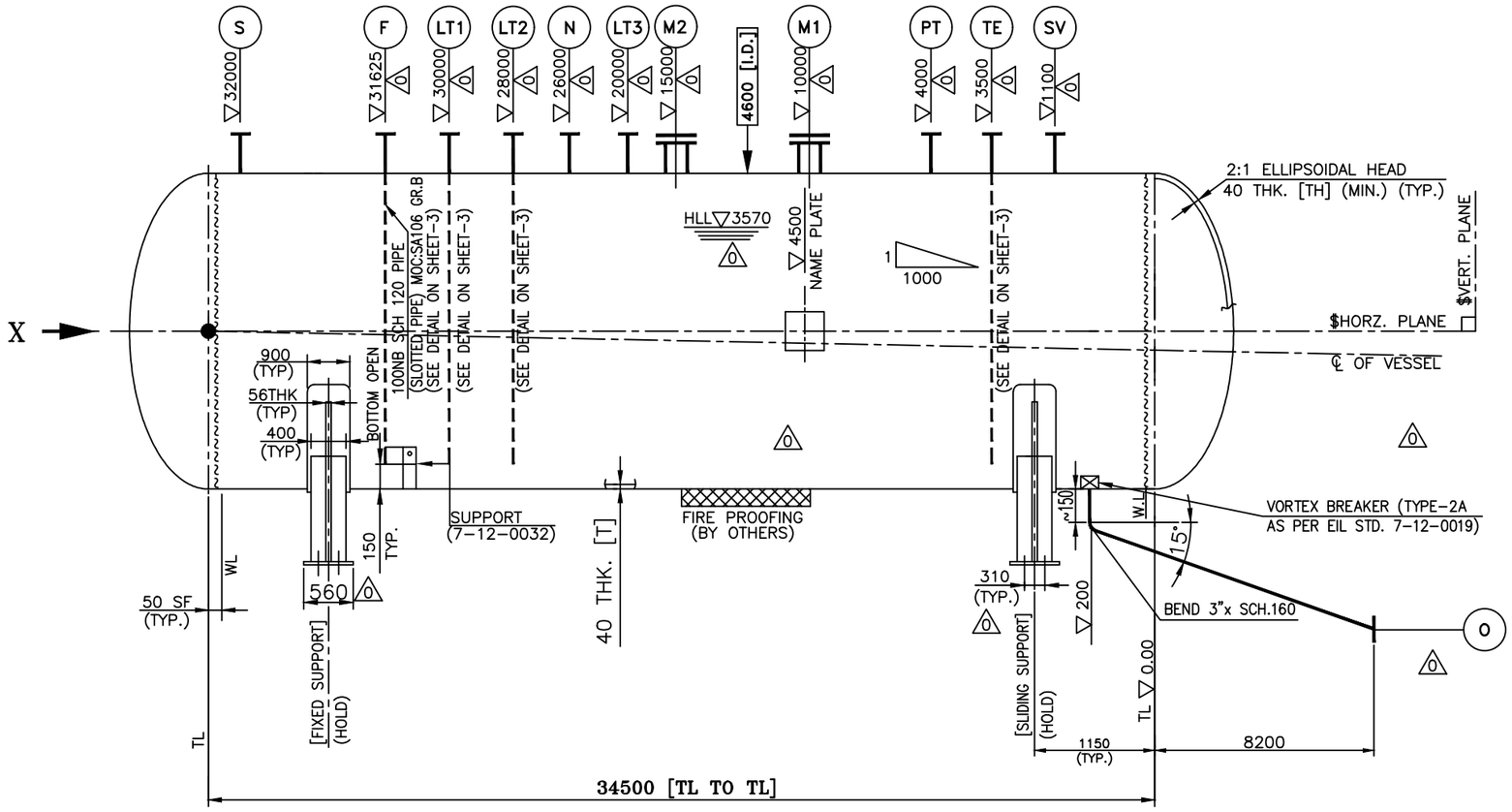
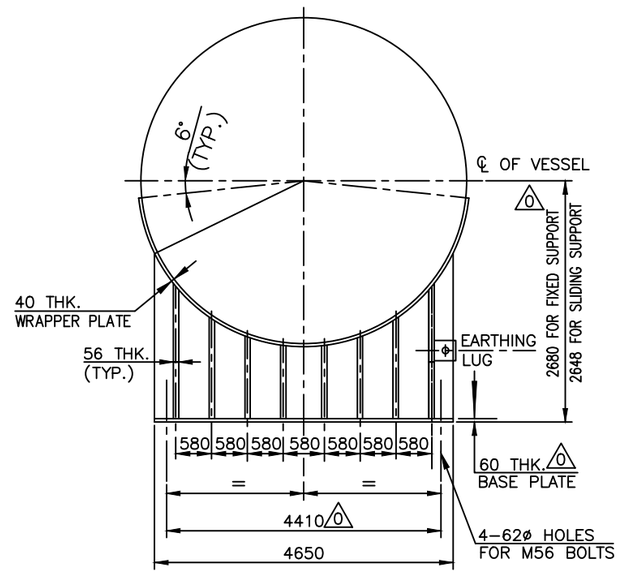
60

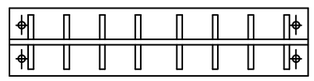
$ NOZZLES AND GASKET FACE OF FLANGES SHALL BE PARALLEL TO VERTICAL PLANE/HORIZONTAL PLANE.
@ BASE PLATE OF SUPPORT SADDLE SHALL BE PARALLEL TO HORIZONTAL PLANE.
# NOZZLE ELEVATION/PROJECTION ARE WITH REFERENCE TO VERTICAL/HORIZONTAL PLANE



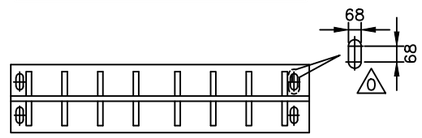


VIEW-'X'

(NOZZLES NOT SHOWN)
(FOR ALL OTHER DIMS. REFER EIL STD.)



HOLES FOR FIXED SUPPORT



HOLES FOR SLIDING SUPPORT

ENGINEERS INDIA LIMITED
NEW DELHI

BHARAT PETROLEUM CORP. LTD.
BINA PETROCHEMICAL & REFINERY EXPANSION PROJECT (BPREP)

REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED
0	13.03.2026	ISSUED FOR PURCHASE	ROHIT	CS	PB	
B	15.10.2025	REVISED & REISSUED FOR BIDS/ENGG.	AS	CS	PB	
A	29.07.2025	ISSUED FOR BIDS/ENGG.	AS	AY	PB	

VESSEL DESIGN DATA
ISOPENTANE STORAGE BULLET
ITEM NO. 510-TT-00-003 A/B (AG)

वेसेल डिजाइन डाटा
आइसोपैन्टेन स्टोरेज बुलेट
आइटम नम्बर 510-टीटी-00-003 A/B(AG)

DRAWING NO. B957-510-80-42-DS-3001
REV. 0
SHEET 2 OF 3

1-1641-0503 REV.0 A3-420x297

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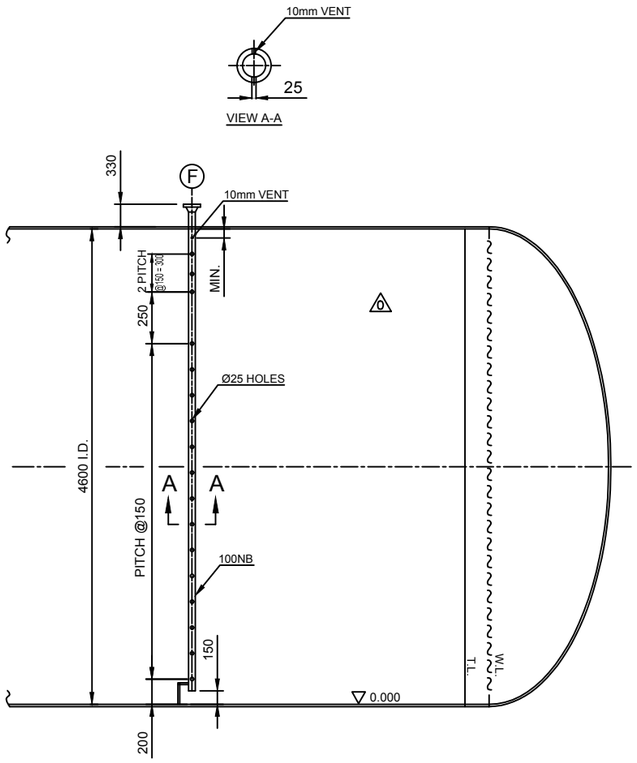
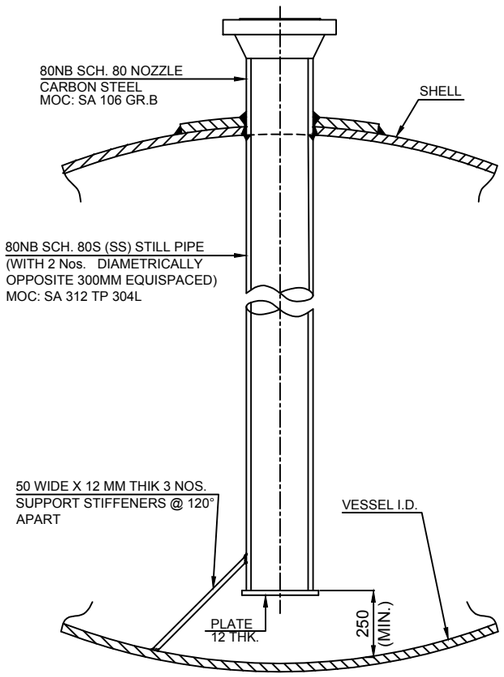
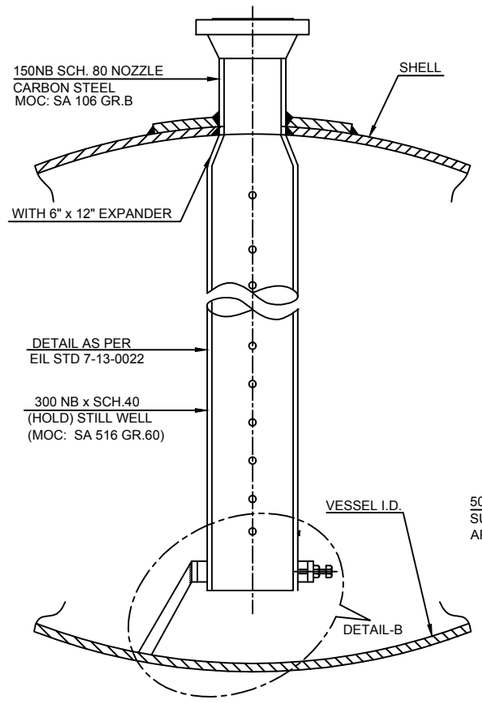


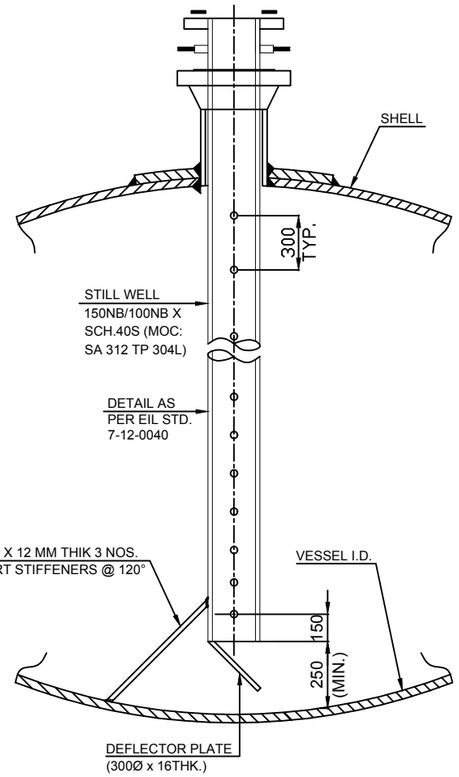
MOUNDED BULLET INTERNAL FEED PIPE DETAIL
(NOZZLE-F) (HOLD)



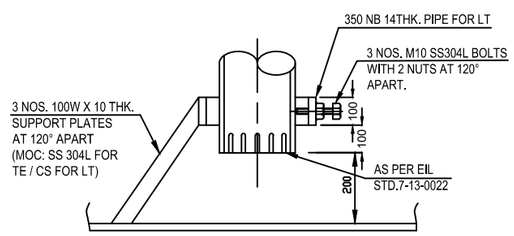
DETAIL OF STILL WELL FOR NOZZLE - TE 0



DETAIL OF STILL WELL FOR NOZZLE - LT-1
(SERVO TYPE)



DETAIL OF STILL WELL FOR NOZZLE - LT-2 & LT-3
(RADAR TYPE REFER EIL STD. 7-12-0040)
(HOLD)



DETAIL – B
FOR LT–1

ENGINEERS INDIA LIMITED
NEW DELHI

BHARAT PETROLEUM CORP. LTD.
BINA PETROCHEMICAL & REFINERY EXPANSION PROJECT (BPREP)

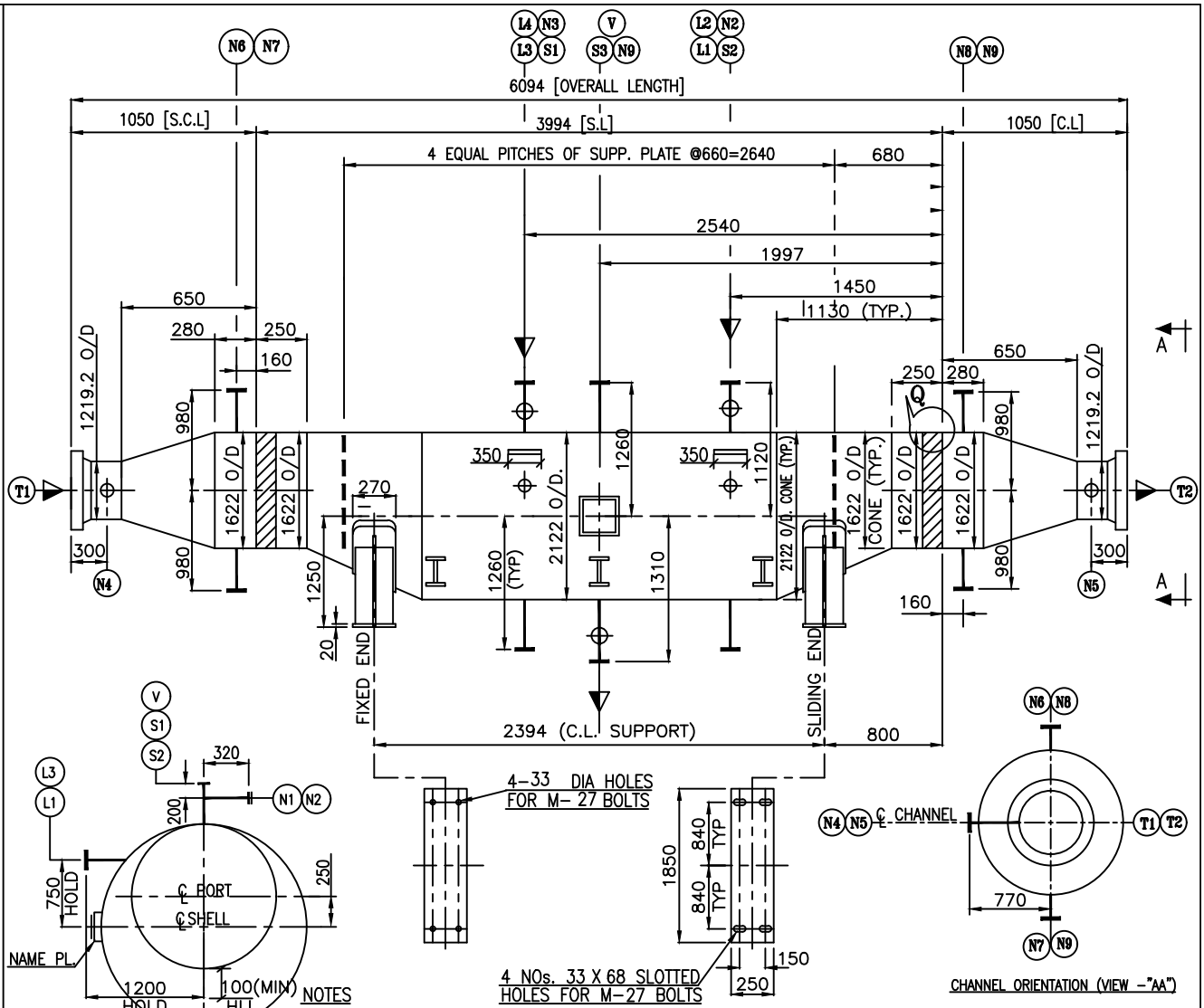
REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED
0	13.03.2026	ISSUED FOR PURCHASE	ROHIT	CS	PB	
B	15.10.2025	REVISED & REISSUED FOR BIDS/ENGG.	AS	CS	PB	
A	29.07.2025	ISSUED FOR BIDS/ENGG.	AS	AY	PB	

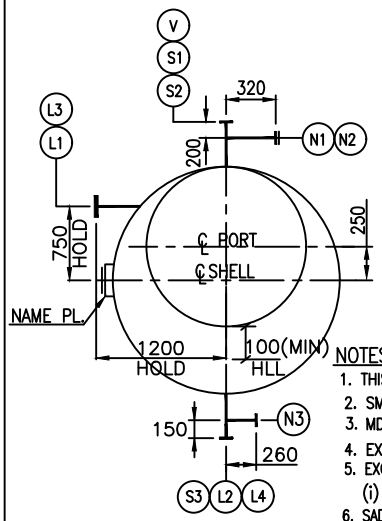
VESSEL DESIGN DATA
ISOPENTANE STORAGE BULLET
ITEM NO. 510-TT-00-003 A/B (AG)

वेसेल डिजाइन डाटा
आइसोपैन्टेन स्टोरेज बुलेट
आइटम नम्बर 510-टीटी-00-003 A/B(AG)

DRAWING NO. B957-510-80-42-DS-3001
REV. 0
SHEET 3 OF 3

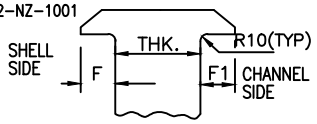
1-1641-0503 REV.0 A3-420x297





SHELL ORIENTATION (VIEW –"AA")
(HOLD)

CHANNEL ORIENTATION (VIEW –"AA")



DETAIL–Q

NOTES

1. THIS UNIT HAS BEEN DESIGNED WITH NOZZLE LOAD AS PER SKETCH NO.B957–500–80–42–NZ–1001
2. SMOOTH FINISH TO 125AARH.
3. MDMT: SHELL SIDE = 1.1°C ,TUBE SIDE = (–)110°C.
4. EXCHANGER IS AN INVERTED KETTLE WITH AXIAL CHANNEL NOZZLES.
5. EXCHANGER DESIGNED FOR SHELL AND TUBE AVERAGE METAL TEMP. OF
   (i) 143.2°C/133.4°C FOR NORMAL OPERATION.
6. SADDLE ANGLE AND WRAPPER PLATE ANGLE SHALL BE 150° AND 162° MINIMUM RESPECTIVELY.

@ FEED, INTERMEDIATE AND FINISHED PRODUCT

TYPE OF EXCH. NKN (H) (NOTE–6) SERVICE : COLD BLOWDOWN SUPER HEATER

SHELLS PER UNIT– ONE
NO. OF UNITS – ONE

DESIGN DATA

NOZZLE DATA

	SHELL SIDE	TUBE SIDE
DESIGN PRESSURE Kgf/cm²g	7/FV	5.4
DESIGN TEMPERATURE °C (NOTE–3)	240	(–)110/65
HYD. TEST PRESSURE Kgf/cm²g	10.07	7.02
FLUID CIRCULATED	LP STEAM	ETHYLENE
NO. OF PASSES	ONE	ONE
WORKING PRESSURE Kgf/cm²g	3.0	0.35
WORKING TEMP. (IN/OUT) °C	143.2/143.1	(–)84.6/5
CORROSION ALLOWANCE mm	–	–
STRESS RELIEVING	–	–
RADIOGRAPHY (NOTE–5)	SPOT	100%
JOINT EFFICIENCY	0.85	1.0
INSULATION (mm)	65 (IH)	PP

NOZZLE MARK	SIZE N.B./O.D. (INCH/mm)	ASME CLASS	SCH /THK (mm)	TYPE FACING	PAD W X T (mmXmm)	FLG. FACE FINISH	DESIGNATION
S1/S2	12	150	12	WNRF	70x12	NOTE2	SHELL SIDE INLET
S3	4	150	120S/B	WNRF	40x12	NOTE2	SHELL SIDE OUTLET
T1	48	150	12	WNRF	–	NOTE2	TUBE SIDE INLET
T2	48	150	12	WNRF	–	NOTE2	TUBE SIDE OUTLET
L1–2	2.0	300	160S/B	WNRF	–	NOTE2	STAND PIPE FOR LEVEL INSTRUMENT
L3–4	2.0	300	160S/B	WNRF	–	NOTE2	LEVEL GAUGE
V	2.0	300	160S/B	WNRF	–	NOTE2	VENT + BF
N1~N3	1.5	150	160S/B	WNRF	–	NOTE2	MP CONN. + BF
N4–N5	1.5"I.D.	150	13.45	LWNRF	–	NOTE2	MP CONN. + BF
N6/N8	1.5"I.D.	150	13.45	LWNRF	–	NOTE2	CHANNEL VENT+BF
N7/N9	1.5"I.D.	150	13.45	LWNRF	–	NOTE2	CHANNEL DRAIN+BF

NO.	DATE	REVISION	BY	CHKD.	APPROVALS
B	26.12.2025	REVISED & ISSUED FOR BIDS/ENGG.	SUNIL	DN/KRK	AT
A	21.11.2025	ISSUED FOR BIDS/ENGG.	Vinay	DN/KRK	AT

EMPTY WEIGHT [KG] ~ 15000 p.shell
WT. FULL OF WATER [KG] ~ 30000 p.shell

ENGINEERS INDIA LTD.
STATIC & MACHINERY EQUIPMENT DEPT.
NEW DELHI

SETTING PLAN FOR
ITEM NO. 500–EE–AT–002
PROJECT : BPREP CLIENT : BPCL UNIT : @

DRAWING NO. B957–500–80–42–DS–4012 SHEET 1 OF 3

REV. B

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F–0540–101 REV. 2 A4–210X297[THERMAL D/S REF. NO.] B957–500–80–45–DS–002 REV–1

MECHANICAL DETAILS

ITEM NO 500-EE-AT-002 TEMA CLASS R 2023 EDITION. ASME SEC.VIII DIV.1 2023 EDITION	1
SIZE 1590/2090 X 4000 TYPE NKN (H) ; CONNECTED IN - STACKING -	2
DUTY/UNIT 7.1X1.2 MMKcal/hr SURFACE AREA / SHELL 311 Sqm NO. OF UNITS- ONE SHELLS/UNIT- ONE	3
[NO. OF STACKS] - [SHELLS/STACK] -	

DESCRIPTION	MATERIAL	DETAILS	Wt(Kg)	
SHELL	SA240Gr304L	[S.O.D.] = 2122 ; [S.THK] = 16		5
SHELL CONE	SA240Gr304L	[SC.O.D.] = 1622/2122; [SC.THK] = 16		6
SHELL PORT	SA240Gr304L	O.D. = 1622 ; THK = 16		7
CHANNEL	SA240Gr304L	[C.O.D.] = 1622 ; [C.THK] = 12		8
CHANNEL CONE	SA240Gr304L	O.D. = 1219.2/1622 ; THK = 12		9
CHANNEL PORT	SA240Gr304L	O.D. = 1219.2 ; THK = 12		10
TUBES	SA213TP304L	O.D. = 40 ; [T/s THK] =2 MIN. LENGTH = 4000 NO= 699 PITCH(NOTE4)		11
TUBE SHEET	SA965F304L	DETAIL = Q (REFER SHT.-1) THK = 70 F = 24 F1 = 19		12
BAFFLES	SA240Gr304L	TYPE= SUPP. PLATE ; THK= 12 ; NO REQD.= 5 ; CUT = (NOTE4)		13

FLANGE NO.	TYPE	MATERIAL	A	BCD	B	Go	G1	H	T	GASKET DATA			BOLT DATA			Wt (Kg)	
										O.D.(D)	WIDTH	TYPE	NO	BOLT DIA			
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
																	16
																	17
																	18
																	19

DESCRIPTION	GASKET MATL.	BOLTING MATERIAL.		DESCRIPTION	MATERIAL	REMARKS	Wt(Kg)	
FLANGE 1-2	-	-		CHANNEL COVER	-	DETAIL = - ; THK,T1 =-		20
FLANGE 3	-	-		BACKING RING	-	DETAIL-1 ; T1= - E= -		21
FLANGE 4	-	-		CONN. PIECE	-	DETAIL= - T2 = -		22
FLANGE 5&5A	-	-		PARTITION PL.	-	THK = - T1= - T2= - DETAIL-15		23
FL.,HD. FLANGE	-	-		IMP. PLATE	SA240Gr304L	THK = 12		24
SHELL NOZZLES.	SS304LSP.WD. NOTE5	SA193GrB7/SA194Gr2H		SUPPORT PL.	-	THK = -		25
CHANNEL NOZZ.	SS304LSP.WD. NOTE5	SA320GrB8CL2/SA194Gr8		TIE RODS	SS304L	DIA = (NOTE4) NOS.= (NOTE4)		26
	SHELL SIDE.	CHANNEL SIDE.	Wt(Kg)	SPACERS	SA213TP304L	O.D. = (NOTE4) THK.= (NOTE4)		27
NOZZLE NECK	SA312TP304L	SA240Gr304L/SA182F304L		SEALING STRIPS	-	WIDTH =- THK =- NO =-		28
NOZZLE FLGS.	SA182F304L	SA182F304L		SUPPORTING STRIPS	SA240Gr304L	WIDTH=(NOTE-4) THK=(NOTE-4) NO=(NOTE-4)		29
PAD/WRAPPER PL.	SA240Gr304L	SA240Gr304L		SADDLE PLATE	SA240Gr304L	DETAIL AS PER EIL STD 7-15-0004		30
GUSSET/LUGS	SA240Gr304L	SA240Gr304L		NAME PL /BKT.	SS/SA240Gr304L	DETAIL AS PER EIL STD 7-15-0017		31
COUPLING/PLUGS	-	-		EYEBOLT/PLUG.	-	SIZE: - NOS.= -		32
				WARN PL./BRT.	SA240Gr304L	EIL STD. 7-15-0018 (NOTE-7)		33
				SUPPORTING BLOCK/ SUPPORT BEAM	SA240Gr304L	REFER SHEET-3		34

TEST RING- NO TEST FLANGE- NO

TUBE TO TUBE SHEET JOINT- STRENGTH WELDED AND EXPANDED WITH TWO GROOVES (NOTE-8)

NOTES:-
1 ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE STATED
2 FOR CONSTRUCTIONAL DETAIL AND NOMENCLATURE REFER STD., 7-15-0001,7-15-0002
3 ALL OVER ∇ FINISH REQUIRED UNLESS OTHERWISE STATED.
4 REFER GUIDELINES FOR PREPARING TUBE LAYOUT AND TUBE LAYOUT DRG NO. B957-500-80-45-002.
5 SPIRAL WOUND GASKETS FOR NOZZLES SHALL BE 4.5 THK WITH GRAFOIL FILLER AND 3.2 THK SS OUTER RING. DIMENSIONS AS PER ASME B16.20.
6 TUBE SIDE IS IN LOW TEMPERATURE SERVICE.
7 WARNING PLATE SHALL BE PROVIDED. FOLLOWING SHALL BE MENTIONED IN WARNING PLATE.
  I) DO NOT RUN THIS HEAT EXCHANGER ON TUBE SIDE WITHOUT SHELL SIDE FLUID.
8 TUBE TO TUBESHEET JOINT SHALL BE 'STRENGTH WELDED (AS PER FIG. 2 OF 6-15-0003) & EXPANDED WITH TWO GROOVES'. FOR GROOVES DETAIL REFER 7-15-0006.
9. ALL NOZZLE FLANGES UP TO 24" SHALL BE AS PER ASME B16.5 & GREATER THAN 24" SHALL BE AS PER ASME B16.47 SERIES-B.

NO.	DATE	REVISION	BY	CHKD	APPROVALS		
B	26.12.2025	SHT.1 REVISED & ISSUED FOR BIDS/ENGG.	SUNIL	DN/KRK	AT		
A	21.11.2025	ISSUED FOR BIDS/ENGG.	Vinay	DN/KRK	AT		

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F-0540-101 REV. 2 A4-210X297

ENGINEERS INDIA LTD.
STATIC & MACHINERY EQUIPMENT DEPT.
NEW DELHI

SECTION DRAWING FOR
ITEM NO. 500-EE-AT-002
PROJECT : BPREP CLIENT : BPCL UNIT : @

DRAWING NO. B957-500-80-42-DS-4012 SHEET 2 OF 3

REV. B

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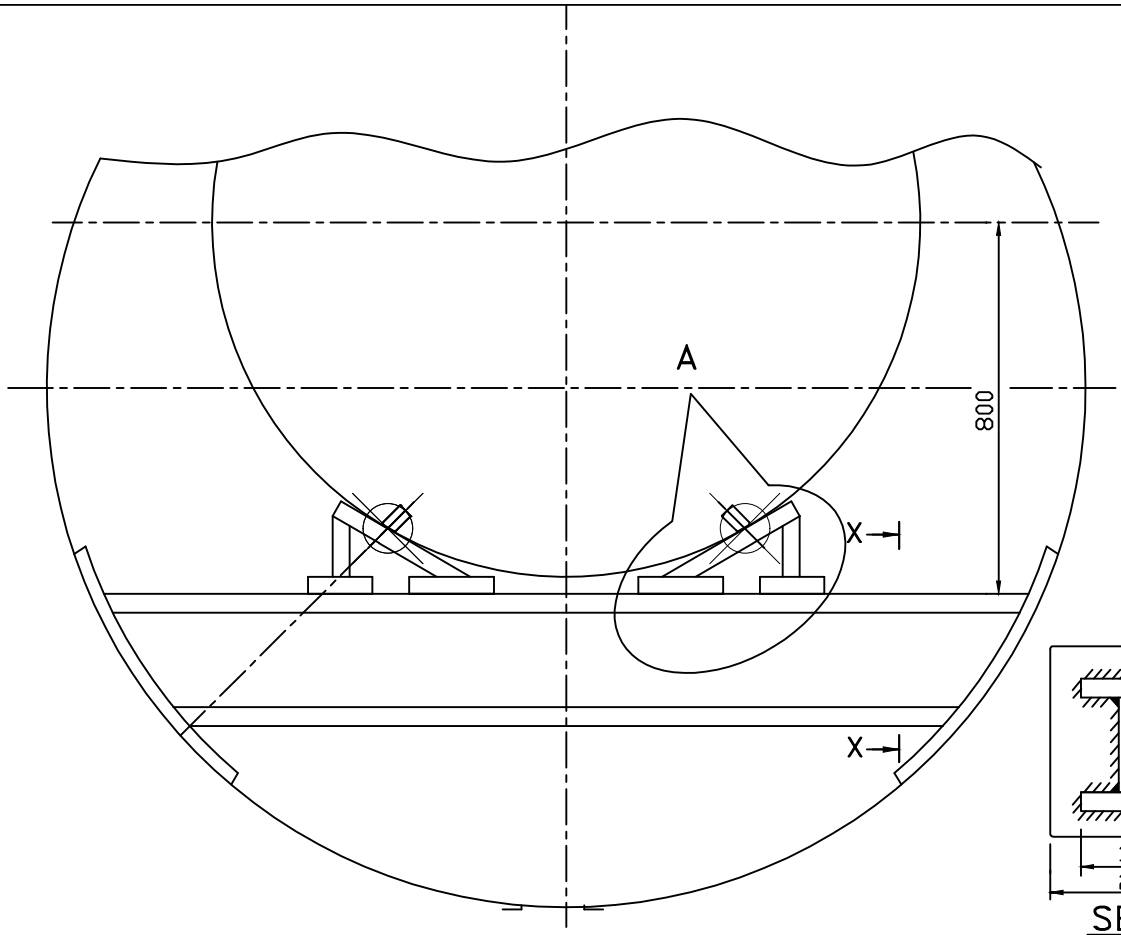
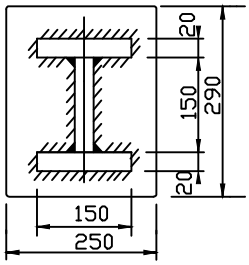
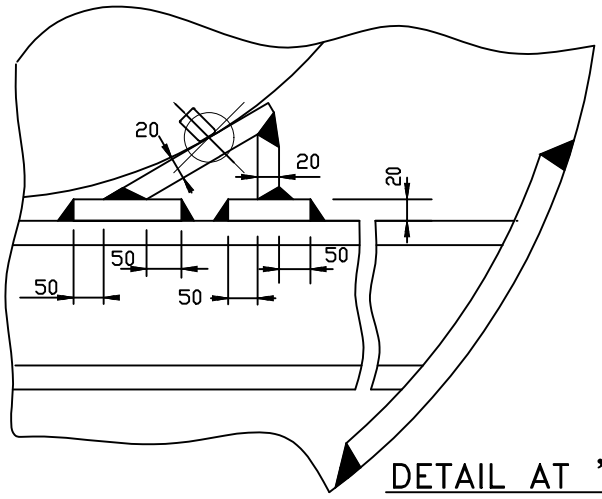
EIL 1641-540 REV. 0 A4-210X297





SEC–XX



DETAIL AT 'A'

NOTES:–

1. VENDOR SHALL CONSIDER ABOVE DETAIL AS MINIMUM. IT IS VENDORS RESPONSIBILITY TO DESIGN & DEVELOP THE DETAIL OF TUBE BUNDLE SUPPORTING ARRANGEMENT WHICH SHALL BE SUITABLE FOR TUBE BUNDLE LOAD.
2. VENDOR SHALL ADJUST THE ELEVATION OF SUPPORT I-BEAMS AND SUPPORTING BLOCK. MINIMUM 3NOS. OF SUPPORT BEAM SHALL BE PROVIDED.
3. SUPPORTING BLOCK SHALL BE COVERED MAXIMUM LENGTH OF TUBE.

NO.	DATE	REVISION	BY	CHKD	APPROVALS			
B	26.12.2025	SHT.1 REVISED & ISSUED FOR BIDS/ENGG.	SUNIL	DN/KRK	AT			
A	21.11.2025	ISSUED FOR BIDS/ENGG.	Vinay	DN/KRK	AT			

ENGINEERS INDIA LTD. STATIC & MACHINERY EQUIPMENT DEPT. NEW DELHI	TUBE BUNDLE SUPPORT DETAIL FOR ITEM NO. 500-EE-AT-002 PROJECT : BPREP CLIENT : BPCL UNIT : @	DRAWING NO. B957-500-80-42-DS-4012 SHEET 3 OF 3	REV. B

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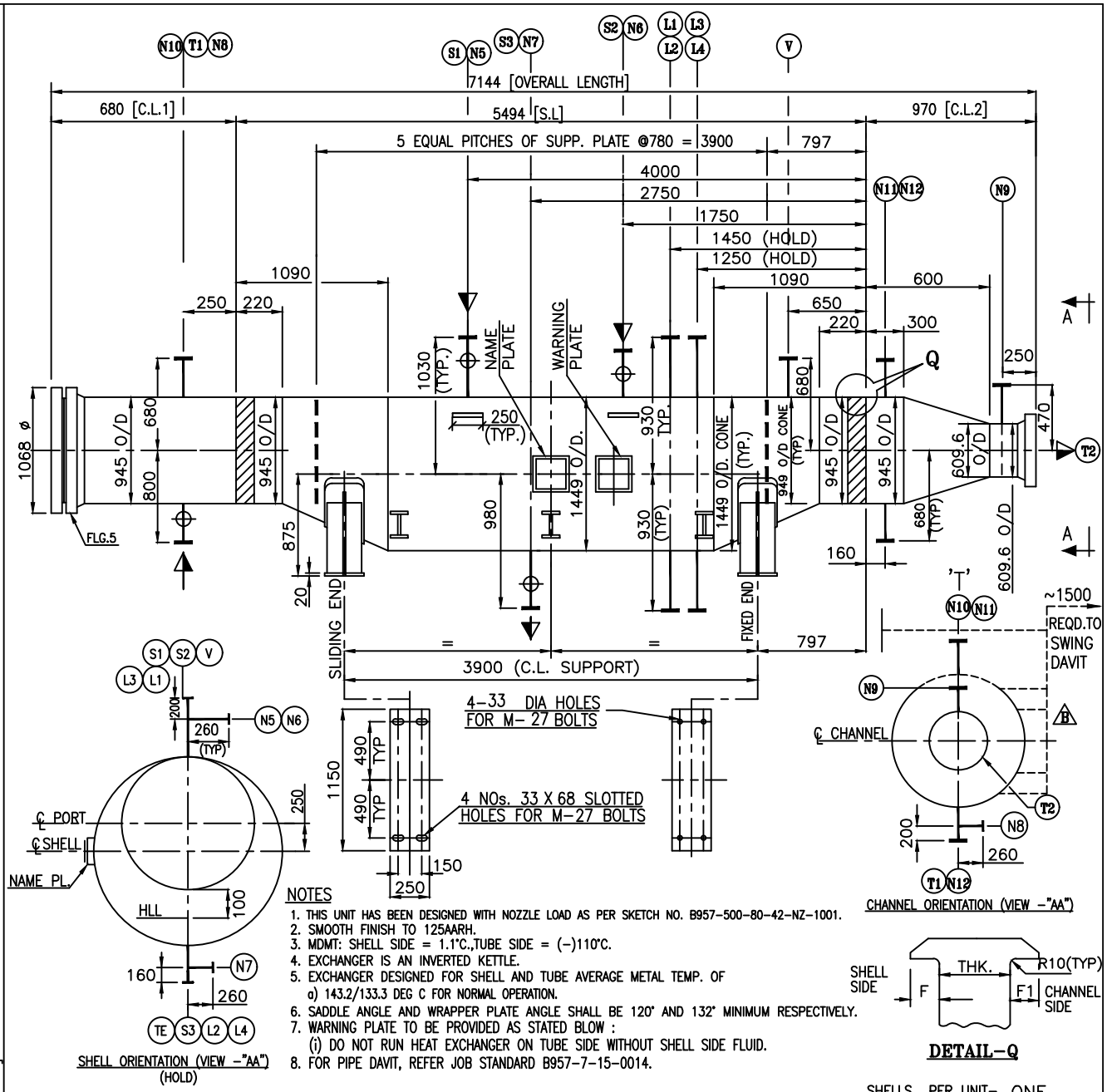
F-0540-101 REV. 2 A4-210X297[THERMAL D/S REF. NO.] B957-500-80-45-DS-001 REV-1



NOTES

1. THIS UNIT HAS BEEN DESIGNED WITH NOZZLE LOAD AS PER SKETCH NO. B957-500-80-42-NZ-1001.
2. SMOOTH FINISH TO 125AARH.
3. MDMT: SHELL SIDE = 1.1°C.,TUBE SIDE = (-)110°C.
4. EXCHANGER IS AN INVERTED KETTLE.
5. EXCHANGER DESIGNED FOR SHELL AND TUBE AVERAGE METAL TEMP. OF
   a) 143.2/133.3 DEG C FOR NORMAL OPERATION.
6. SADDLE ANGLE AND WRAPPER PLATE ANGLE SHALL BE 120° AND 132° MINIMUM RESPECTIVELY.
7. WARNING PLATE TO BE PROVIDED AS STATED BLOW :
   (i) DO NOT RUN HEAT EXCHANGER ON TUBE SIDE WITHOUT SHELL SIDE FLUID.
8. FOR PIPE DAVIT, REFER JOB STANDARD B957-7-15-0014.

TYPE OF EXCH. NKN (H) (NOTE-5) SERVICE : COLD BLOWDOWN VAPORIZER

SHELLS PER UNIT- ONE
NO. OF UNITS - ONE

DESIGN DATA

	SHELL SIDE	TUBE SIDE
DESIGN PRESSURE Kgf/cm^{2}g	7.0/FV	5.4
DESIGN TEMPERATURE °C (NOTE-3)	240	(-)110/65
HYD. TEST PRESSURE Kgf/cm^{2}g	10.07	7.02
FLUID CIRCULATED	LP STEAM	ETHYLENE
NO. OF PASSES	ONE	ONE
WORKING PRESSURE Kgf/cm^{2}g	3.0	1.7
WORKING TEMP. (IN/OUT) °C	143.2/143.1	(-)85.63/(-)67.23
CORROSION ALLOWANCE mm	-	-
STRESS RELIEVING	AS PER CODE	AS PER CODE
RADIOGRAPHY	SPOT	100%
JOINT EFFICIENCY	0.85	1.0
INSULATION (mm)	65(IH)	(ANTI-SWEAT) (HOLD)

NOZZLE DATA

NOZZLE MARK	SIZE N.B./O.D. (INCH/mm)	ASME CLASS	SCH /THK (mm) /B	TYPE FACING	PAD W X T (mmXmm)	FLG. FACE FINISH	DESIGNATION
S1/S2	8"	150	80S	WNRF	70x12	NOTE2	SHELL SIDE INLETS
S3	4"	150	120S	WNRF	50x12	NOTE2	SHELL SIDE OUTLET
T1	8"ID	150	-	LWNRF	-	NOTE2	TUBE SIDE INLET
T2	24"	150	10	WNRF	-	NOTE2	TUBE SIDE OUTLET
L1-L2	2.0"	300	160S	WNRF	-	NOTE2	LEVEL INSTRUMENT
L3-L4	2.0"	300	160S	WNRF	-	NOTE2	LEVEL GAUGE
N5-N7	1.5"	150	160S	WNRF	-	NOTE2	MP CONN. + BF
N8-N9	1.5"ID	150	13.45	LWNRF	-	NOTE2	MP CONN. + BF
N10-N11	1.5"ID	150	13.45	LWNRF	-	NOTE2	CHANNEL VENT+BF
N12	1.5"ID	150	13.45	LWNRF	-	NOTE2	CHANNEL DRAIN+BF
V	2"	300	160S	WNRF		NOTE2	SHELL VENT + B.F

NO.	DATE	REVISION	BY	CHKD.	APPROVALS
B	26.12.2025	REVISED & ISSUED FOR BIDS/ENGG.	SUNIL	GK/KRK	AT
A	21.11.2025	ISSUED FOR BIDS/ENGG.	Vinay	GK/KRK	AT

EMPTY WEIGHT [KG] ~ 9500 p.shell
WT. FULL OF WATER [KG] ~ 17500 p.shell

ENGINEERS INDIA LTD.
STATIC & MACHINERY EQUIPMENT DEPT.
NEW DELHI

SETTING PLAN FOR
ITEM NO. 500-EE-AT-001
PROJECT : BPREP CLIENT : BPCL UNIT : OFFSITES

DRAWING NO. B957-500-80-42-4001 REV. B
SHEET 1 OF 3

Signature Not Verified
Digitally signed by ARITRA DE
Date: 2026.05.18 17:39:20 IST
Location: eProcure-EPROC