



**TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM
SUB-VENDOR LIST**

SPECIFICATION NO. PE-TS-XXX-166-A001

REVISION 01

DATE: 07/07/2015

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	LT MOTORS		HUBLI	
		SIEMENS	MUMBAI	
		ABB	BANGALORE / FARADABAD	
		BHARAT BIJLEE	MUMBAI	
		JYOTI	VADODARA	
		MARATHON	KOLKATA	
		NGEF	BANDALORE / HUBLI	
		BHARAT ELECTRIC (BHEL)		
		LHP	SOLAPUR	
26	PRESSURE / DP / TEMP.SWITCH	SOR	USA	
		GIC(GAUGES BOURDON)	PANVEL	
		HERION	GERMANY	
		ITT BARTON	USA	
		DELTA CONTROL	UK	
		ASHCROFT	USA / GERMANY	
		TRAFAG	RANIPET	
		INDFOSS	GHAZIABAD	
		ASHCROFT	GANDHINAGAR	
		SWITZER	CHENNAI	EXCEPT 9000 SERIES
27	LEVEL INDIA TOR FLOAT AND BOARD TYPE	FLOW STAR	FARIDABAD	
		SCIENTIFIC DEVICES	MUMBAI	
		GAUGES BOURDEN	PANVEL	
		PUNE TECH TROL	PUNE	
		SBEM	PUNE	
		LEVCON	KOLKATA	
		SIGMA	MUMBAI	
		CHEMTROL		
		DK INSTRUMENT	KOLKATA	
		V AUTOMAT	DELHI	
28	PRESSURER / DP GAUGE / TEMPERATURE GAUGE (DIAL TYPE)	H GURU (SI)	BANGALORE	
		H GURU INDUSTRIES	MUZAFFARPUR / RISHRA	
		AN INSTRUMENT	KOLKATA	
		GOA THERMOSTATIC	GOA	
		WAAREE	VAPI	
		MANOMETER	MUMBAI	
		GLUCK	MUMBAI	
		FORBES MARSHALL	HYDERABAD	
		ASHCROFT	GANDHINAGAR	
		WIKI	PUNE	
		GAGES BOURDON	MUMBAI / GOA	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI	



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		BOSE PANDA INSTRUMENTS PVT.LTD.	KOLKARA	ONLY PRESSURE AND DP GAUGE
		BUDENBERG GUAGE CO.LTD.	UK	ONLY TEMPERATURE GAUGE
		GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	GOA	
29	RTD /THERMOCOUPLE ASSEMBLY	PYROELECTRIC	GOA	
		GIC(THERMAL INSTRUMENTS)	MAHARASHTRA	
		TEMPSENS	UDAIPUR	
		DETRIVE	MUMBAI	
		TECHNO INSTRUMENTS	GUJRAT	
		TEMPSENS INSTRUMENT (I) PVT LTD	UDAIPUR	
		TM TECNOMATIC SPA	ITALY	
		TOSHNIWAL INDUSTRIES PVT. LTD.,	AJMER	
		THERMAL INSTRUMENT INDIA PVT. LTD.	MUMBAI	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI	
		GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	GOA	
30	ELECTRICAL ACTUATORS	ROTORK	BANGALORE	
		ROTORK	CHENNAI	
		AUMA	BANGALORE	
		LIMITORK	FARIDABAD	
31	LEVEL SWITCH (FLOAT AND DISPLACER TYPE)	TRAC	HYDERABAD	
		LEVCON	KOLKATA	
		DK INSTRUMENTS	KOLKATA	
		SBEM	PUNE	
		SBEM	PUNE	
		FLOW STAR	FARIDABAD	
		SIGMA	MUMBAI	
		V AUTOMAT	DELHI	
32	TEMPERATURE TRANSMITTER	EMERSON PROCESS MGT	PAWANE	
		MOORE	USA	
		ABB	FARIDABAD	
		YOKOGAWA	BANGLORE	MAKE YOKOGAWA, JAPAN
		ABB LIMITED	FARIDABAD	
		ENDRESS + HAUSER (INDIA) PVT. LTD.,	DELHI	
		MOORE INDUSTRIES INTERNATIONAL INC.	USA	
		SIEMENS LIMITED	MUMBAI	
		SMART INSTRUMENTS LTD, BRAZIL	MUMBAI	
		HONEYWELL AUTOMATION INDIA LIMITED	DELHI	
		TOSHNIWAL INDUSTRIES PVT. LTD.,	AJMER	
		YOKOGAWA INDIA LIMITED,	BANGALORE	

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33	AIR FILTER REGULATOR	PLACKA INSTRUMENT	CHENNAI	
		SHAVO NORGEN	MUMBAI	
		FISHER SANMAR	CHENNAI	
34	SOLENOID VALVE	AVCON	MUMBAI	
		ROTEX	BARODA/VV NAGAR	
		SMC	NOIDA	
		NUCON	HYDERABAD	
		ASCO	CHENNAI	
35	LOCAL CONTROL PANEL	PYROTECH	UDAIPUR	
		POSITRONICS	VADODARA	
		JACKSON	NOIDA	
		CONTROL DEVICE	KOLKATA	
		ROCKWELL AUTOMATION INDIA LTD	GHAZIABAD	
		SIEMENS LIMITED	DELHI	
		SCHNEIDER ELECTRIC INDIA PVT.LTD.	DELHI	
		JOSPER	NOIDA	
		I C A	MUMBAI	
		INDIAN SWITCH GEAR	VADODARA	
		SWITCHING CKT	KOLKATA	
		36	JUNCTION BOX	PYROTECH
POSITRONICS	VADODARA			
JACKSON	NOIDA			
CONTROL DEVICE	KOLKATA			
JOSPER	NOIDA			
I C A	MUMBAI			
AJMERA INDUSTRIAL & ENGINEERING WORKS	MUMBAI			
FLEXPRO ELECTRICALS PVT. LTD.	GUJARAT			
K.S.INSTRUMENTS PVT.LTD.	BANGALORE			
SUCHITRA INDUSTRIES	BANGALORE			
SHRENIK & COMPANY,	AHMEDABAD			
HOFFMAN	BANGALORE			
RITTAL	BANGALORE			
SWITCHING CKT	KOLKATA			
37	CABLE LUGS (NON FLAME PROOF)			3D
		DOWELL	MUMBAI	
		CHITRA	NASIK	
38	CABLE GLANDS (NON FLAME PROOF)	ARUP	KOLKATA	
		SUNIL	KOLKATA	
		QPIE	KOLKATA	
		COMMET	MUMBAI	
39	CABLE GLAND,	AJMERA	MUMBAI	



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	LUGS, JB (FLAME PROOF)	BALIGA	CHENNAI	
		FLEXPRO	NAVSARI	
40	BATTERY CHARGER FOR PLC	CHLORIDE POWER	KOLKATA	
		CHABBI	JALGAON	
		AMAR RAJA	TIRUPATI	
		STATCON	NOIDA	
		HBL POWER SYSTEM	HYDERABAD	
		JEMA ENERGY	SPAIN	
		MASS-TECH CONTROLS PVT.LTD.	MUMBAI	
		DUBAS	BANGALORE	
		CALDYNE	KOLKATA	
41	DC LEAD ACID / NI- CD BATTERIES	AMCO SAFT INDIA LTD	BANGALORE	NI-CD BATTERIES ONLY
		EXIDE INDUSTRIES LTD	DELHI	LEAD ACID BATTERIES ONLY.
		HBL POWER SYSTEMS LTD	HYDERABAD	NI/CD AND TUBULAR TYPE FOR LEAD ACID
		HOPPECKE BATTERIEN GMBH & CO.KG,	GERMANY	
		AMAR RAJA	TIRUPATI	
		SAFT	FRANCE/SWEDEN	
42	CONTROL / POWER CABLE	CORDS CABLE	BHIWADI	
		RADIANT CABLES	HYDERABAD	
		POLYCAB	DAMAN	
		KEI	BHIWADI	
		NICCO	KOLKATA	
		RAVIN CABLES	PUNE	
		INCAB	PUNE	
		HVPL	FARIDABAD	
		TORRENT CABLE	NADIAD	
		HAVELLS	ALWAR	
		PARAMOUNT	KHUSHKHERA	
		SRI RAM CABLES	BHIWADI	
		THERMOCABLES	HYDERABAD	
		TORRENT CABLE	NADIAD	
		UNIVERSAL CABLES	SATNA	
		GEMSCAB	BHIWADI	
		DELTON	FARIDABAD	
43	PLC BASED PANELS	SIEMENS	NASIK	
		SCHNEIDER	NASIK	
		ROCKWELL	SAHIBABAD	
		GE INTELLIGENT PLATFORM	BANGALORE	
		HONEYWELL AUTOMATION INDIA LIMITED ,	PUNE	
		ABB	BANGALORE	
44	OWS/PC	HP/COMPAQ /DELL/HCL/IBM/LENOVO		



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45	PRINTER	HP/CANNON/EPSON/XEROX/IBM/L EXMARK		
46	INSTRUMENT FITTINGS	AURA INCORPORATED	DELHI	
		ASTEC VALVES & FITTINGS PVT. LTD.,	MUMBAI	
		ARYA CRAFTS & ENGINEERING PVT. LTD.	MUMBAI	
		COMFIT & VALVE PVT. LTD.	NANDASAN	
		FLUIDFIT ENGINEERS PVT. LTD.	MUMBAI	REGISTERED AS PER 22ND ELECTRICAL AND C&I MISCC MEETING DTD. 15.01.2014
		FLUID CONTROLS PVT. LTD.	MUMBAI	NAME CHANGED FROM M/S HYD- AIR VALVES PVT. LTD. TO M/S FLUID CONTROLS PVT. LTD. AS PER 25TH MISCC-ELECTRICAL AND C&I DTD. 20.02.2014
		HP VALVES & FITTINGS INDIA PVT. LTD.	CHENNAI	
		PRECISION ENGINEERING INDUSTRIES	MUMBAI	
		PANAM ENGINEERS,	MUMBAI	
		PERFECT INSTRUMENTATION CONTROL (INDIA) PVT. LTD.	MUMBAI	
47	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	VIKAS INDUSTRIAL PRODUCTS	NOIDA	FINANCIAL LIMIT REVIEWED ON 05.06.2014
		AM-TECH ENGG.SERVICES	PUNE	
		INDUSTRIAL PERFORATION (I) PVT. LTD.	KOLKATA	
		INDMARK FORMTECH PVT. LTD.	PUNE	
		PREMIER POWER PRODUCTS (CAL) PVT. LTD.	KOLKATA	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL- PEM APPROVED GALVANIZERS.
		RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	KOLKATA	
48	CABLE TRAY SUPPORT SYSTEM- WELDED(GALV)	STEELITE ENGINEERING LTD.	MUMBAI	
		ASSOCIATED POWER STRUCTURES PVT. LTD.	G. I. D. C., MAKARPURA, VADODARA- GUJARAT	WORKS ADDRESSES ARE APPLICABLE FOR MANUFACTURING AND GALVANISING.
		INDUSTRIAL PERFORATION (I) PVT.LTD.	DUM DUM KOLKATA-WEST BENGAL	
		INDMARK FORMTECH PVT. LTD.	MIDC BHOSARI PUNE- MAHARASHTRA	GALVANIZING UNIT LOCATED AT PHAS-3, E-11/1, MIDC, PUNE ,
		JAMNA METAL COMPANY	DSIDC, NARLA INDL. AREA DELHI	
		PREMIER POWER PRODUCTS (CAL) PVT. LTD.	KOLKATA,-WEST BENGAL	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL- PEM APPROVED GALVANIZERS.
		PATNY SYSTEMS (P) LTD	SARDAR PATEL	

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	CABLE TRAY SUPPORT SYSTEM- WELDED(GALV)		ROAD SEUNDRABAD	
		PASSIVE INFRA PROJECTS PVT. LTD.	VAISHALI, PITAMPURA DELHI-	
		RUKMANI ELECTRICAL & COMPONENTS PVT LTD	KOLKATA-WEST BENGAL-INDIA	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL- PEM APPROVED GALVANIZERS.
		RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	P.K. TAGORE STREET, MAIN BUILDING KOLKATA-WEST BENGAL	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL- PEM APPROVED GALVANIZERS. ADDITIONAL WORKS AT "SANKRAIL INDUSTRIAL PARK, BHAGABATIPUR MAUJA, DHULAGARH, HOWRAH- 711302" APPROVED
		RABI ENGINEERING WORKS PVT. LTD.	R.N. GUHA ROAD, DUM DUM, KOLKATA- WEST BENGAL	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL- PEM APPROVED GALVANIZERS.
		SARAL INDUSTRIES	INDUSTRIAL AREA-1 SULTANPUR ROAD RAE BARELI-UTTAR PRADESH	REGISTERED IN PERMANENT CATEGORY ALONG WITH GALVANIZER M/S SARAL PROJECTS AND PROCESSORS , ,
		UNITECH FABRICATORS AND ENGINEERS PVT LTD	M.B.RAOD , BIRATI KALABAGAN KOLKATA KOLKATA-WEST BENGAL	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL- PEM APPROVED GALVANIZERS.
49	CABLE TRAY SUPPORT SYSTEM- WELDED(UNGALV)	RASHTRIYA ISPAT NIGAM LIMITED	AMBAWADI AHMEDABAD-	
		STEEL AUTHORITY OF INDIA LTD.	ISPAT BHAWAN LODI ROAD NEW DELHI-	
50	CABLE TERM.& JOINT KITS	3M ELECTRO AND COMMUNICATION INDIA P.LTD	RAJENDRA PLACE, DELHI	HEAT SHRINKABLE TYPE ONLY.
		HARI CONSOLIDATED PVT.LTD.,NEW DELHI	JHANDEWALAN, NEW DELHI-DELHI	
		RAYCHEM RPG PRIVATE LIMITED	JANAKPURI NEW DELHI	
		YAMUNA CABLE ACCESSORIES PVT. LTD.	AMBALA ROAD, JAGADHRI YAMUNANAGAR- HARYANA	
51	LIMIT SWITCH	BCH	NEW DELHI	
		SIEMENS	NEW DELHI	
		JAIBALAJI	NEWDELHI	
52	ANNUNCIATOR	IIC	MUMBAI	
		MINILEC	AHEMDABAD	
		PROCON	CHENNAI	

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53	INTERPOSING RELAY	ECONIX	MUMBAI	
		PHEONIX	DELHI	
54	SELECTOR SWITCH	SCHENIDER	INDIA	
		SIEMENS	INDIA	
		L&T	INDIA	
		KAYCEE	INDIA	
55	INDICATION LAMPS, PUSHBUTTON, AUX. CONTACTOR, AUX. RELAYS	SCHENIDER	INDIA	
		SIEMENS	INDIA	
		ABB	INDIA	
		L&T	INDIA	
56	TIMER	BCH	INDIA	
		EAPL	INDIA	
57	PNEUMATIC ACTUATOR/CYLINDER(METALLIC)	SCHRADDER	MUMBAI	
		NUCON	HYDERABAD	
		ROTEX	MUMBAI	
		VAAS	CHENNAI	
58	INSTRUMENT RACKS	PYROTECH, CHEMIN, SAJAS		

The make of Sub-vendor items shall be generally as indicated above which is subject to customer / BHEL approval during detail engineering.

Make of any unlisted items shall be subject to customer / BHEL approval during detail engineering. For such items, bidder to furnish list of sub-vendors during detail engineering stage for Customer / BHEL's review and approval. Bidder shall furnish following supporting documentation within 1 month of placement of LOI. Thereafter no request for additional sub-vendor shall be entertained.

- Documentation to show that the equipment /system has been supplied for a plant of similar or higher capacity.
- Documentation in the form of certificate that the equipment/system has been operating satisfactorily for two years as on the scheduled date of bid opening.

The successful bidder will get the makes of all items approved from Customer/ Consultant during detail engineering within two months of placement of LOI. The complete list will be necessarily be submitted within one month of placement of LOI to ensure timely placement of order for BOIs

Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges; counter flanges etc. from approved sub vendor only.



5 X 800 MW YADADRI TPS

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM

SECTION: I-A
ANNEXURE-C

(DRAWINGS / DOCUMENTS SUBMISSION PROCEDURE)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT PPEI, NOIDA-
INDIA

5 X 800MW YADADRI TPS

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM

ANNEXURE - D
(MDL WITH SUBMISSION SCHEDULE)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

ANNEXURE-D					
DRAWING / DOC SUBMISSION SCHEDULE DURING DEAIL ENGINEERING					
PROJECT : 5 X 800 MW YADADRI TPS PROJECT					
PACKAGE : FUEL OIL UNLOADING & STORAGE SYSTEM					
S.N	DRAWING NO.	DRAWING TITLE	Sch submission week from LOI	CAT	Resubmission after incorporating comments
1	PE-V0-417-166-A003	DESIGN CALCULATION OF ROOF STRUCTURE OF TANKS WITH STAAD CALCULATION FOR FOHS	6	A-CUST	WITHIN 1 WEEK
2	PE-V0-417-166-A004	SIZING CALCULATION OF UTILITIES OF FOHS (STEAM CONSUMPTION, PIPE SIZING, SIZING CALC FOR PRS , STEAM TRAP, FLOOR COIL HEATER AND INSULATION & CLADDING)	4	I-CUST	WITHIN 1 WEEK
3	PE-V0-417-166-A005	DATASHEET & GAD OF SCREW PUMPS & MOTORS FOR FOHS	8	I-CUST	WITHIN 1 WEEK
4	PE-V0-417-166-A006	NPSH AND PUMP HEAD CALULATION OF PUMPS FOR FOHS	6	A-CUST	WITHIN 1 WEEK
5	PE-V0-417-166-A007	DESIGN CALCULATION AND GAD OF SUCTION HEATER FOR FOHS	8	I-CUST	WITHIN 1 WEEK
6	PE-V0-417-166-A009	STRESS ANALYSIS OF LINES FOR FOHS	10	I-CUST	WITHIN 1 WEEK
7	PE-V0-417-166-A010	DESIGN CALCULATION AND GAD OF OWS FOR FOHS	8	I-CUST	WITHIN 1 WEEK
8	PE-V0-417-166-A012	PAINTING SCHEDULE OF FOHS	4	A-CUST	WITHIN 1 WEEK
9	PE-V0-417-166-A013	DS AND GAD OF PRS, TCV, TRAP, INSULATION AND CLADDING FOR FOHS	10	I-CUST	WITHIN 1 WEEK
10	PE-V0-417-166-A014	DATASHEET OF FOHS INSTRUMENTS	10	I-CUST	WITHIN 1 WEEK
11	PE-V0-417-166-A016	PIPING LAYOUT IN TANK FARM AREA INCLUDING LDO & HFO ROAD TANKER UNLOADING OF FOHS	8	A-CUST	WITHIN 1 WEEK
12	PE-V0-417-166-A017	PIPING LAYOUT IN HFO UNLOADING PUMP HOUSE (NEAR RAILWAY UNLOADING AREA) OF FOHS	10	A-CUST	WITHIN 1 WEEK
13	PE-V0-417-166-A017a	PIPING LAYOUT IN COMBINED UNLOADING PUMP HOUSE (NEAR TANKFARM AREA) OF FOHS	10	A-CUST	WITHIN 1 WEEK
14	PE-V0-417-166-A018	GAD OF FOHS (COMPOSITE LAYOUT) FOR CCOE APPROVAL	10	A-CUST	WITHIN 1 WEEK
15	PE-V0-417-166-A019	SUGGESTIVE ELECTRICAL LAYOUT DRAWING OF FOHS	10	I-CUST	WITHIN 1 WEEK
16	PE-V0-417-166-A023	FABRICATION DRAWING OF FOHS TANKS INCLUDING ACCESSORIES	14	I-CUST	WITHIN 1 WEEK
17	PE-V0-417-166-A024	DESIGN CALCULATION & GAD OF MISCELLANEOUS TANKS FOR FOHS	10	I-CUST	WITHIN 1 WEEK
18	PE-V0-417-166-A025	CIVIL INPUT DRAWING IN TANK FARM AREA INCLUDING LDO & HFO ROAD TANKER UNLOADING FOR FOHS	12	I-CUST	WITHIN 1 WEEK
19	PE-V0-417-166-A026	QAP OF SCREW PUMP & MOTORS FOR FOHS	8	I-CUST	WITHIN 1 WEEK
20	PE-V0-417-166-A027	QAP OF PRS, TCV, TRAP, INSULATION AND CLADDING FOR FOHS	10	I-CUST	WITHIN 1 WEEK
21	PE-V0-417-166-A028	QAP OF SUMP PUMP & MOTORS FOR FOHS	8	I-CUST	WITHIN 1 WEEK
22	PE-V0-417-166-A029	QAP OF FOHS INSTRUMENTS	10	I-CUST	WITHIN 1 WEEK
23	PE-V0-417-166-A030	QAP OF CONTROL PANEL	12	I-CUST	WITHIN 1 WEEK
24	PE-V0-417-166-A031	EQUIPMENT SCHEDULES OF FOHS	16	I-CUST	WITHIN 1 WEEK
25	PE-V0-417-166-A032	CABLE SCHEDULE OF FOHS	14	I-G-P	WITHIN 1 WEEK
26	PE-V0-417-166-A033	ELECTRICAL LOAD DATA OF FOHS	16	I-G-P	WITHIN 1 WEEK
27	PE-V0-417-166-A034	ISOMETRIC DRAWING OF FOHS WITH COMPLETE BOQ	10	I-G-P	WITHIN 1 WEEK
28	PE-V0-417-166-A035	SUB-VENDOR LIST WITH INSPECTION CATEGORIZATION LIST FOR FOHS	4	A-CUST	WITHIN 1 WEEK
29	PE-V0-417-166-A036	INSTRUMENT INSTALLATION DIAGRAM OF FOHS	14	I-CUST	WITHIN 1 WEEK
30	PE-V0-417-166-A039	INSULATION I& CLADDING NSTALLATION PROCEDURE FOR FOHS EQUIPMENTS	14	I-G-P	WITHIN 1 WEEK
31	PE-V0-417-166-A040	STEAM TRACING INSTALLATION PROCEDURE	16	I-G-P	WITHIN 1 WEEK
32	PE-V0-417-166-A042	COMMISSIONING PROCEDURE OF FOHS	16	I-G-P	WITHIN 1 WEEK
33	PE-V0-417-166-A044	O&M MANUAL OF FOHS	16	I-CUST	WITHIN 1 WEEK
34	PE-V0-417-166-A045	DEMONSTRATION TEST PROCEDURE OF FOHS	16	A-CUST	WITHIN 1 WEEK

7336/2020/PS-PEM-MAX

35	PE-V0-417-166-A041	ANALOG & BINARY I/O LIST, BOM, HMI PICTURES/ PLANT SCHEMATICS FOR FOHS (DCS BASED)	12	*I-G-P	WITHIN 1 WEEK
36	PE-V0-417-166-A046	SCHEME/ LOGIC DIAGRAM FOR FOHS (DCS BASED)	12	I-G-P	WITHIN 1 WEEK
37	PE-V0-417-166-A047	PROCESS MANUSCRIPT FOR IMPLEMENTATION IN DCS FOR FOHS	12	I-G-P	WITHIN 1 WEEK
38	PE-V0-417-166-A048	DATASHEET & GAD OF SUMP PUMPS & MOTORS IN FOHS	8	I-CUST	WITHIN 1 WEEK
39	PE-V0-417-166-A049	DS AND GAD OF VALVES,HOSE AND STRAINER	10	I-CUST	WITHIN 1 WEEK
40	PE-V0-417-166-A050	DS AND GAD PIPES, PLATES AND FITTINGS ETC FOR FOHS	8	I-CUST	WITHIN 1 WEEK
41	PE-V0-417-166-A051	PIPING LAYOUT IN UNLOADING AREA (RAILWAY) OF FOHS	10	A-CUST	WITHIN 1 WEEK
42	PE-V0-417-166-A052	PIPING LAYOUT IN YARD AREA OF FOHS	10	A-CUST	WITHIN 1 WEEK
43	PE-V0-417-166-A053	CIVIL INPUT DRAWING IN UNLOADING PUMP HOUSE (NEAR RAILWAY UNLOADING AREA) OF FOHS	12	I-G-P	WITHIN 1 WEEK
44	PE-V0-417-166-A053a	CIVIL INPUT DRAWING IN COMBINED UNLOADING PUMP HOUSE (NEAR TANKFARM AREA) OF FOHS	12	I-G-P	WITHIN 1 WEEK
45	PE-V0-417-166-A054	CIVIL INPUT DRAWING IN UNLOADING AREA (RAILWAY) OF FOHS	12	I-G-P	WITHIN 1 WEEK
46	PE-V0-417-166-A055	CIVIL INPUT DRAWING IN YARD AREA OF FOHS	12	I-G-P	WITHIN 1 WEEK
47	PE-V0-417-166-A056	QAP OF VALVES, HOSE AND STRAINER FOR FOHS	10	I-CUST	WITHIN 1 WEEK
48	PE-V0-417-166-A057	QAP OF PIPES, PLATES AND FITTINGS ETC FOR FOHS	8	I-CUST	WITHIN 1 WEEK
49	PE-V0-417-166-A058	ERECTION PROCEDURE OF ALL EQUIPMENT IN FOHS SCOPE	16	I-CUST	WITHIN 1 WEEK

NOTES

1. Finally approved documents / drawings to be provided in editable format(MS office/Autocad format) for onward submission to end customer.
2. Bidder to note that during detailed engineering, drwg/doc will be submitted through web based document management system in addition to hard copies to be submitted as per drawing/document distribution schedule. Procedure for the same shall be informed after award of contract.
3. *I-G-P stands for ' internal generation purpose'.

SIGNATURE:

NAME:

DESIGNATION:

COMPANY:

DATE:

COMPANY SEAL

5 X 800MW YADADRI TPS

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM

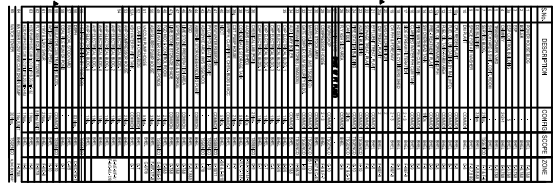
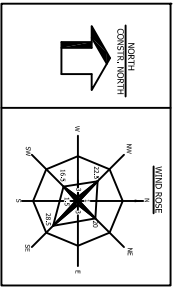
ANNEXURE - E

(INPUT DRAWINGS & DOCUMENTS OF TENDER))

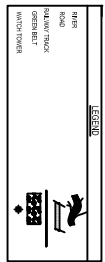
Sl. No.	Drawing No.	Title
1	PE-DG-417-100-M001	Plot plan
2	PE-DG-417-166-A001 (Sheet 1 of 4)	Process & Instrumentation Diagram (LEGEND)
3	PE-DG-417-166-A001 (Sheet 2 of 4)	Process & Instrumentation Diagram of LDO
4	PE-DG-417-166-A001(Sheet 3 of 4)	Process & Instrumentation Diagram of HFO
5	PE-DG-417-166-A001 (Sheet 4 of 4)	Process & Instrumentation Diagram of steam & condensate
6	PE-DG-417-166-A002 (Sheet 1 of 2)	GA Drawing of HFO Tanks
7	PE-DG-417-166-A002 (Sheet 2 of 2)	GA Drawing of LDO Tanks
8	PE-DG-417-166-A003	Unloading Pump House and Dyke area for FOHS
9	SKETCH-1 &2	Layout Drawings for unloading area near railway

Note:

ALL THE REQUIREMENTS SHOWN UNDER DRAWING ARE BARE MINIMUM, ANY OTHER ITEM FOUND APPLICABLE DURING DETAILED ENGINEERING AS PER TECHNICAL SPECIFICATION/ DESIGN CODE/ FUNCTIONAL REQUIREMENT SHALL BE SUPPLIED BY BIDDER WITHOUT ANY COMMERCIAL IMPLICATION TO BHEL.



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CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD
YADADRI TPS (5X800 MW)
CONSULTANT: TATA CONSULTING ENGINEERS LIMITED
BANGALORE INDIA

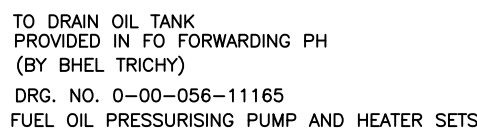
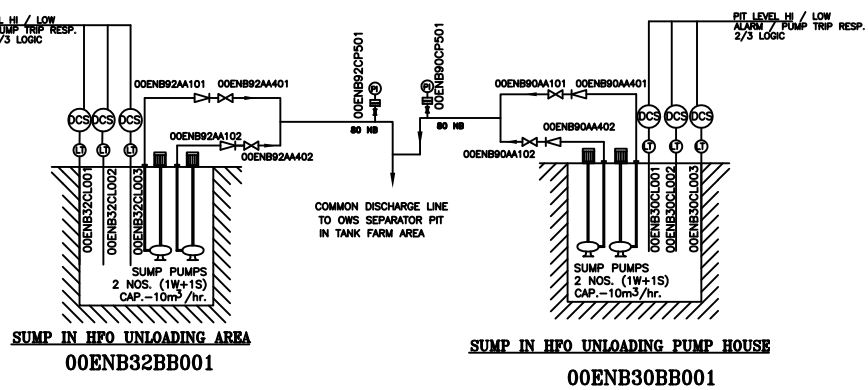


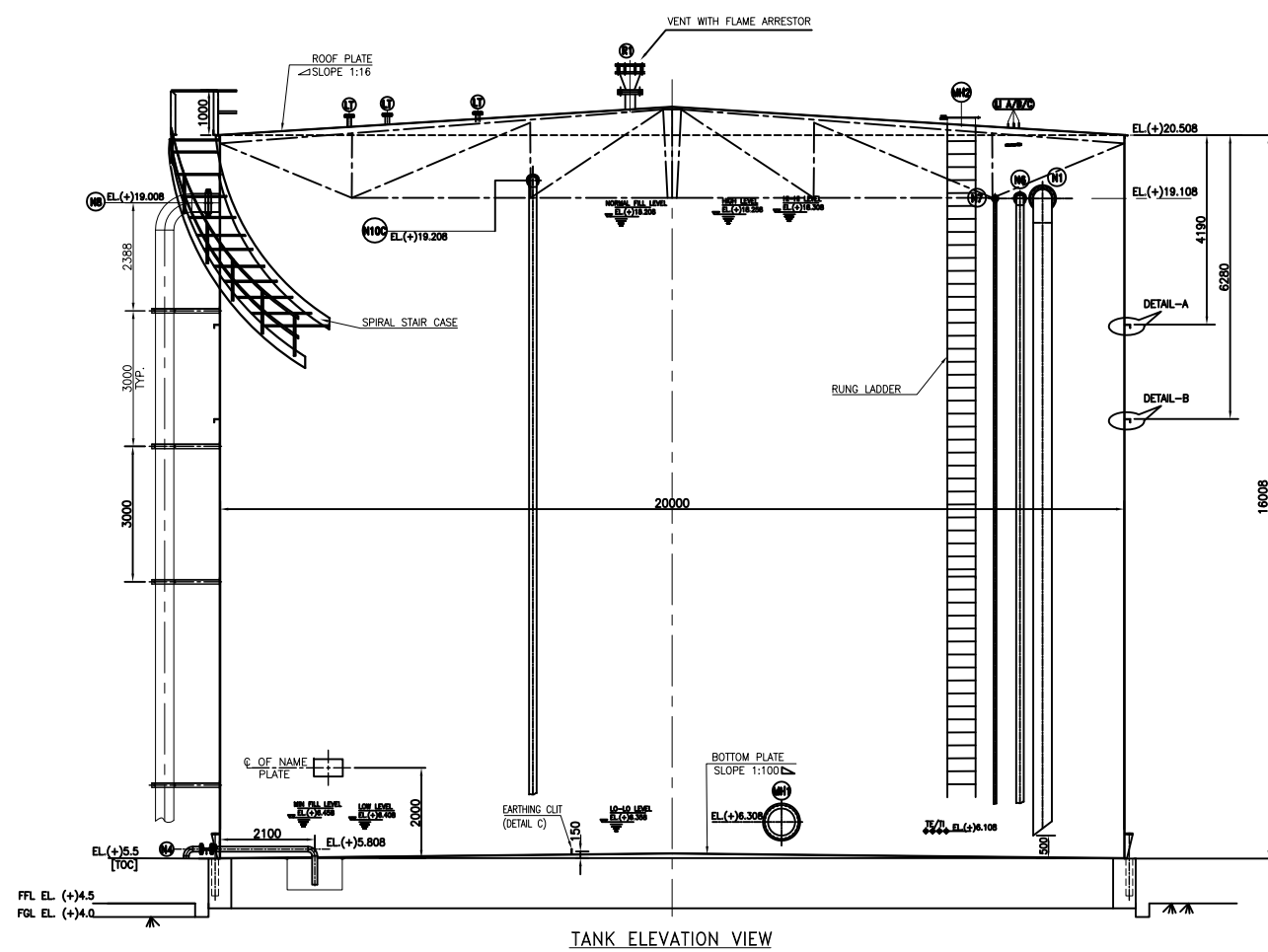
BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
Noida

JOB NO.	STATUS	CONTRACT	JOB NO.	STATUS	CONTRACT	JOB NO.	STATUS	CONTRACT	JOB NO.	STATUS	CONTRACT	JOB NO.	STATUS	CONTRACT
417	CONTRACT		417	CONTRACT		417	CONTRACT		417	CONTRACT		417	CONTRACT	

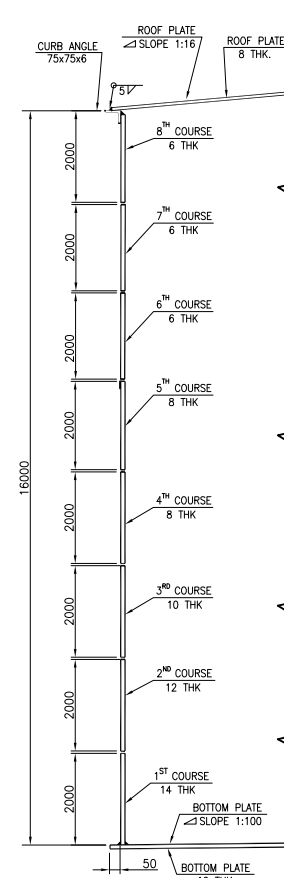
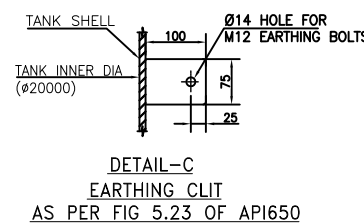
TITLE: PLOT PLAN

REV.	DATE	BY	CHKD.	APPD.	REV.	DATE	BY	CHKD.	APPD.	REV.	DATE	BY	CHKD.	APPD.	REV.	DATE	BY	CHKD.	APPD.

Page 217 of 429

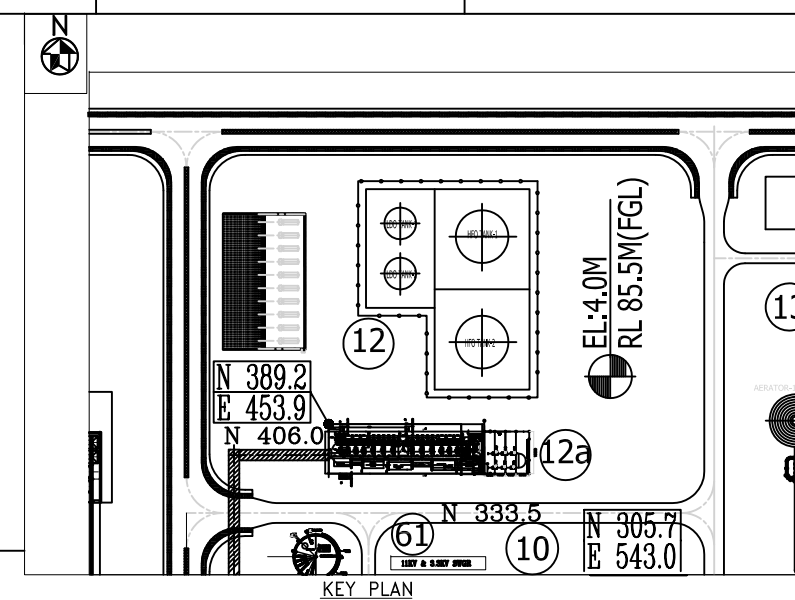


TANK ELEVATION VIEW

SHELL ARRANGEMENT FOR 1ST TO 08TH COURSE

Name of Manufacturer:	BHEL
PROJECT	5x800 MW YADADRI TPS
NAME OF THE EQUIPMENT	HFO STORAGE TANK
TANK NOMINAL DIAMETER	2000 MM
TANK NOMINAL HEIGHT	17.00 M
MAXIMUM CAPACITY	4333 m ³ M3
NET CAPACITY	4000 M3
DATE OF MANUFACTURE	2018
DESIGN LIQUID LEVEL	13.80 M
DESIGN CODE	AP1650
MAXIMUM OPERATING PRESS.	DMC-HYDROSTATIC 3.0
HYDRO TEST PRESSURE	HYDRO TEST PRESSURE = 3.000 MPa
MAXIMUM OPERATING TEMP.	50 DEG
DESIGN TEMPERATURE	50 DEG
MATERIAL OF TANK	SS 304 GR. 2H
ISS TAG NO. OF TANKS	HFO TANK-1: SOEN1080001 HFO TANK-2: SOEN1108001
3 MM THK MATERIAL - SS304	200

NAME PLATE DETAIL



KEY PLAN

DESIGN DATA			
DESCRIPTION	UNIT	DETAIL	
DESIGN CODE	-	API 650	
STORED PRODUCT	-	HFO	
DENSITY OF PRODUCT STORED	kg/m ³	890 to 950	
DESIGN SPECIFIC GRAVITY OF PRODUCT STORED	-	1	
WELD JOINT EFFICIENCY	-	0.85	
TYPE OF TANK	-	VERTICAL CYLINDRICAL, SUPPORTED CONE ROOF	
NUMBER OF TANKS	no	TWO (2)	
DIAMETER OF TANK (ID)	mm	20000	
HEIGHT OF TANK	mm	16000	
TANK EMPTY WEIGHT	kg	130521	
TANK FILLED WEIGHT	kg	4454181	
NET WORKING CAPACITY	m ³	4004 < AS PER FIG 5.4 OF API650	
MAXIMUM TANK CAPACITY	m ³	4333 < AS PER FIG 5.4 OF API650	
BASIC WIND SPEED	m/s	44	
DESIGN TEMPERATURE	°C	60	
INTERNAL DESIGN PRESSURE	KPa	18 AS PER API650	
OPERATING PRESSURE	-	ATMOSPHERIC	
CORROSION ALLOWANCE	mm	2	
SEISMIC FACTORS	-	ZONE-III, PEAK GROUND ACCELERATION = 0.16g	
SEISMIC MOMENTS	KNM	RING WALL MOMENT = 37138.49, SLAB MOMENT = 53287.01	
WIND LOAD &	KN	VERTICAL=336, HORIZONTAL=552.64	
WIND MOMENT	KNM	8214.40	
ROOF LOAD < UNIFORM LIVE	kg/m ²	150	
TESTING	-	AS PER CL.7.3 AND SECTION 8 OF API650	
RATE OF FILLING OF TANK (MAX)	m ³ /hr	600	
RATE OF EMPTYING OF TANK (MAX)	m ³ /hr	361 (total of all unit) AS PER BHEL TRICY. DRG. NO. 0-00-056-11166	

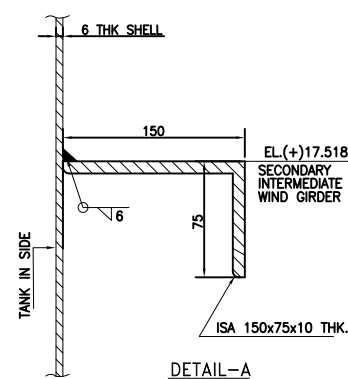
MATERIAL SPECIFICATION	
ITEM	MATERIAL
PLATES FOR SHELL, BOTTOM & ROOF STRUCTURES	IS: 2062 GR.B
PIPES	IS: 2062 GRA
FLANGES	UP TO 50NB - ASTM A106 GR. SCH40, 65 TO 150NB - ASTM A106 GR. SCH40, 200 TO 350NB - API 5L GR.B, ERW, SCH40, 400 TO 800NB - FABRICATED FROM IS: 2062 GR.B PLATES.
GASKETS	FOR OIL - IS: 2062 GR.B, SORF FOR STEAM & CONDENSATE - ASTM-105, SORF FOR TANK MANHOLES - GRAPHOL, 3THK, SS 304 METALLIC SPIRAL WOUND, FOR TANK MANHOLES - CNAF 3THK
FITTINGS	FOR OIL & WATER: 50 NB AND BELOW - ASTM A105, SW ENDS 65NB TO 350NB - ASTM A 234, GR. WPB, BW ENDS 350NB TO 600NB - CS MADE FROM PARENT PIPE MITRE/FABRICATION BW ENDS FOR STEAM & CONDENSATE: 50 NB AND BELOW - ASTM A105, SW ENDS 65NB TO 400NB - ASTM A 234, GR. WPB, BW ENDS
BOLTS & NUTS	FOR OIL, WATER SERVICES AND STRUCTURALS - ASTM A 193 Gr. B7, FOR STEAM & CONDENSATE SERVICE - ASTM A 194 Gr 2H
NAME PLATE	SS 304

SHELL NOZZLES & APPURTENANCES FOR TANK							
MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE ELE FROM TOP OF BOTTOM PLATE AS PER TABLE 5.6a OF API650	PROJ. DIST. FROM SHELL PLATE AS PER TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
N1	450	1	SDRF, 150H	14600.0	250	12.70	HFO INLET
N2	450	1	SDRF, 150H	600	250	12.70	OUTLET (SUCTION HEATER-1)
N4	100	1	SDRF, 150H	300	175	8.56	DRAW-OFF SUMP
N5	450	1	SDRF, 150H	600	250	12.7	OUTLET(SUCTION HEATER-2)
N6	300	1	SDRF, 150H	14600.0	225	12.70	HFO RETURN FROM BOILER
N7	80	1	SDRF, 150H	14600.0	175	7.62	OIL RETURN FROM DWS
N8	500	1	SDRF, 150H	14500.0	250	12.70	OVERFLOW
N10	100	1	SDRF, 150H	14700	200	10.97	FOAM POURER
N11 A/B/ C/D	50	4	SDRF, 150H	475.0	150	5.54	STEAM INLET TO FLOOR COIL HEATER
N12 A/B/ C/D	50	4	SDRF, 150H	475.0	150	5.54	STEAM INLET TO FLOOR COIL HEATER
N13 A/B/ C/D	50	4	SDRF, 150H	255.0	150	5.54	CONDENSATE OUT OF FLOOR COIL HEATER
N14 A/B/ C/D	50	4	SDRF, 150H	255.0	150	5.54	CONDENSATE OUT OF FLOOR COIL HEATER
N15	25	1	SDRF, #150	400	150	6.35	DRAIN NOZZLE FOR SAMPLING COLLECTION
N16	250	1	SDRF, 150H	400	225	12.70	HFO INTER TANK TRANSFER
N17	450	1	SDRF, 150H	14600.0	250	12.70	SPARE INLET(BLIND FLANGE)
N18	400	1	SDRF, 150H	600	200	12.7	SPARE OUTLET WITH VALVE
TE M33X 2 - SDOCK ET	3	-	-	600	-	-	TEMPERATURE ELEMENT
T1 M33X 2 - SDOCK ET	1	-	-	600	-	-	TEMPERATURE INDICATOR
MH1	600	1	AS PER FIG 5.16 OF API650	800.0	150	6.0	SHELL MANHOLE WITH BLIND FLANGE
EC	-	2	AS PER DETAIL C	-	-	-	EARTHING CLIT

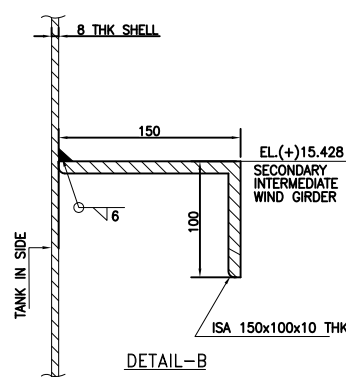
ROOF NOZZLES & APPURTENANCES FOR TANK							
MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE DISTANCE FROM ROOF CENTRE	PROJ. DIST. FROM SHELL PLATE AS PER TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
R1	300	1	SDRF, #150	1000	200	12.7	VENT WITH FLAME ARRESTOR
R2 G/a/c/d	40	4	SDRF, #150	4500	-	-	NOZZLE FOR HEAT DETECTION
LT	80	3	SDRF, #150	8500	175	7.62	LEVEL TRANSMITTERS (RADAR TYPE)
LI A/B/ C	25	3	SDRF, #150	9500	150	6.35	LEVEL INDICATOR < FLOAT & ARROW TYPE
MH2	600	1	AS PER FIG 5.16 OF API650	9400	150	6	ROOF MANHOLE WITH COVER

NOTES:-

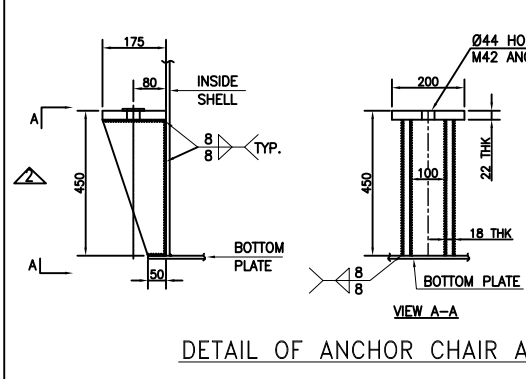
- ALL DIMENSIONS ARE IN MM. ELEVATIONS ARE IN METRE UNLESS OTHERWISE SPECIFIED.
- THE FINISHED FLOOR LEVEL (FLL) OF POWER HOUSE BUILDING GROUND FLOOR IS EL. + 0.00M WHICH CORRESPONDS TO RL. 81.5M, I.E., 0.5M ABOVE FGL (RL81.0M) IN MAIN PLANT AREA.
- TANK SURFACE SHOULD BE CLEANED THOROUGHLY AFTER FABRICATION FROM LOOSE SUBSTANCES AND FOREIGN MATERIALS SUCH AS DIRT, RUST, SCALE, OIL, GREASE AND WELDING FLUX ETC.
- VERTICAL SHELL JOINTS SHALL BE OFFSET FROM EACH OTHER WITH A MINIMUM DISTANCE OF 5 TIMES THE THICKNESS OF SHELL COURSE UNDER CONSIDERATION.
- BOTTOM PLATE SHALL UNIFORMLY REST ON THE FOUNDATION. THREE PLATE JOINTS IN BOTTOM PLATE SHALL NOT BE CLOSER THAN 300mm FROM EACH OTHER AND ALSO FROM THE TANK SHELL.
- EARTHING LUG AND NAME PLATE SHALL BE WELDED TO THE TANK AS PER SITE REQUIREMENT.
- ALL THE INLET PIPING SHALL BE EXTENDED UP TO BOTTOM OF TANK AND CLEARANCE BETWEEN THE BOTTOM OF TANK AND THE EDGES OF INLET PIPING SHALL BE 500 MM MAXIMUM.
- WEIR PLATE SHALL BE PROVIDED AT THE BOTTOM OF ALL THE INLET PIPES INSIDE TANK TO AVOID EROSION OF BOTTOM PLATE.
- TREAD AND RISE FOR STAIRCASE OF THE TANK SHALL BE 250 AND 200 MM RESPECTIVELY.
- LEVEL INDICATOR SUPPORTS SHALL BE PROVIDED ON THE SHELL & ROOF.
- NOZZLE FOR FOAM POURER, HOLES FOR HEAT DETECTOR ON TANK ROOF, PAD PLATES ON TANK FOR SUPPORTING FOAM POURER PIPE AND M/W SPRAY SYSTEM SHALL BE PROVIDED BY BHEL-PESD HYD. AS PER FIRE PROTECTION SYSTEM DRAWING.
- FINAL PAINTING SHALL BE CARRIED OUT AS PER APPROVED PAINTING SCHEDULE AFTER HYDRO TEST OF TANK.
- TANK NOZZLE FLANGES SHALL BE PROVIDED WITH COUNTER FLANGES ALONG WITH NUTS & BOLTS BY TANK VENDOR.
- OPERATING PLATFORMS SHALL BE PROVIDED BY TANK VENDOR FOR ALL THE INACCESSIBLE VALVES AND FOAM POURER OF TANK.
- FABRICATION, ERECTION AND TESTING SHALL BE AS PER API650/IS 803.
- FOR MANUAL WELDING PROCESSES, FILLET WELD LEGS OR GROOVE WELD DEPTHS GREATER THAN 6MM SHALL BE MULTIPASS.
- ALL TANK SHELL WELD INTERSECTIONS WHERE VERTICAL JOINTS MEET THE HORIZONTAL JOINTS SHALL BE RADIOGRAPHED, REGARDLESS OF THICKNESS.
- ALL RADIOGRAPHY OR OTHER NDE AND ANY WELDING SHALL BE COMPLETED PRIOR TO HYDROSTATIC TESTING.
- THE TANK HYDROSTATIC TEST SHALL BE CONDUCTED BEFORE PERMANENT EXTERNAL PIPING IS CONNECTED TO THE TANK EXCEPT FOR PIPING THAT IS NECESSARY TO FILL AND EMPTY THE TANK, WHICH SHOULD HAVE A FLEXIBLE COMPONENT TO ALLOW FOR SETTLEMENT.
- ALL INLET PIPING TO THE TANK SHALL BE PROVIDED WITH SUITABLE SIPHON BREAKER.
- MANHOLE FOR ROOF AND SHELL OF TANK SHALL BE HINGED TYPE.
- NOZZLE ORIENTATION OF TANK#1 IS MIRROR IMAGE OF TANK#2
- INSULATION & CLADDING SHALL BE PROVIDED ON COMPLETE SHELL OF THE HFO TANKS.
- RADIOGRAPHY OF TANKS SHALL BE DONE AS PER CLAUSE 8.1.2 TO 8.1.8 OF API 650.
- FOR STIFFNER, PLEASE REFER DETAIL-A AND DETAIL-B FOR WIND GIRDER



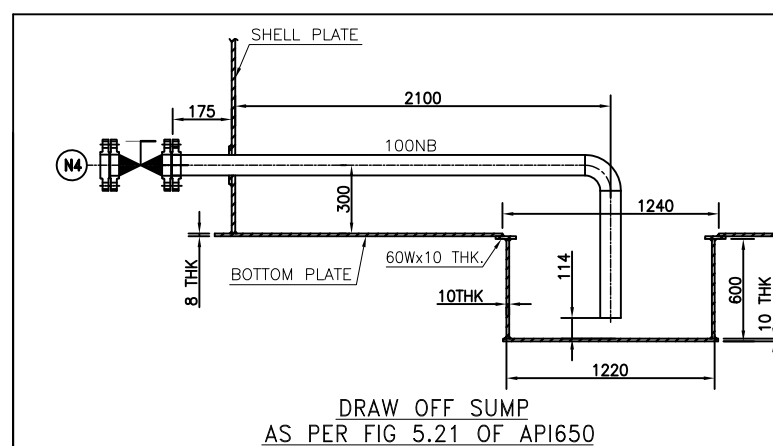
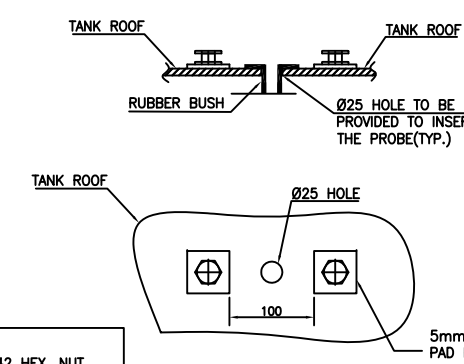
DETAIL-A



DETAIL-B

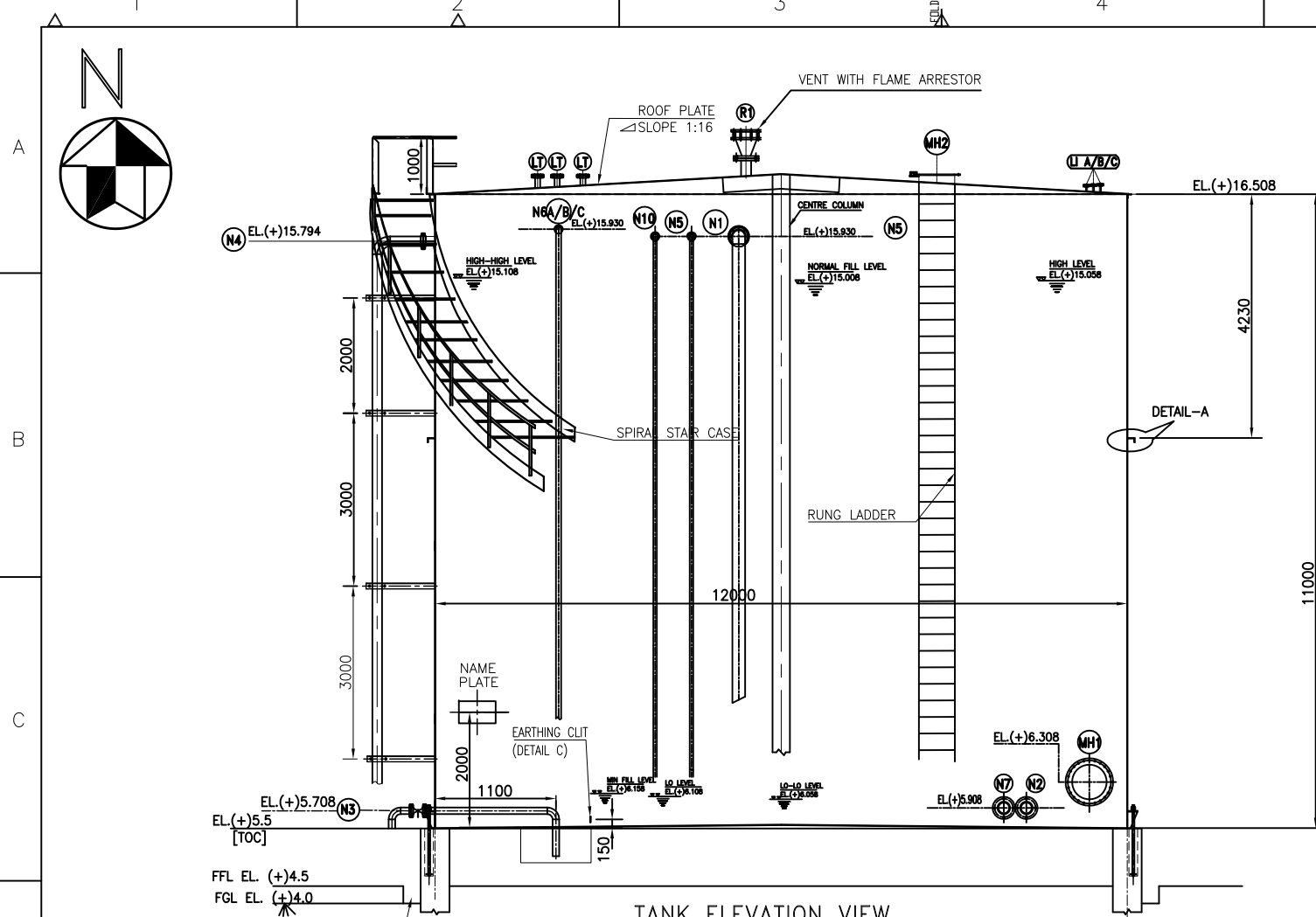


DETAIL OF ANCHOR CHAIR AND ANCHOR BOLT

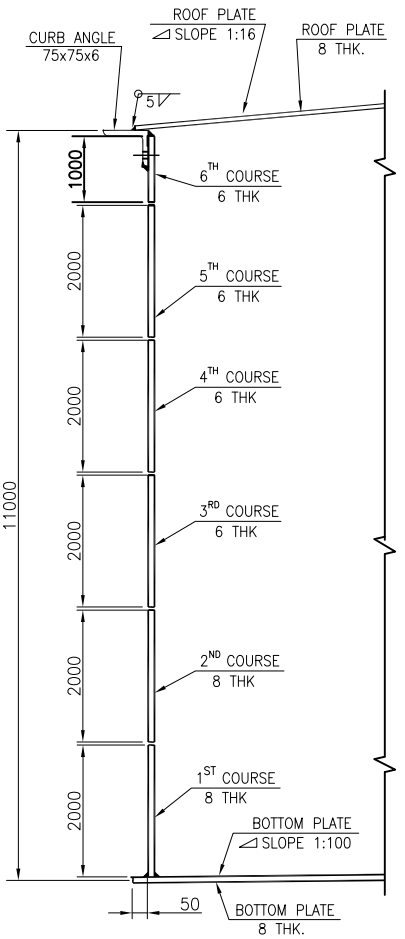
DRAW OFF SUMP
AS PER FIG 5.21 OF API650MOUNTING DETAILS OF PROBE
TYPE HEAT DETECTOR

JOB NO.		: 417		
STATUS		: CONTRACT		
REV	DATE	DESN.	CHD.	APPD.
01	03.12.18	SKY	SR	HK
02	01.08.19	SKY	SR	HK

CUSTOMER STAMP									
CUSTOMER		TELANGANA STATE POWER GENERATION CORPORATION LTD TELANGANA STATE, INDIA							
CONSULTANT		TATA CONSULTING ENGINEERS LIMITED, BANGALORE							
PROJECT		5x800 MW YADADRI TPS, NALGONDA							
BHEL		BHARAT HEAVY ELECTRICALS LTD POWER SECTOR - PROJECT ENGINEERING MANAGEMENT NOIDA, UTTAR PRADESH - 201301		CODE		NAME		SIGN	DATE
				M		DRN	SKY	S/D	17.02.18
						DESN	SKY	S/D	17.02.18
						CHK	SR	S/D	17.02.18
						APPD	HK	S/D	17.02.18
PACKAGE		FUEL OIL UNLOADING & STORAGE SYSTEM							
TITLE		GA AND NOZZLE ORIENTATION DRAWING OF HFO STORAGE TANK CAP. 4000M ³							
				DEPT.	SCALE	NTS		BHEL DRAWING NO.	
				SIGN					PE-DG-417-166-A002



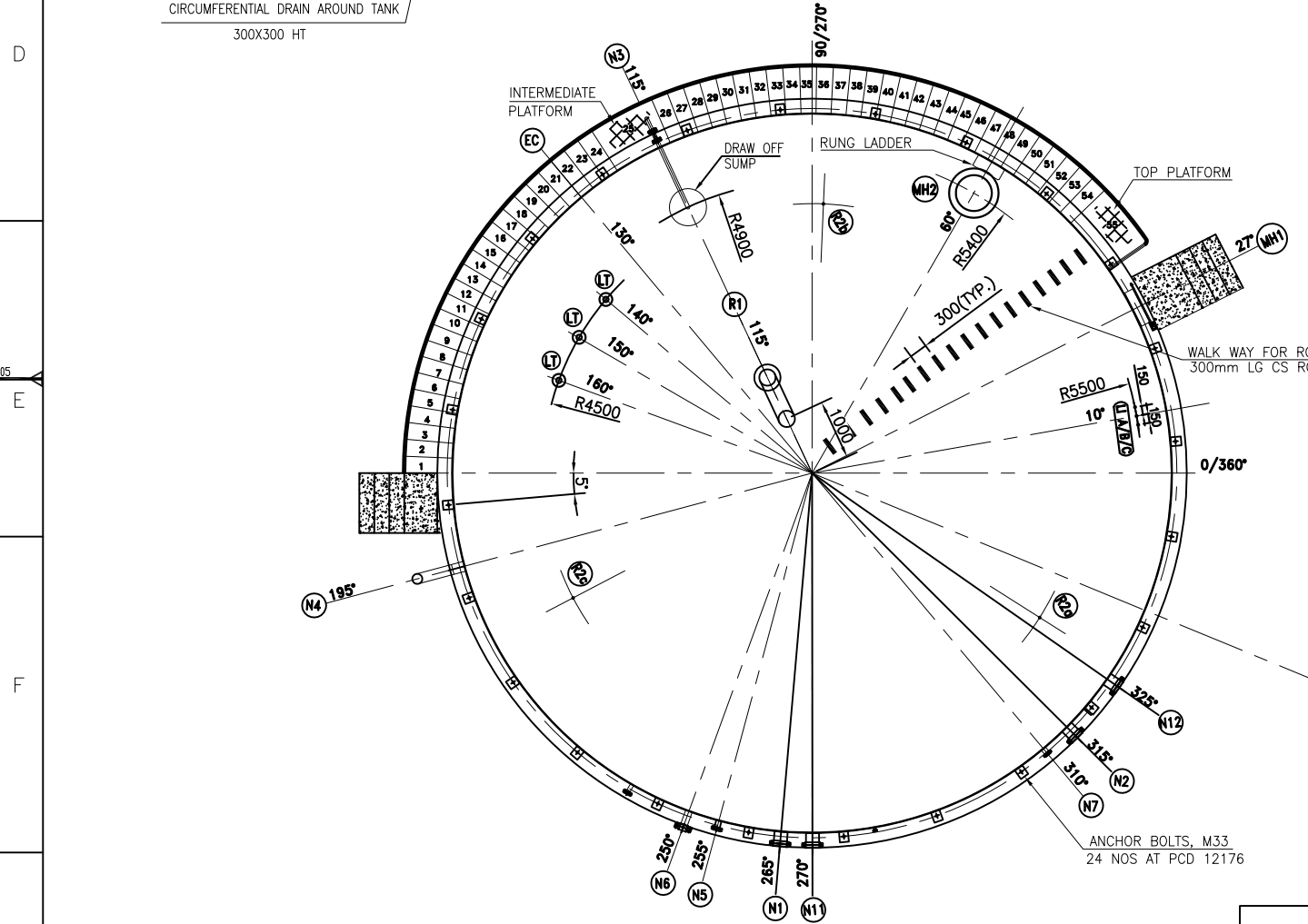
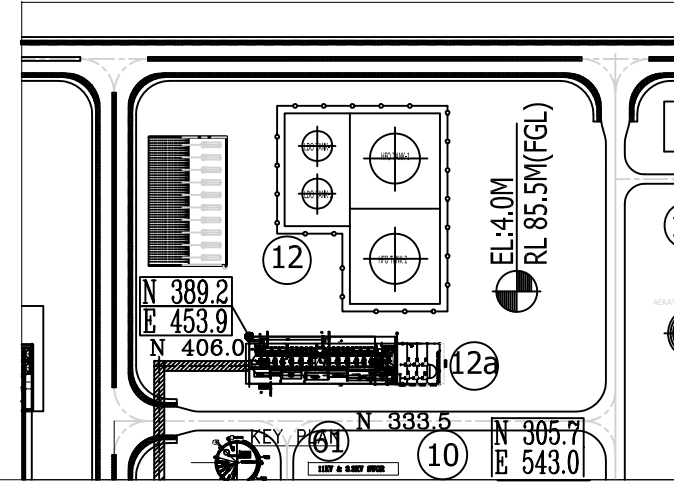
TANK ELEVATION VIEW



SHELL ARRANGEMENT FOR 1ST TO 06TH COURSE

Name of Manufacturer:		BHEL
PROJECT		5x800 MW YADADRI TPS
NAME OF THE EQUIPMENT		LDO STORAGE TANK
TANK NOMINAL DIAMETER		1200 MM
TANK NOMINAL HEIGHT		11700 MM
MAXIMUM CAPACITY		1000 M3
NET CAPACITY		1000 M3
DATE OF MANUFACTURE		2018
DESIGN LOAD LEVEL		1.60
DESIGN CODE		API650
MAXIMUM OPERATING PRESS.		1.60
HYDRO TEST PRESSURE		2.40
MAXIMUM OPERATING TEMP.		150
DESIGN TEMPERATURE		150
MATERIAL OF TANK		SS304
KOS TAG NO. OF TANKS		LDO TANK-1: 90E081088001 LDO TANK-2: 90E081188001

NAME PLATE DETAIL



NOZZLE ORIENTATION OF LDO TANK

S. N.	DRAWING NO.	TITLE
1.	PE-DC-417-166-A002	DESIGN CALC - LDO STORAGE TANK OF CAPACITY 1000 CUM
2.	PE-DG-417-166-A001	P&ID FOR LDO UNLOADING SYSTEM SH 2 OF 4
3.	PE-DG-417-100-M001	PLOT PLAN
4.	0-00-056-11166	SCHEME OF FUEL OIL SYSTEM-KEY DIAGRAM
5.	0-00-056-11167	SCHEME OF FUEL OIL SYSTEM- LDO PRESSURISING, HFO PRESSURISING & HEATING UNITS UNIT-1 & 2
6.	0-00-056-11168	SCHEME OF FUEL OIL SYSTEM- LDO PRESSURISING, HFO PRESSURISING & HEATING UNITS UNIT-3,4&5
7.	PE-V0-417-166-A012	PAINTING SCHEDULE OF FDHS
8.	PY-VP-1-M081-8665-01	P&ID OF FOAM SYSTEM

ALL THE REQUIREMENTS SHOWN UNDER GA DRAWING ARE BARE MINIMUM, ANY OTHER ITEM FOUND APPLICABLE DURING DETAILED ENGINEERING AS PER TECHNICAL SPECIFICATION/ FUNCTIONAL REQUIREMENT SHALL BE SUPPLIED BY BIDDER WITHOUT ANY COMMERCIAL IMPLICATION TO BHEL.

DESCRIPTION	UNIT	DETAIL
DESIGN CODE	-	API 650
STORED PRODUCT	-	LDO
DENSITY OF PRODUCT STORED	KG/M3	890 TO 950
DESIGN SPECIFIC GRAVITY OF PRODUCT STORED	-	1
WELD JOINT EFFICIENCY	-	0.85
TYPE OF TANK	-	VERTICAL CYLINDRICAL, SUPPORTED CONE ROOF
NUMBER OF TANKS	no	TWO (2)
DIAMETER OF TANK (ID)	mm	12000
HEIGHT OF TANK	mm	11000
TANK EMPTY WEIGHT	kg	41984
TANK FILLED WEIGHT	kg	1126984
NET WORKING CAPACITY	m3	1000 (AS PER FIG 5.4 OF API650)
MAXIMUM TANK CAPACITY	m3	1085 (AS PER FIG 5.4 OF API650)
BASIC WIND SPEED	m/s	44
DESIGN TEMPERATURE	°C	60
INTERNAL DESIGN PRESSURE	KPa	18 AS PER API650 FOR SEISMIC CALCULATION
OPERATING PRESSURE	-	ATMOSPHERIC
CORROSION ALLOWANCE	mm	2.0
SEISMIC FACTORS	-	ZONE-III, PEAK GROUND ACCELERATION = 0.16g
SEISMIC MOMENTS	KNM	RING WALL MOMENT = 6183.64, SLAB MOMENT = 8766.79
WIND LOAD	KN	VERTICAL = 138.6, HORIZONTAL = 198.96
WIND MOMENT	KNM	1956.06
ROOF LOAD (UNIFORM LIVE)	kg/m2	150
TESTING	-	AS PER CL7.3 AND SECTION 8 OF API650
RATE OF FILLING OF TANK (MAX)	m3/hr	100, FOR THREE (3) NOS. 2" W +1S, LDO TRANSFER PUMPS (CAP. 50 M3/HR EACH)
RATE OF EMPTYING OF TANK (MAX)	m3/hr	98 (total of all unit) AS PER BHEL TRICY DRG. NO. 0-00-056-11166, DRG. NO. 0-00-056-11167, DRG. NO. 0-00-056-11168

ITEM	MATERIAL
PLATES FOR SHELL, BOTTOM & ROOF	IS: 2062 GR.B
STRUCTURES	IS: 2062 GRA
PIPES	UP TO 50NB - ASTM A106 GR. SCH40, 50 TO 150NB - ASTM A106 GR. SCH40, 150 TO 350NB - API 5L GR.B, ERW SCH40, 400 TO 600NB - FABRICATED FROM IS: 2062 GR.B PLATES.
FLANGES	FOR OIL - IS: 2062 GR.B, SORF FOR STEAM & CONDENSATE - ASTM-105, SORF
GASKETS	FOR OIL & WATER: 50 NB AND BELOW - ASTM A105, SW ENDS 65NB TO 300NB - ASTM A 234, GR. WPB, BW ENDS 350NB TO 600NB - CS MADE FROM PARENT PIPE MITRE/FABRICATION BW ENDS FOR STEAM & CONDENSATE: 50 NB AND BELOW - ASTM A105, SW ENDS 65NB TO 400NB - ASTM A 234, GR. WPB, BW ENDS
FITTINGS	FOR OIL, WATER SERVICES AND STRUCTURALS - ASTM A 193 Gr. B7, FOR STEAM & CONDENSATE SERVICE - ASTM A 194 Gr 2H
BOLTS & NUTS	FOR STEAM & CONDENSATE SERVICE
NAME PLATE	SS 304

SHELL NOZZLES & APPURTENANCES FOR TANK

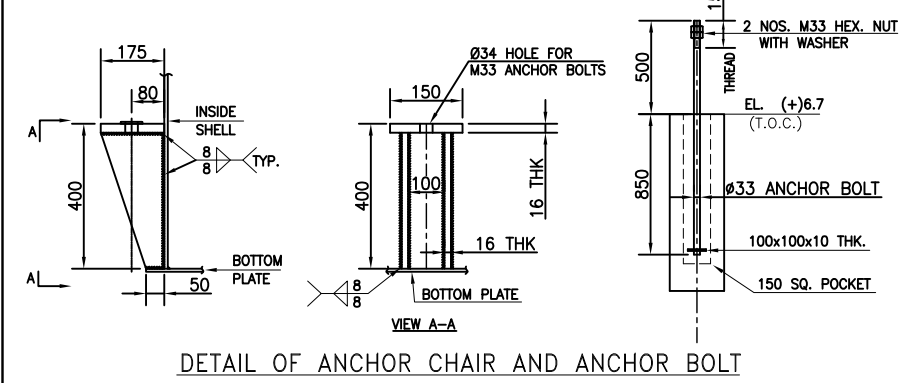
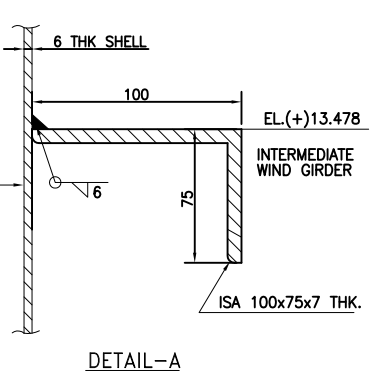
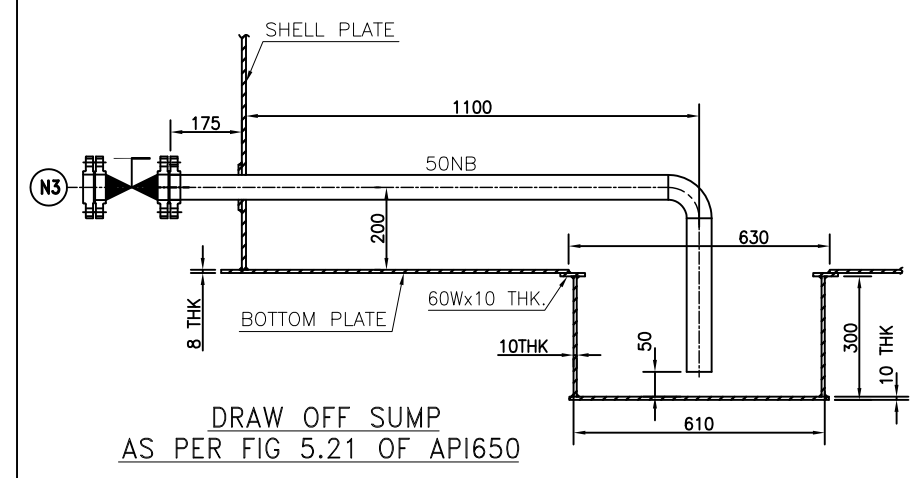
MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE ELE. FROM TOP OF BOTTOM PLATE AS PER TABLE 5.6a OF API650	PROJ. DIST. FROM SHELL PLATE AS PER TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
N1	200	1	SORF,150#	10422.0	200	12.70	LDO INLET
N2	250	1	SORF,150#	400	225	12.70	LDO OUTLET
N3	50	1	SORF,150#	200	150	5.54	DRAW-OFF SUMP
N4	250	1	SORF,150#	10286.0	225	12.70	OVERFLOW
N5	150	1	SORF,150#	10422.0	200	10.97	LDO RETURN FROM BOILER
N6	80	1	SORF,150#	10422	175	8.56	FOAM POURER
N7	25	1	SORF, #150	400	150	6.35	DRAIN NOZZLE FOR SAMPLING COLLECTION
N8	200	1	SORF, #150	350	200	12.70	LDO INTER TANK TRANSFER
N9	80	1	SORF,150#	250	175	7.62	SUPPLY LINE TO AUXILIARY BOILER
N10	40	1	SORF,150#	10422	150	5.08	RETURN LINE FROM AUXILIARY BOILER
N11	200	1	SORF,150#	10422.0	200	12.70	SPARE INLET<BLIND FLANGE>
N12	250	1	SORF,150#	400	225	12.7	SPARE OUTLET WITH VALVE
MH1	600	1	AS PER FIG 5.16 OF API650	800.0	150	6.0	SHELL MANHOLE WITH BLIND FLANGE
EC	-	2	AS PER DETAIL C	-	-	-	EARTHING CLIT

ROOF NOZZLES & APPURTENANCES FOR TANK

MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE DISTANCE FROM ROOF CENTRE	PROJ. DIST. FROM SHELL PLATE AS PER TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
R1	150	1	SORF, #150	1000	200	10.97	VENT WITH FLAME ARRESTOR
R2 a/b/c/d	40	4	-	3000	-	-	NOZZLE FOR HEAT DETECTION
LT	80	3	SORF, #150	4500	175	7.62	LEVEL TRANSMITTERS (RADAR TYPE)
L1 A/B/C	25	3	SORF, #150	5500	150	6.35	LEVEL INDICATOR < FLOAT & ARROW TYPE>
MH2	600	1	AS PER FIG 5.16 OF API650	5400	150	6	ROOF MANHOLE WITH COVER

NOTES:-

- ALL DIMENSIONS ARE IN MM., ELEVATIONS ARE IN METRE UNLESS OTHER WISE SPECIFIED.
- THE FINISHED FLOOR LEVEL (F.F.L) OF POWER HOUSE BUILDING GROUND FLOOR IS EL. + 0.00M WHICH CORRESPONDS TO RL 81.5M, i.e., 0.5M ABOVE FGL (RL81.0M) IN MAIN PLANT AREA.
- TANK SURFACE SHOULD BE CLEANED THOUGHLY AFTER FABRICATION FROM LOOSE SUBSTANCES AND FOREIGN MATERIALS SUCH AS DIRT, RUST, SCALE, OIL, GREASE AND WELDING FLUX ETC.
- VERTICAL SHELL JOINTS SHALL BE OFFSET FROM EACH OTHER WITH A MINIMUM DISTANCE OF 5 TIMES THE THICKNESS OF SHELL COURSE UNDER CONSIDERATION.
- BOTTOM PLATE SHALL UNIFORMLY REST ON THE FOUNDATION. THREE PLATE JOINTS IN BOTTOM PLATE SHALL NOT BE CLOSER THAN 300mm FROM EACH OTHER AND ALSO FROM THE TANK SHELL.
- EARTHING LUG AND NAME PLATE SHALL BE WELDED TO THE TANK AS PER SITE REQUIREMENT.
- ALL THE INLET PIPING SHALL BE EXTENDED UPTO BOTTOM OF TANK AND CLEARANCE BETWEEN THE BOTTOM OF TANK AND THE EDGES OF INLET PIPING SHALL BE 500 MM MAXIMUM.
- WEIR PLATE SHALL BE PROVIDED AT THE BOTTOM OF ALL THE INLET PIPES INSIDE TANK TO AVOID EROSION OF BOTTOM PLATE.
- TREAD AND RISE FOR STAIRCASE OF THE TANK SHALL BE 250 AND 200 MM RESPECTIVELY.
- LEVEL INDICATOR SUPPORTS SHALL BE PROVIDED ON THE SHELL & ROOF.
- NOZZLE FOR FOAM POURER, HOLES FOR HEAT DETECTOR ON TANK ROOF, PAD PLATES ON TANK FOR SUPPORTING FOAM POURER PIPE AND M/W SPRAY SYSTEM SHALL BE PROVIDED BY BHEL-PESD HYD. AS PER FIRE PROTECTION SYSTEM DRAWING.
- FINAL PAINTING SHALL BE CARRIED OUT AS PER APPROVED PAINTING SCHEDULE AFTER HYDRO TEST OF TANK.
- TANK NOZZLE FLANGES SHALL BE PROVIDED WITH COUNTER FLANGES ALONG WITH NUTS & BOLTS BY TANK VENDOR.
- OPERATING PLATFORMS SHALL BE PROVIDED BY TANK VENDOR FOR ALL THE INACCESSIBLE VALVES AND FOAM POURER OF TANK.
- FABRICATION, ERECTION AND TESTING SHALL BE AS PER API650/IS 803.
- FOR MANUAL WELDING PROCESSES, FILLET WELD LEGS OR GROOVE WELD DEPTHS GREATER THAN 6MM SHALL BE MULTIPASS.
- ALL TANK SHELL WELD INTERSECTIONS WHERE VERTICAL JOINTS MEET THE HORIZONTAL JOINTS SHALL BE RADIOGRAPHED, REGARDLESS OF THICKNESS.
- ALL RADIOGRAPHY OR OTHER NDE AND ANY WELDING SHALL BE COMPLETED PRIOR TO HYDROSTATIC TESTING.
- THE TANK HYDROSTATIC TEST SHALL BE CONDUCTED BEFORE PERMANENT EXTERNAL PIPING IS CONNECTED TO THE TANK EXCEPT FOR PIPING THAT IS NECESSARY TO FILL AND EMPTY THE TANK, WHICH SHOULD HAVE A FLEXIBLE COMPONENT TO ALLOW FOR SETTLEMENT.
- ALL INLET PIPING TO THE TANK SHALL BE PROVIDED WITH SUITABLE SIPHON BREAKER.
- MANHOLE FOR ROOF AND SHELL OF TANK SHALL BE HINGED TYPE.
- NOZZLE ORIENTATION OF TANK#1 IS MIRROR IMAGE OF TANK#2
- RADIOGRAPHY OF TANKS SHALL BE DONE AS PER CLAUSE 8.1.2 TO 8.1.8 OF API 650.
- FOR STIFNER, PLEASE REFER DETAIL-A FOR WIND GIRDER



TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA STATE, INDIA

TATA CONSULTING ENGINEERS LIMITED, BANGALORE

5x800 MW YADADRI TPS, NALGONDA

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR - PROJECT ENGINEERING MANAGEMENT
NOIDA, UTTAR PRADESH - 201301

DEPT. CODE

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DATE

APPRO

PK

S/D

17.02.18

PACKAGE

FUEL OIL UNLOADING & STORAGE SYSTEM

TITLE

GA AND NOZZLE ORIENTATION DRAWING OF LDO STORAGE TANK CAP. 1000M³

DEPT.

SCALE

NTS

SIGN

DATE

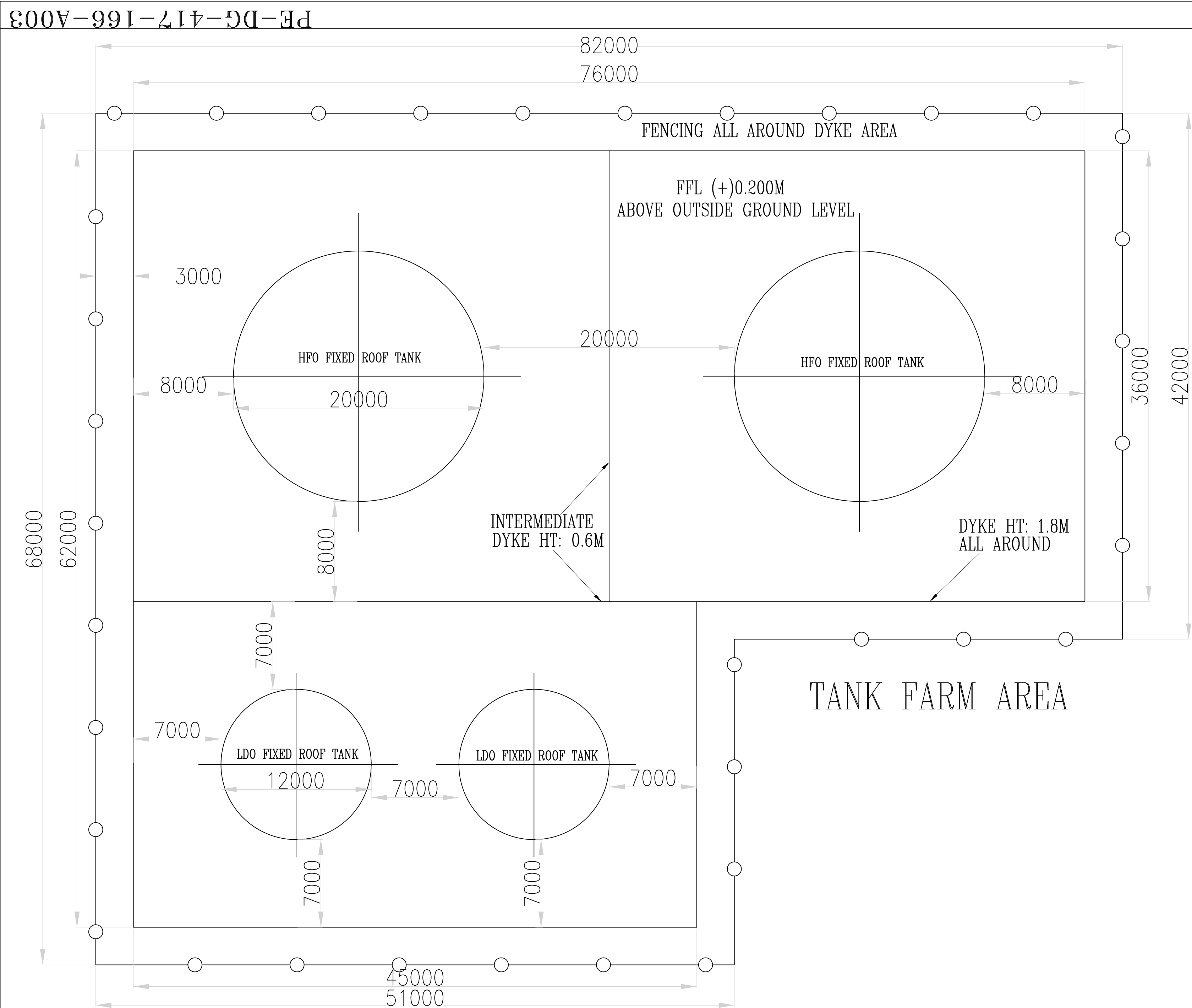
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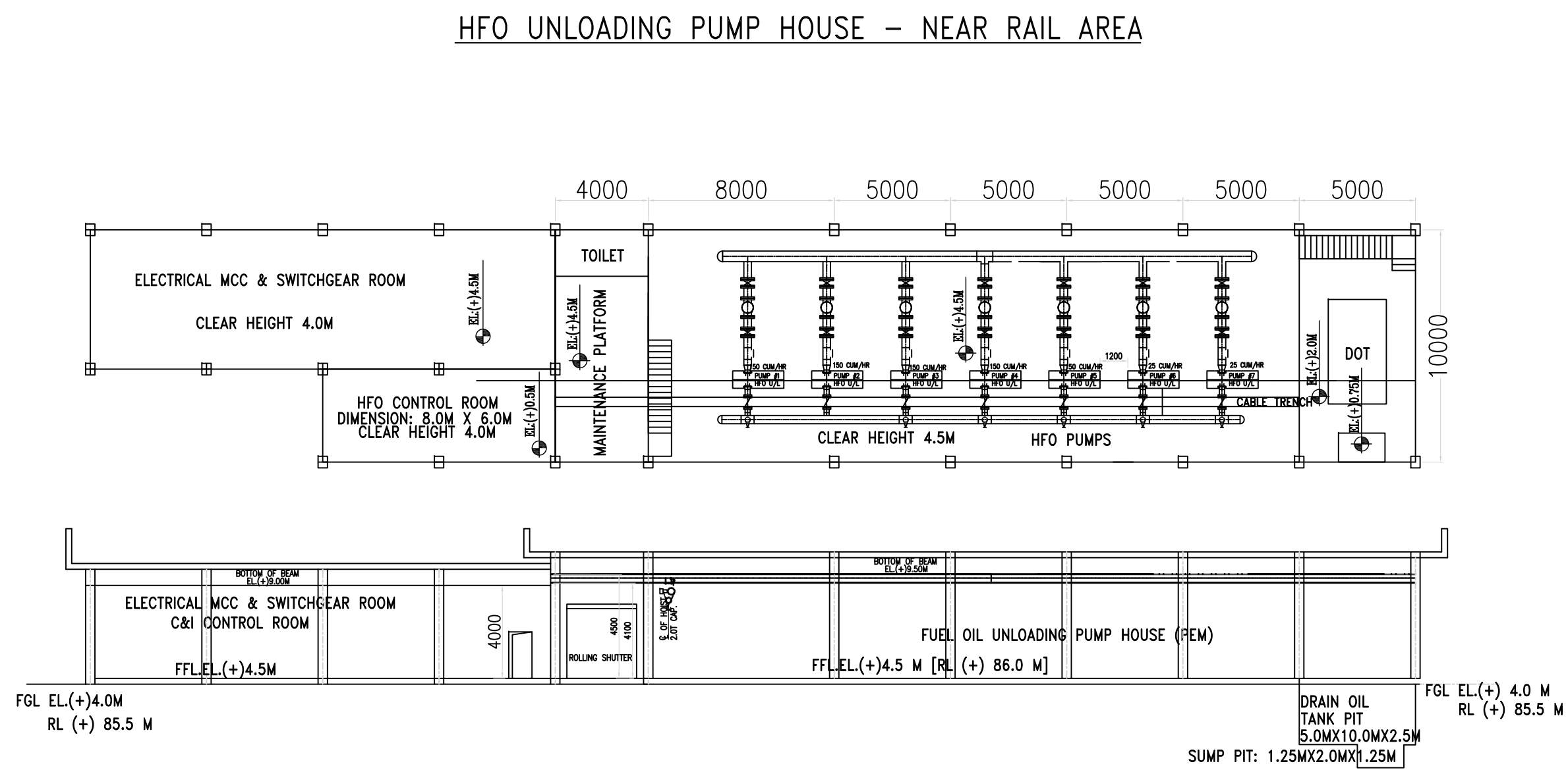
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ALL DIMENSIONS ARE IN MM

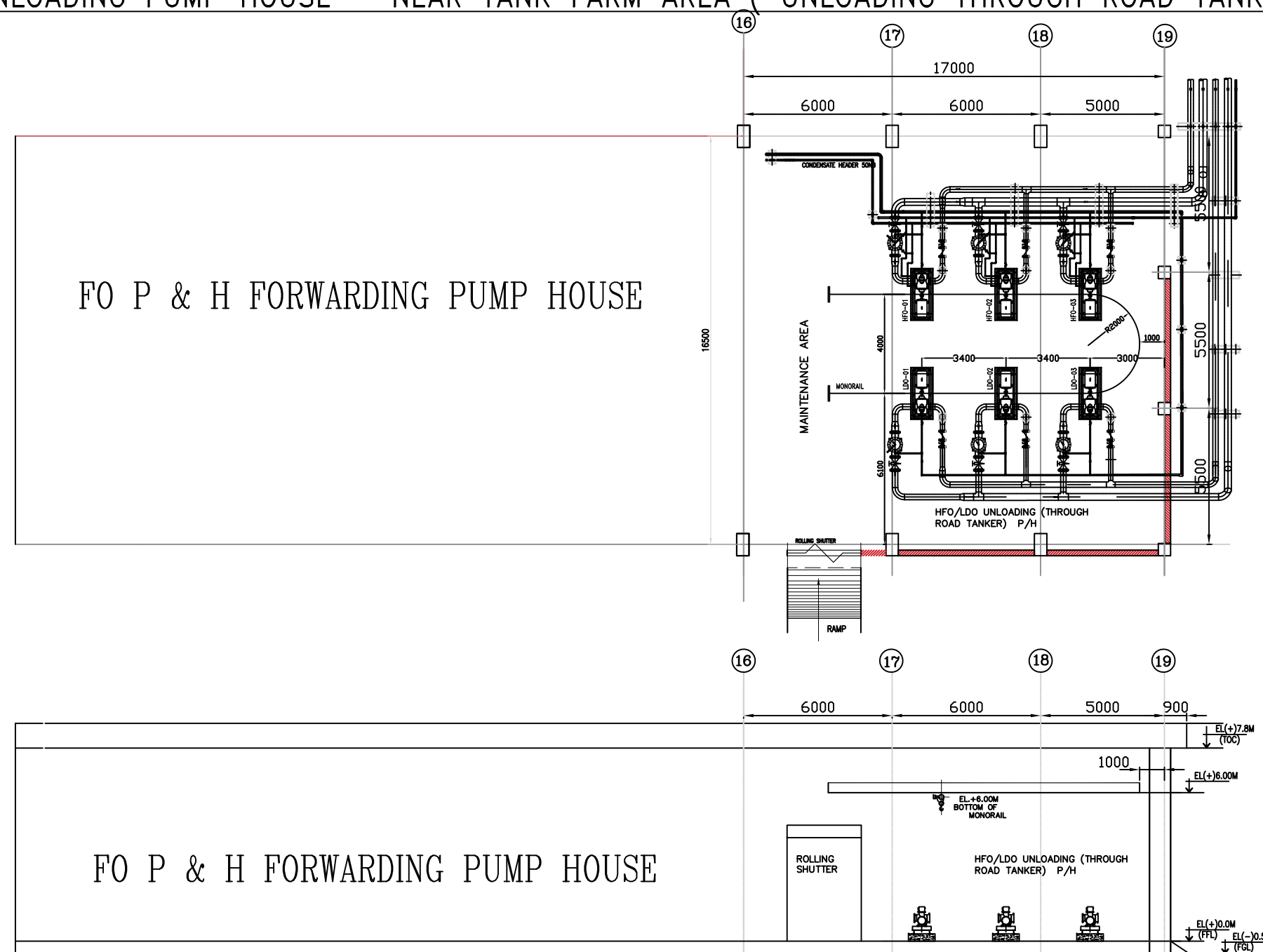


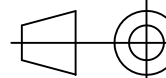
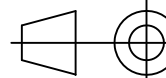
1) ALL DIMENSION ARE IN MM AND LEVEL ARE IN METERS

- 2) BIDDER TO CONFIRM THE SIZES OF THE UNLOADING PUMP HOUSE AND DYKE AREA INDICATED IN THE DRAWING.
- 3) MONORAIL BEAM FOR CHAIN PULLEY BLOCK (2.0 T) ALONG THE PUMP HOUSE LENGTH WILL BE PROVIDED BY BHEL—CIVIL.
- 4) BIDDER TO CONFIRM THE SIZES OF THE UNLOADING PUMP HOUSE AND DYKE AREA INDICATED IN THE DRAWING.



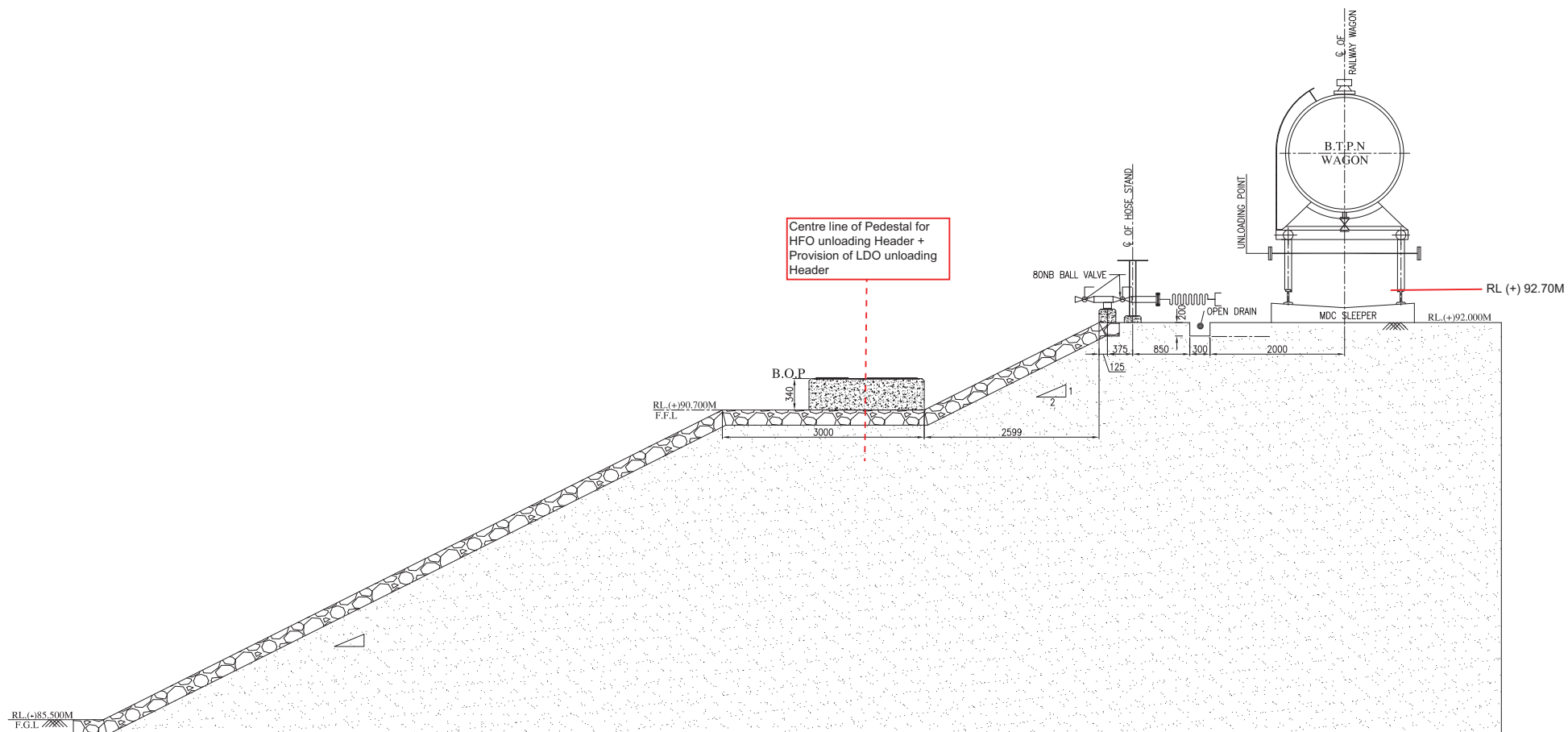
HFO & LDO UNLOADING PUMP HOUSE – NEAR TANK FARM AREA (UNLOADING THROUGH ROAD TANKER)

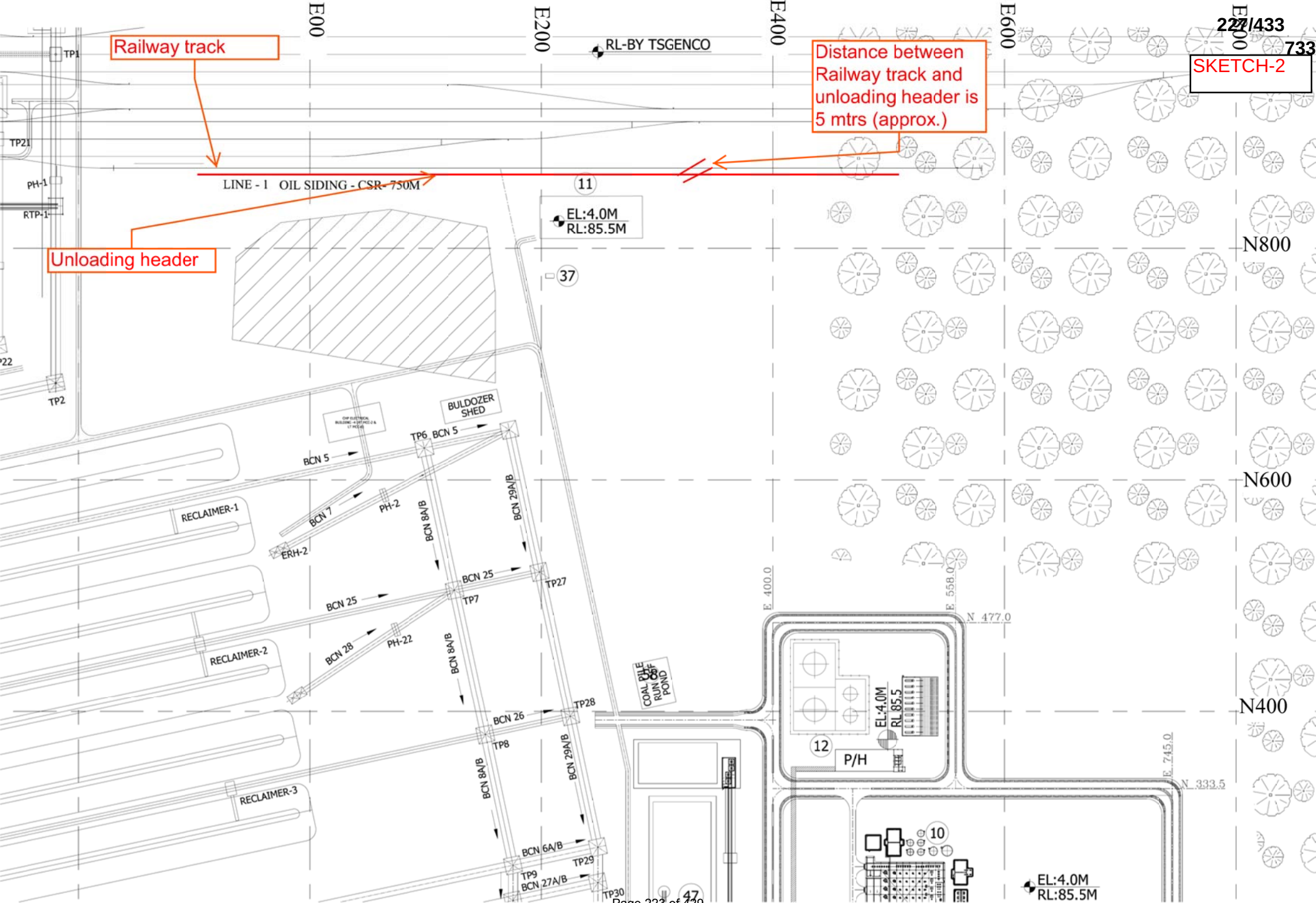


CUSTOMER:	TELANGANA STATE POWER GENERATION CORPORATION LTD TELANGANA STATE, INDIA 5X800 MW YADADRI TPS										
 Maharatna Company	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA										
COPY RIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED it must not be used directly or indirectly in any way detrimental to the interest of the company.					DEPT	NAME		SIGN	DATE		
					CODE	DRN	SKY	-SD-	03.03.2020		
					M	DESJN	SR	-SD-	03.03.2020		
						CHD	SR	-SD-	03.03.2020		
						APPD	HK	-SD-	03.03.2020		
TITLE											
UNLOADING PUMP HOUSE AND DYKE AREA FOR FOHS											
						DEPT.	SCALE		DRAWING NO. PE-DG-417-166-A003		
						SIGN					
											
							SHEET 1 OF 1			REV. 00	

SKETCH-1

5X800 MW YADADRI - FOHS





227/433
733
SKETCH-2

5 X 800MW YADADRI TPS

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM

ANNEXURE - F
(MANDATORY SPARES LIST)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

Annexure-F

Mandatory spares- FOHS Yadadri		
SI. NO.	PARTICULARS	QUANTITY
XI	Fuel Oil Transfer System	
1.0	Tanks & Pumps	
1.1	Suction Heater Gaskets	
1.1.1	For LDO/HFO Tanks	8 sets
1.2	Suction Heater Nuts and Bolts	
1.2.1	For LDO/HFO Tanks	2 Lot
1.3	Pump suction Strainer Basket	6 Nos. for each type
1.4	Pump suction Strainer Gasket	12 Nos. for each type
1.5	Pump O-Ring and Gasket	24 Nos. for each type
1.6	Various types of Gland packing for valves	2 Lot for each type
1.7	Pump Screw	6 Nos. for each type
1.8	Pump and Motor Bearing	
1.8.1	For HFO & LDO transfer pump	8 sets for each pump
1.8.2	For Drain Oil Pump	4 sets
1.9	Relief Valve Spring	
1.9.1	For HFO & LDO transfer pump	6 nos.
1.9.2	For Drain Oil Pump	6 nos.
1.10	Suction Heater Heating Element	2 No.
1.11	Mat Coil Heater – Heating Element	4 sections
1.12	Thermodynamic traps	10 Nos.
1.13	Inverted Bucket type traps	4 Nos.
2.0	Electrical Items	
2.1	415 Volt Motor (above 30KW Rating upto 200KW)	
2.1.1	End Shield Cover Driving & Non-Driving End	2 Set for each type and rating of Motor
2.1.2	Driving End & Non-Driving End Bearing	2 Set for each type and rating of Motor
2.1.3	Cooling Fan	2 No. for each type and rating of Motor
2.1.4	Motor Space Heater	2 No. for each type and rating of Motor
2.1.5	Motor Terminal Block	2 No. for each type and rating of Motor
2.1.6	Complete Set of Coupling	2 Set for each Application
2.2	415 Volt Motor (Upto 30KW Rating)	
2.2.1	Driving End & Non-Driving End Bearing	6 Set for each type and rating of Motor
2.2.2	Cooling Fan	4 No. for each type and rating of Motor
2.2.3	Motor Terminal Block	10 No. for each type and rating of Motor
2.2.4	Complete Set of Coupling	2 Set for each Application
2.3	Lugs & Glands	
2.3.1	Glands & Lugs	40% of each type, size & rating of cables
2.4	Actuator	
2.4.1	Complete set of Actuator	2 Nos. for each type and rating
2.4.2	Limit Switch	6 Nos each type and rating
2.4.3	Torque Switch	6 Nos each type and rating
2.4.4	Auxiliary Contact	2 nos each type and rating
2.4.5	Motor	2 nos each type and rating
2.4.6	Complete Seal kit	2 Sets for each type and rating
2.4.7	Complete O-Ring Set	2 Sets
2.4.8	Electronic Card	Two(2) for each type/make
2.4.9	Feedback Assembly (4-20mA) for Inching type	Two(2) for each type/make
3.0	C&I Items	
	The Bidder shall offer mandatory spares of the same make, model and type for items which are offered in the main offer. Further, offered spare parts shall be of the same grade and shall have same performance as the instruments which they are to replace.	
3.1.	Field Instruments	
3.1.1.1	Transmitters/ Gauges/Switches etc. along with relevant accessories	20% of total or at least four (whichever is higher) for each type along with accessories.
3.1.1.2	Temperature Element (RTD/Thermo-couple) with thermowell	20% of each type, range and immersion length. Minimum 10 nos.
3.1.2	HFO/LFO Oil meter	
3.1.2.1	Sensor	2 nos. each for each type, model & range
3.1.2.2	O Rings	4 nos. of each size
3.1.2.3	Gaskets	6 nos. of each size
3.2	Control Valves	
3.2.1	Pneumatic Control Valves & Block Valves	
3.2.1.1	Plot Relay	2 sets for each valve
3.2.1.2	Actuator Diaphragm	2 nos. for each valve

7336/2020/PS-PEM-MAX

3.2.1.3	Feedback Linkage	2 nos. for each valve
3.2.1.4	Smart Positioners	20% of total quantity of each model/type
3.2.1.5	I/P Converters (If any)	20% of total quantity or minimum 30 nos.
3.2.1.6	Complete Consumables for Valve Viz. O-ring, Gland Packing, Packing Ring, Bonnet Seal etc	4 Sets each size, rating, type
3.2.1.7	Valve Disc	4 Sets each size, rating, type
3.2.1.8	Valve Spindle	4 Sets each size, rating, type
3.2.1.9	Valve Seat	4 Sets each size, rating, type
3.2.1.10	Bush	4 Sets each size, rating, type
3.2.1.11	Guide	4 Sets each size, rating, type
3.2.1.12	Guide Bush	4 Sets each size, rating, type
3.2.1.13	Coupling Nut	4 Sets each size, rating, type
3.2.1.14	Actuator Piston with Rod & Seal	4 Sets each size, rating, type
3.2.1.15	Control valve stem packing and spare operator moulded rubber diaphragms	2 sets for each size, rating, type
3.2.1.16	Valve trim (including cage, plug, stem, seat rings, guide bushings etc.) for each of the control valves as offered.	2 sets for each size, rating, type
3.2.1.17	Solenoid valves, position transmitters, limit switches, I/P convertors, positioners etc of each type	20% of total quantity spare with minimum 2 no. for each size, rating, type
3.2.2	Solenoid Valves	
3.2.2.1	Solenoid Valve Coil	4 nos. of each rating & insulation
3.2.2.2	Plunger	2 nos. of each type
3.2.2.3	Seat	4 nos. of each type & size
3.2.2.4	Gaskets	4 sets of each type & size
3.2.2.5	O-Ring set	10 sets of each type & size
3.3	Process Connection Piping (Impulse piping/tubing, sampling piping / tubing & air supply piping as applicable)	
3.3.1	Valves of all types	20% of each type, class, size & model
3.3.2	Valve Manifolds (2 way/3 way/5 way)	20% of each type, class, size & model
3.3.3	Fittings	20% of each type, class, size & model
3.3.4	Filter Regulators	40% of each model
3.4	Junction Box	
3.4.1	Junction box	20% of total quantity for each size but minimum 2 nos.
3.4.2	Terminals in Terminal blocks	20 nos. of each type

Note:

i)	Mandatory spares listed above are bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified above, same shall be deemed to have been covered in bidder's scope of supply.
ii)	"One (1) Set" and "One (1) set of each type & rating" is defined as total numbers as required for one complete replacement for one equipment of similar size & capacity.
iii)	In case any spare indicated in the specification is "not applicable" for particular equipment, then suitable applicable alternate spare shall be supplied by the bidder without any financial implication."
vi)	For quantities indicated in percentage, fractions are to be rounded-off to next higher integer.

5 X 800MW YADADRI TPS

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM

ANNEXURE - G
(PAINTING SPECIFICATION)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

TECHNICAL SPECIFICATION
FOR
PROTECTIVE LINING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

- 1.01.00 This specification addresses the requirements of all labour, material, and appliances necessary with reference to preparations for lining / painting, application as well as finishing of all lining / painting for all mechanical and electrical equipment, piping and valves, structures etc. included under the scope of this Package.
- 1.02.00 The Bidder shall furnish and apply all lining, primers including wash primers if required, under-coats, finish coats and colour bands as described hereinafter or necessary to complete the work in all respects.

2.00.00 CODES & STANDARDS

- 2.01.00 The Bidder shall follow relevant Indian and International Standards wherever applicable in cleaning of surface, selection of lining material / paints and their application. The entire work shall conform to the following standards / specifications (latest revision or as specified).
 - a) SSPC SP 10 / NACE 2 / : Near White Blast Cleaning
 - b) SSPC PA 2 : Measurement of dry film Coating Thickness with magnetic gauges.
 - c) ASTM D 4541 : Method for pull off strength using portable Adhesion Tester.
 - d) NACE RP 0274 – 2004 : High-Voltage Electrical Inspection of Pipeline Coatings
 - e) NACE SP 0188 – 2006 : Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

- f) NACE RP 0169 – 2002 : Control of External Corrosion on Underground or Submerged Metallic Piping Systems
- g) AWWA C 210 – 2007 : Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
- h) IS 3589:2001 Annexure B : Steel Pipes for Water and Sewage Specification.
- i) AWWA C222-2000 : Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings.
- j) IS 13213 : 2000 : Polyurethane Full Gloss Enamel (Two pack)

3.00.00 GENERAL REQUIREMENTS

- 3.01.00** The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.
- 3.02.00** The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.
- 3.03.00** The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.
- 3.04.00** The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.
- 3.05.00** Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

- 3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.
- 3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.
- 3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.
- 3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.
- 3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.
- 3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.
- 3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting.
- 3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.
- 3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.
- 3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).
- 3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

3.17.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.

3.18.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.

3.19.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER

4.01.00 After erection at site, the outside surfaces of all equipment having a shop coat shall be given further priming coat and finished coats of paint as detailed in following clauses. However, if the painting system is such that the shop coat and primer coat to be applied at site are not compatible, then shop coat has to be removed from the surface of equipment before application of primer coat with prior blasting.

All factory finished paints shall be touched up at site as required.

All uninsulated piping shall be finished with final paintings after use of proper wash primer and primer. Aluminium sheet jacketed piping need not be painted. Colour bands of Purchaser's approved shade shall however be applied on jacketed piping near walls or partitions, at all junctions, near valves and all other places as instructed by the Purchaser. All structures shall be painted with approved paint.

4.02.00 Surface Preparation

4.02.01 Unless mentioned otherwise, all rust and mill scale shall be removed by blasting to Sa 2-1/2 Swiss Standard before applying the primer.

4.02.02 Special care shall be taken to remove grease and oil by means of suitable solvents like Trichloroethylene or Carbon Tetrachloride.

4.02.03 The minimum degree of surface preparations for all equipment, piping, fittings, valves, structures etc. shall be "Near White" according to Steel Structure, Painting Council-SSPC-SP-10 before application of any primer/paint.

4.03.00 Painting

- 4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc. to be installed indoor shall be as follows :
- a) Surface preparation shall be done either manually or by any other approved method.
 - b) Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.
 - c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.
 - d) Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.
 - e) Total DFT of paint system shall not be less than 150 microns.
- 4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :
- a) Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.
 - b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.
 - c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.
 - d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.
 - e) Total DFT of paint system shall not be less than 300 microns.
- 4.03.03 Specification for application of paints for external surfaces protection of steel pipes and fittings which are **buried underground / laid inside a huge pipe & or submerged Under Water and laid under Pipe Trenches** (in road/rail/pipe or trench crossings) shall be as follows :

The no. of coats and DFT specified above is minimum. However to achieve above specified DFT, no of coats can be increased as per paint manufacture's recommendation.

External surface of the pipe, fittings, specialties etc. handling raw water/clarified water/filter water shall be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent less polyurethane to build up coating of dry film thickness of 2000 micron including primer coat.

- 4.03.04 Specification for application of paints for **internal surface protection of large diameter pipes** (sizes above 600 mm NB and above) if any, shall be as follows :
- a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.
 - b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.
 - c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.
- 4.03.05 Specification for application of paints for protection of **internal surfaces of DM Water Storage Tank(s)** shall be as follows :
- a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.
 - b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.
 - c) Total thickness of primer and paint should not be less than 500 microns.
- 4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.
- 4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.
- 4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

The no. of coats and DFT specified above is minimum. However to achieve above specified DFT, no of coats can be increased as per paint manufacture's recommendation.

4.03.09 All machined surfaces shall have two (2) coats of water repellant grease after thorough cleaning.

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

Pipe shall be blast cleaned by sand. The cleanliness achieved prior to application shall be in accordance with the requirement of SSPC SP 10 / NACE 2 / Sa2½ of ISO 8501 (near white metal)

- a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.
- b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

- a) Coating shall be applied when
 - i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
 - ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater than 50°C.
- b) Material preparation shall be in accordance with manufacturer's recommendations.
- c) Application of epoxy coating system :

The epoxy coating system shall be applied as per recommendation of the manufacturer and shall be applied by airless spray / plural component spray machine. For more than one coat, the second shall be applied with the time limits as recommended by the manufacturer.

5.03.00 Application of PU Coating

- a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).
- b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS :

6.01.00 Measurement of dry film thickness

Measurement of dry film thickness of coating : Coating thickness shall be in the range of $\pm 20\%$ and as per SSPC PA 2.

6.01.01 Apparatus / Instrument:-

The instrument used for dry film thickness may be Type 1 pull of gauges or Type 2 electronic gauges.

6.01.02 Procedures:-

- a) Number of measurements:
For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).
- b) If the structure is less than 300 square feet, each 100 square feet should be measured.
- c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.
- d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet
- e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness.
Area measurement must be within specified range.

6.02.00 Electrical Inspection (Holiday) Test

- 6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.
- 6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.
- 6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.
- The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)
- $$\text{Testing Voltage } V = 7900 \sqrt{T} \pm 10 \text{ percent where } T \text{ is the average coating thickness in mm.}$$
- 6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.
- 6.03.00 Adhesion Pull off Test :**
- After holiday the coated surface is subjected to adhesion pull off test as per ASTM D 4541.
- 6.03.01 Apparatus / Instrument: Adhesion tester consists of three basic components:
- A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling "Jaw" at the bottom and also dollies.
- 6.03.02 Prepare the test surface :
- Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.
- 6.03.03 Prepare Dolly (Test Pull Stub) :

The dolly is a round, two sided aluminium fixture. Both sides of the dolly looks same, however, one side sloped on top surface while flat on bottom surface. As the surface of the dolly is polished aluminium, roughen the same using a coarse sand paper.

6.03.04 Select an adhesive:

Use araldite, a 100% solid epoxy adhesive. This adhesive requires at least 24 hours at room temperature to cure.

6.03.05 Attach the dolly to the surface.

- a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.
- b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.
- c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.
- d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.03.06 Adhesion Test Procedure

- a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.
- b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.
- c) Slide the dragging indicator pin on the black column to zero by pushing it downward.
- d) Firmly hold the base of the instrument in one hand and rotate the handwheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

6.04.00 Coating Repair

Defective Coating shall be repaired in accordance with the following subsections.

6.04.01 Surface Preparation:

Accessible areas of pipe requiring coating repairs shall be cleaned to remove debris and damaged coating using surface grinders or other means. The adjacent coating shall be feathered by sanding, grinding or other method. Accumulated debris shall be removed by blowing with contaminant free air or wiping with clean rags.

6.04.02 Areas not accessible for coating repair such as interior surfaces of small diameter pipe shall be reprocessed and recoated.

6.04.03 Coating Application :

The coating system shall be applied to the prepared areas in accordance with procedure.

6.04.04 Repair Inspection :

Repaired portion shall be electrically inspected using a holiday detector.

6.05.00 Welded Field Joints

6.05.01 Preparation :

The weld joints shall be cleaned so as to be free from mud, oil, grease, welding flux, weld spatter and other foreign contaminants. The cleaned metal surfaces of the weld joint shall then be blasted or abraded using rotary abrading pads. The adjacent liquid Epoxy / PU coating shall be feathered by abrading the coating surface for a distance of 25 mm.

6.05.02 Electrical Inspection :

After curing the coating system applied to the welding joints shall be holiday tested. Any holidays indicated by the detector shall be marked with chalk to identify the area of repair.

7.00.00 INFORMATION/DATA REQUIRED

The Bidder shall submit complete list of paints and primers proposed, giving detail information, such as, chemical composition, drying time etc. and also unit rates for application of each type of paint along with supply shall be furnished.

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PAINTING SCHEDULE						
APPLICATION	AREA	PROCESS	PAINT TYPE	NO OF COATS	DRY FILM THICKNESS (MICRONS/COAT)	SHADE / FINISH
			(SUITABLE FOR INDUSTRIAL APPLICATION)			
HFO, LDO TANKS, DOT & HEATERS: (INTERNAL SURFACE OF ROOF, SHELL, BOTTOM AND FLOOR COIL HEATER)	INTERNAL	SURFACE PREPARATION	Wire Brushing			
		PRIMER	Double boiled linseed oil	2	--	NA
		INTERMEDIATE COAT	NA	NA	NA	NA
		FINAL COAT	NA	NA	NA	NA
		TOTAL DFT (MIN)			---	
HFO UN INSULATED & LDO TANKS (FOR EXTERNAL SURFACE)	EXTERNAL	SURFACE PREPARATION	Sand Blasting to SA 2.5			
		PRIMER	Epoxy resin based zinc phosphate primer.	1	100	NA
		INTERMEDIATE COAT	Epoxy resin based paint pigmented with Titanium Dioxide.	1	100	NA
		FINAL COAT	Epoxy paint	1	75	
			Polyurethane finish paint	1	25	
		TOTAL DFT (MIN)			300	
HFO INSULATED & DRAIN OIL TANKS (FOR EXTERNAL SURFACE)	EXTERNAL	SURFACE PREPARATION	Sand Blasting to SA 2.5			
		PRIMER	Epoxy resin based zinc phosphate primer.	1	100	NA
		INTERMEDIATE COAT	NA	NA	NA	NA
		FINAL COAT	NA	NA	NA	NA
		TOTAL DFT (MIN)			100	
STEAM AND CONDENSATE LINES AND SUCTION HEATER HEAD (FOR EXTERNAL SURFACE) INSULATED	EXTERNAL	SURFACE PREPARATION	Sand Blasting to SA 2.5			
		PRIMER	Heat Resistant Aluminium paint	2	20	NA
		INTERMEDIATE COAT	NA	NA	NA	NA
		FINAL COAT	NA	NA	NA	NA
		TOTAL DFT (MIN)			40	
HFO & LDO TANKS :	UNDERNEATH	SURFACE PREPARATION	Wire brushing			
		PRIMER	Coal tar epoxy	1	80-100	Black
		INTERMEDIATE COAT	NA	NA	NA	NA
		FINAL COAT	NA	NA	NA	NA
		TOTAL DFT (MIN)			80-100	

PAINTING SCHEDULE						
APPLICATION	AREA	PROCESS	PAINT TYPE (SUITABLE FOR INDUSTRIAL APPLICATION)	NO OF COATS	DRY FILM THICKNESS (MICRONS/COAT)	SHADE / FINISH
HFO, DRAIN OIL PIPE LINES, PUMPS, STRAINERS, VALVES, ETC (INSULATED)	EXTERNAL	SURFACE PREPARATION	Degreasing and Mech. Cleaning with wire brushing/hand tool(SA/ST2/ST3 as applicable)			
		PRIMER	Epoxy resin based zinc phosphate primer.	1	100	NA
		INTERMEDIATE COAT	NA	NA	NA	NA
		FINAL COAT	NA	NA	NA	NA
		TOTAL DFT (MIN)			100	
LDO, OILY WATER, AIR AND WATER LINES, PUMPS, STRAINERS, VALVES AND STRUCTURALS	EXTERNAL	SURFACE PREPARATION	Sand Blasting to SA 2.5			
		PRIMER	Epoxy resin based zinc phosphate primer.	1	100	----
		INTERMEDIATE COAT	Epoxy resin based paint pigmented with Titanium Dioxide.	1	100	
		FINAL COAT	Epoxy paint	1	75	
			Polyurethane finish paint	1	25	
		TOTAL DFT (MIN)			300	
CONTROL PANEL	INTERNAL & EXTERNAL	SURFACE PREPARATION	Sand Blasting to SA 2.5			
		PRIMER	Inhibitive Epoxy Primer	2	1.5 MIL	----
		INTERMEDIATE COAT	NA	NA	NA	NA
		FINAL COAT	Catalyzed Epoxy or Polyurethane	2	2 MIL	
		TOTAL DFT (MIN)			7 MIL	
Notes:						
1		Incase of insulated surfaces,only primer coat shall be applied.				
2		G.I pipes will not be painted.Further GI piping shall be given necessary colour banding for identification as per colour scheme.				
3		All pipes shall be painted at site.				
4		All structural steel items shall be painted at site.				
5		All shop painted equipments should be repainted for any damages during transportation at site.				
6		Method of painting application shall be as per paint manufacturer's recommendation.				
7		All instruments shall be painted as per manufacturer standard practice.				
8		Surface Preparation as per Swedish Standards SIS 05-5900. Degreasing will be as per Standard SSPC-SP1.				

	FUEL OIL HANDLING SYSTEM 5 X 800MW YADADRI TPS	SPECIFICATION No: PE-TS-417-166-A001	
		Annexure-H	
		SECTION-1A	
		REV. 00	DATE: MAY 2020

Annexure-H

OPERATION AND MAINTENANCE SERVICES FOR FUEL OIL HANDLING SYSTEM

	FUEL OIL HANDLING SYSTEM 5 X 800MW YADADRI TPS	SPECIFICATION No: PE-TS-417-166-A001	
		Annexure-H	
		SECTION-1A	
		REV. 00	DATE: MAY 2020

OPERATION AND MAINTENANCE SERVICES

The bidder scope also covers the Operation and Maintenance (O&M) services for Preventive / Breakdown maintenance for a period of one (1) years from the date of successful handover of fuel oil handling system to end customer.

Bidder to note that, bidder shall use only genuine parts as per frequencies mentioned in O&M Manual. Any damage or malfunction caused by the use of unauthentic parts or unqualified personnel shall be responsibility of bidder and as a consequence of above bidder is required to replenish the unauthorised part and abridge the qualified person without any commercial implication to BHEL.

O&M Services scope also covers all regular maintenance by certified and trained service engineers and / or supply of genuine parts and lubricants as per the original manufacturer recommendations in a pro-active manner.

1.0 Scope of Work:

The scope of work includes:

1. Operation and maintenance of the entire fuel oil handling system package for a period of one year shall be in the scope of work. The O&M services shall be provided for all the items / instruments / equipment provided by the bidder in the package.
2. The fuel oil pumps should not be stand unused for long periods. The pumps shall be started once a week or as recommended by the pump manufacturer. Such operation of the fuel oil pumps or rotation of shafts by hand (if required) periodically shall be done by the bidder as a part of the O&M services.
3. Periodic maintenance including check, rectification, refilling etc, but not limited to the following, of
 - Level of oils in the timing gearbox,
 - Leakages from the stuffing boxes,
 - Automatic controls and/or regulating valves
 - Alignment checks for couplings,
 - Periodic check of capacities and absorbed horsepower.
 - Lubrication of ball bearings, gears etc.
4. In case of breakdown, bidder shall depute qualified Service manpower and rectify the same with in strict time frame, not exceeding 48 hours.
5. Spares and consumables required for preventive Maintenance shall be in the scope of bidder. However, any spare required under breakdown condition will be provided to Bidder's service provider by BHEL on the written request basis shall be provided by Bidder on mutual settlement of related commercial issues.
6. Supply of various maintenance kits (if applicable) for any of the items/ equipment / instruments for the package shall be supplied by the bidder along with the main supply. Such maintenance kits if required during the O&M period shall be in the scope of bidder.

2.0 Tools and tackles

- Tools and tackles required for handling the component will be provided to the Bidder (successful bidder) on the written request basis. Bidder shall not claim any delay or compensation due to unavailability of these items, if any. In such cases bidder need to arrange the required tools and tackles at his own cost.
- However, bidder to furnish one set of all such tools & tackles under "Special tools & tackles" for maintenance purpose within the quoted price, specified elsewhere in specification.

	FUEL OIL HANDLING SYSTEM 5 X 800MW YADADRI TPS	SPECIFICATION No: PE-TS-417-166-A001	
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3.0 Measuring Instruments and commissioning Spare

- Measuring Instruments like Vibration meter, multi-meter, clamp-on meter, noise meter will be provided to the Bidder on the written request basis. Bidder shall not claim any delay or compensation due to unavailability of these items, if any. In such cases Bidder need to arrange the required instruments at his own cost.
- However, bidder to furnish one set of all such measuring instruments and commissioning spares under commissioning spares for maintenance purpose within the quoted price, specified elsewhere in specification.

4.0 Bidder is to arrange all the safety gears like helmets, air plugs, safety shoes etc during the maintenance.

5.0 Bidder is to submit the Servicing Report (SR) of completed Breakdown Maintenance.

6.0 If any damage to the equipment and its accessories due to improper maintenance by bidder shall be recovered from the bidder.

**TELANGANA STATE POWER GENERATION
CORPORATION LTD
TELANGANA STATE, INDIA**

5x800 MW YADADRI TPS, NALGONDA

**FUEL OIL HANDLING AND STORAGE SYSTEM
TECHNICAL SPECIFICATION
(ELECTRICAL PORTION)**

SECTION -IB



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT,
NOIDA, U.P., INDIA**

7336/2020/PS-PEM-MAX



TITLE:

**FUEL OIL HANDLING AND STORAGE SYSTEM
TECHNICAL SPECIFICATION
(ELECTRICAL PORTION)**

5X800 MW YADADRI TPS

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION: **C**REV NO. : **00** DATE: 04/04/2018

SHEET: 1 OF 1

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	TECHNICAL SPECIFICATION FOR FUEL OIL HANDLING AND STORAGE SYSTEM 5X800 MW YADADRI TPS (ELECTRICAL PORTION)	SPECIFICATION NO. VOLUME NO. : II-B SECTION : I REV NO. : 00 DATE: 10/01/2020 SHEET : 1 OF 3
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SPECIFIC TECHNICAL REQUIREMENTS

FOR LV MOTORS (ELECTRICAL)

SECTION-I

	TECHNICAL SPECIFICATION FOR FUEL OIL HANDLING AND STORAGE SYSTEM 5X800 MW YADADRI TPS (ELECTRICAL PORTION)	SPECIFICATION NO. VOLUME NO. : II-B SECTION : I REV NO. : 00 DATE: 10/01/2020 SHEET : 1 OF 3
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SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipment's.
- d) Electrical load requirement for FUEL OIL HANDLING AND STORAGE SYSTEM.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc. shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “both end equipment in vendor's scope” shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor” Annexure - I.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc., is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

	TECHNICAL SPECIFICATION FOR FUEL OIL HANDLING AND STORAGE SYSTEM 5X800 MW YADADRI TPS (ELECTRICAL PORTION)	SPECIFICATION NO. VOLUME NO. : II-B SECTION : I REV NO. : 00 DATE: 10/01/2020 SHEET : 1 OF 3
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4.0 List of enclosures:

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Technical specification for motors.
- c) Datasheets for motors.
- d) Electrical Load data format (Annexure –II)
- e) BHEL cable listing format (Annexure –III)
- f) Quality plan for motors.

BASIC TECHNICAL FEATURES FOR LT MOTORS

(FOR BHEL-PEM SCOPE PACKAGES)

										CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD TELANGANA, INDIA 5 x 800 MW YADADRI TPS, NALGONDA									
										OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LTD BANGLORE INDIA									
										BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA									
JOB NO. 417										STATUS CONTRACT									
DISTRIBUTION										COPIE RIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED it must not be used directly or indirectly in any way detrimental to the interest of the company.									
REV. 02	DATE 16.08.2018	ALTD HC	CHD AS	APPD PD	REV. 01	DATE	ALTD	CHD	APPD	DEPT CODE I	NAME DRN HC DESN CHD AS APPD PD	SIGN s.d. s.d. s.d. s.d. s.d. s.d.	DATE 07.12.17 07.12.17 07.12.17 07.12.17 07.12.17 07.12.17						
REVISED IN LINE WITH CUSTOMER COMMENTS DT. 13.08.2018					REVISED IN LINE WITH CUSTOMER COMMENTS DT. 19.04.2018					TITLE BASIC TECHNICAL FEATURES FOR LT MOTORS									
										DEPT.		SCALE		DRAWING NO.					
										SIGN				PE-DC-417-565-E003					
												SHEET 1 OF 7		REV. 02					

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
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- 1.0 This document covers the basic technical features of low tension (LT) squirrel cage induction AC motors employed for driving auxiliaries of BHEL-PEM scope packages in **5 x 800 MW YADRADRI TPS**.

2.0 CODES AND STANDARDS

All motors shall conform to the latest applicable standards as listed below;

- 1) Three phase induction motors: IS: 12615, IEC: 60034
- 2) Single phase AC motors: IS: 996, IEC: 60034
- 3) Crane duty motors: IS: 3177, IEC: 60034
- 4) Energy Efficient motors: IS 12615 or IEC: 60034-30 with Efficiency class IE3

3.0 DESIGN REQUIREMENTS

3.1 Service Conditions

The motors will be installed in hot, humid and tropical atmosphere highly polluted at places with coal dust and/or fly ash. For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

The design ambient temperature shall be 50 deg C.

3.2 Supply system and rated voltage of motors

KW rating	Supply system	Rated voltage of motor
Upto 0.2 kW	240V/415 V	240V/415 V
Above 0.2 kW & up to 175kW	415 V	415 V

3.2.1 Supply voltage & variations shall be as follows:-

Voltage variation (AC Supply): (+/-) 10%

Frequency variation : (+) 3% to (-) 5%

Combined V & F variation : 10% (sum of absolute values)

During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.

3.2.2 Motors shall be capable of running continuously at rated output for each of the conditions specified.

3.3 Motor Rating

All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity. LT motor rating at 50 degree C shall have at least 15% margin over the input power requirement of the driven equipment at rated duty point unless stated otherwise in driven equipment specification. The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.

3.4 Starting Requirements

3.4.1 Motor shall start smoothly and rapidly. Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The

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accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

- 3.4.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value of 85 (eighty five) percent rated voltage.

- 3.4.3 Continuous duty LT motors up to 175 KW Output rating (at 50 deg. C ambient temperature), shall be Premium efficiency (IE3) as per IEC: 60034-30/ IS: 12615 and the locked rotor current of motors shall as per IS 12615.
However, as per system requirement drives rated in the range of 160-210 KW may be considered in either 415V or 3.3 KV

- 3.4.4 Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction. The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage.

- 3.4.5 The following frequency of starts shall apply

- i) Three cold starts in succession with the motor being initially at a temperature not exceeding the ambient temperature.
- ii) Two hot starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- iii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature (not to be repeated in the second successive hour)

- 3.4.6 Locked motor withstand time of hot motors at 110% rated voltage shall be as follows:

- a) For motors with starting time upto 20 sec.
- at least 3 sec. more than starting time.
- b) For motor with starting time above 20 secs but not exceeding 45 secs.
- at least 5.0 sec. more than starting time.
- c) For motors with starting time above 45 secs.
- at least 10%. more than starting time.

The starting time of the motor referred above is at minimum permissible voltage. Wherever the above requirements are not complied with, speed switches of approved make & type shall be provided to bypass the locked rotor protection for a pre-selected time during starting of motors. The speed switches shall have one NO & one NC contacts having maximum interrupting capacity of 5 Amps at 240V AC and 0.25 amps at 220 V DC.

Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilising motor rated capacity.

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3.5 Running Requirements

- 3.5.1 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given above.
- 3.5.2 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.
- 3.5.3 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

3.6 Stress during bus Transfer

- 3.6.1 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.
- 3.6.2 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.

4.0 SPECIFIC REQUIREMENTS

4.1 Enclosure

All motor enclosures for outdoor, semi-outdoor & indoor application shall conform to the degree of protection IP-55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy. For hazardous area approved type of increased safety enclosure shall be furnished.

4.2 Cooling

- 4.2.1 The motor shall be self-ventilated type, either totally enclosed fan cooled IC 411(TEFC), totally enclosed tube ventilated IC 511(TETV) or closed air circuit air- cooled IC 611(CACA).

4.3 Winding and Insulation

All insulated winding shall be of copper. All motors shall have class F insulation but limited to class B temperature rise. Windings shall be impregnated to make them non-hygroscopic and oil resistant.

Tropical Protection

All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

All fittings and hardware shall be corrosion resistant.

4.4 Bearings

- 4.4.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be rated for minimum service life of 40,000Hrs.
- 4.4.2 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.

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- 4.4.3 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.
- 4.4.4 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.
- 4.4.5 Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication. LT motors 15kW and above shall be provided with external greasing arrangement.
- 4.4.6 Oiled bearing shall have an integral self-cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.
- 4.4.7 Forced lubricated or water cooled bearing shall be used as per requirement.
- 4.4.8 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.
- 4.4.9 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

4.5 Noise & Vibration

- 4.5.1 For 415V motors, maximum double amplitude vibrations upto 1500 rpm shall be 40 microns and 15 microns upto 3000 rpm.
- 4.5.2 The noise level shall not exceed 85db (A) at 1.5 meters from the motor.

4.6 Motor Terminal Box

- 4.6.1 Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation
- 4.6.2 Terminal box shall be capable of being turned 360 deg in steps of 90 Deg. for LT motors unless otherwise approved.
- 4.6.3 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.
- 4.6.4 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.
- 4.6.5 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.
- 4.6.6 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- 4.6.7 The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec.
- 4.6.8 Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.
- 4.6.9 The gland plate for single core cable shall be non-magnetic type. A suitable cable adopter box shall be provided if the cable size does not allow the direct termination in the main TB.

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4.6.10 Minimum clearances to be provided between phase to phase and phase to earth shall be as under-

Voltage Rating of Motor Minimum Ph-Ph & Ph-Earth clearance

0.415 kV : 25 mm

Note: In case it is not possible to maintain these clearances, the live parts shall be totally insulated from earth and other Phases. Adequate clearances shall be provided for cable connections.

4.7 **Grounding**

The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer.

The cable terminal box shall have a separate grounding pad.

4.8 **Rating Plate**

In addition to the minimum information required by IS, the following information shall be shown on motor rating plate:

- Temperature rise in Deg.C under rated condition and method of measurement.
- Degree of protection.
- Bearing identification no. and Type of lubrication, Quantity and frequency/ time interval
- Location of insulated bearings.

5.0 **ACCESSORIES**

5.1 **SPACE HEATERS**

Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement. The space heater shall be rated 240 V, 1 Phase, 50Hz and sized to maintain the motor internal temperature above dew point when the motor is idle. The minimum cable size for space heater shall be 2.5 sq.mm copper cable.

5.2 **DELETED**

5.3 **INDICATOR/ SWITCH**

5.3.1 Dial type local indicator with alarm contacts shall be provided for the following:

Hot and cold air temperature of the closed air circuit for CACA motor.

5.3.2 Alarm switch contact rating shall be minimum 2.0 A at 220V D.C. and 10A at 240V A.C.

5.4 **ACCESSORY TERMINAL BOX**

5.4.1 All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.

5.4.2 Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit owner's cable connections.

DRAIN PLUG

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Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

5.5 LIFTING PROVISIONS

Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.

5.6 DOWEL PINS

The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.

7.0 PAINTING

Colour scheme for motors shall be shade 631 of IS-5.

8.0 TESTING

8.1 Type Tests

For LT Motors, type test reports for type tests as per IS: 12615/ IEC: 60034 conducted on equipment similar to those proposed to be supplied shall be submitted. The type Test should have been conducted within last 5 years from enquiry date.

8.2 Routine Tests

All motors shall be subjected to routine tests as per IS: 12615/ IEC: 60034 in the presence of customer or customer representative.

9.0 Variable Frequency Drive motor details:

- i) The motor shall be suitable for operation with a solid-state power supply consisting of an adjustable frequency inverter for speed control.
- ii) The motor shall be suitable for the current waveforms produced by the power supply including the harmonics generated by the drive.
- iii) The Motor shall be designed to operate continuously at any speed over the range 20-100 % of rated speed.
- iv) The permitted voltage variation should take into account the steady state voltage drop across the AC drive and all other system components upstream of the motor.
- v) Motors required to be transferred to DOL, by-pass mode shall be rated for specified variations in system line voltage and frequency. Starting current of motor in DOL, bypass mode shall be limited to value in motor specifications.
- vi) The motor shall be constructed to withstand torque pulsations resulting from harmonics generated by the solid-state power supply.
- vii) The motor insulation shall be designed to accept the applied voltage waveform, within the V_{peak} and dv/dt limits as per IEC-61800-4.
- viii) The drive manufacturer shall be solely responsible for proper selection of the motor for the given load application and the output characteristics of the drive.

REV-00, DATE: 11.03.2015

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGE : FUEL OIL SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor. OR (DE to select the choice applicable for their project)) 415 V AC, 3 phase, 3 wire supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.

Shweta Gaba
11/03/15

S. Datta
11/3/15

REV-00, DATE: 11.03.2015

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGE : FUEL OIL SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	a. In case, vendor's Fuel oil pump house building is located as combined with Heating & Pumping building (BHEL-TRICHY), cable tray/trench layout inside combined building shall be prepared by BHEL-PEM. Vendor to furnish drawing (both in print form as well as in AUTOCAD) of Fuel oil pump house layout clearly indicating all pumps, panels, JB's etc. which require cabling along with their terminal box/location/ Foundation etc. b. In case, vendor's Fuel oil pump house building is separate from Heating & Pumping building (BHEL-TRICHY), vendor shall prepare & submit cable tray/trench & equipment layout (both in print form as well as in AUTOCAD) of the complete Fuel oil pump house building indicating

Shweta Gaba
11/03/15

R. D. D. D.
11/3/15

REV-00, DATE: 11.03.2015

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGE : FUEL OIL SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
				location and identification of all equipment requiring cabling for BHEL review & approval. Vendor to ensure the cable tray lay out shall confirm to NFPA (National fire prevention act)/TAC (Tariff advisory committee) applicable for hazardous area classification.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

Shweta Gole
11/03/15

Ravindra Dutt
11/3/15

7336/2020/PS-PEM-MAX



TITLE

LV MOTORS**DATA SHEET-A**

SPECIFICATION NO.

VOLUME II B

SECTION C

REV NO. 00 DATE 19.01.2018

SHEET 1 OF 1

- | | | | |
|------|--|---|---|
| 1.0 | Design ambient temperature | : | 50 °C |
| 2.0 | Maximum acceptable kW rating of LV motor | : | 175 KW |
| 3.0 | Installation (Indoors/ Outdoors) | : | As required |
| 4.0 | Degree Of Protection | : | IP55 |
| 5.0 | Details of supply system | | |
| | a) Rated voltage (with variation) | : | 240V, 415V $\pm$ 10% |
| | b) Rated frequency (with variation) | : | 50 Hz (Variation: +3% TO –5%) |
| | c) Combined voltage & freq. variation | : | 10% (sum of absolute values) |
| | d) System fault level at rated voltage | : | 50 kA for 1 sec |
| | e) Short time rating for terminal box | : | 50 kA for 0.25 sec |
| | f) LV System grounding | : | Solidly |
| 6.0 | Class of insulation | : | Class 'F', with temp rise limited to class B. |
| 7.0 | Minimum voltage for starting
(As percentage of rated voltage) | : | 80% of rated voltage |
| 8.0 | Power cables data | : | Shall be given during detailed engg. |
| 9.0 | Earth Conductor Size & Material | : | Shall be given during detailed engg. |
| 10.0 | Space heater supply (30KW & ABOVE) | : | 240 V, 1 Φ , 50 Hz |
| 11.0 | Rating up to which Single phase motor | : | Acceptable below 0.20 Kw |
| 12.0 | TYPE OF STARTER PROVIDED IN MCC | : | DOL |
| 13.0 | Locked rotor current | | |
| | a) Limit as percentage of FLC | : | As per IS-12615 |
| | b) Permissible tolerance, if any | : | As per IS-12615 |
| 14.0 | Terminal box | : | Suitable to rotate at 90 degrees |
| 15.0 | Paint shade | : | Shade 631 of IS-5 |

7336/2020/PS-PEM-MAX

	TITLE	MOTOR DATA SHEET – C 5 X 800 MW YADADRI TPS	SPECIFICATION NO.
			VOLUME II B
			SECTION D
			REV NO. 00 DATE
			SHEET 1 OF 2

S. No.	Description		Data to be filled by successful bidder
A.	General		
1	Manufacturer & country of origin		
2	Motor type		
3	Type of starting		
4	Name of the equipment driven by motor & Quantity		
5	Maximum Power requirement of driven equipment		
6	Rated speed of Driven Equipment		
7	Design ambient temperature		
B.	Design and Performance Data		
1	Frame size & type designation		
2	Type of duty		
3	Rated Voltage		
4	Permissible variation for		
5	a	Voltage	
6	b	Frequency	
7	c	Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)		
9	Synchronous speed & Rated slip		
10	Minimum permissible starting voltage		
11	Starting time in sec with mechanism coupled		
12	a) At rated voltage		
13	b) At min starting voltage		
14	Locked rotor current as percentage of FLC (including IS tolerance)		
15	Torque		
	a) Starting		
	b) Maximum		
16	Permissible temp rise at rated output over ambient temp & method		
17	Noise level at 1.0 m (dB		
18	Amplitude of vibration		
19	Efficiency & P.F. at rated voltage & frequency		
	a) At 100% load		
	c) At 75% load		

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

7336/2020/PS-PEM-MAX

	TITLE	MOTOR DATA SHEET – C 5 X 800 MW YADADRI TPS	SPECIFICATION NO.
			VOLUME II B
			SECTION D
			REV NO. 00 DATE
			SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

CABLE SCHEDULE FORMAT

ANNEXURE III

[illegible]

7336/2020/PS-PEM-MAX**Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.**

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
 - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
 - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
 - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
 - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
Cable	No. of cores	Cable code	Cable size
Voltage	(e.g. 01,03,3H, 07)	(See C below)	(e.g. 035,185,2.5, 0.5)
Code (see B below)			

(A) SYSTEM VOLTAGE CODES:

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V

(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:

A = 11KV (Power cables)

7336/2020/PS-PEM-MAX

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)

C = 3.3KV (Power cables)

D = 1.1KV (LV & DC system power & control cables)

E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS

B = Armoured Non-FRLS

C = unarmoured FRLS

D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS

F = Armoured Non-FRLS

G = unarmoured FRLS

H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS

K = Armoured Non-FRLS

L = unarmoured FRLS

M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS

P = Armoured Non-FRLS

Q = unarmoured FRLS

R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES

T = TOUGH RUBBER SHEATH

U = OVERALL SCREENED

V = PAIRED OVERALL SCREENED

W = PAIRED INDIVIDUAL SCREENED

Y = COMPENSATING CABLES

I = PRE-FABRICATED CABLES

Z = JELLY FILLED CABLES

6. Once a cable list has been given to PEM for routing, any subsequent changes required in the cable list (which may be in the form of addition of cables, deletion of cables, change of type or size of cable, etc.) must be informed as specific changes (as a separate file MS Excel of the same format as the original file) to the cable list given earlier if the cable list has been routed and cable schedule generated. The routing status of the cable list shall be got confirmed from PEM by the agency that has prepared the cable list before the changes are intimated. In case PEM confirms that the cable list in question has not been taken up for routing, and the revised cable list is acceptable, the same may be sent. Since cable routing through the program involves adding each cable list to the project cable schedule database, the original cable schedule shall not be furnished to PEM with revisions incorporated within.

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO. :		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:		SECTION: II

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	.	..			
					M	C/N				D	M	C	N	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL													
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TEST REPORT		P/V	-	-	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%	-		FREE FROM CRACKS, UN-EVENNESS ETC.	TEST REPORT		P	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%	-	MANUFACTURER'S DRG./SPEC	FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK		P/V	-	-	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-	-	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-	-	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P/V	-	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:		
		SECTION: II		SHEET 2 OF 9		

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	.	..			
					M	C/N				D	M	C	N	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG./ STD.	TC		P/V	-		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-		
		4.INTERNAL FLAWS	CR	ULTRASONIC TEST	100%	-	ASTM-A388	MANUFACTURER'S STD.	INSPECTION REPORT	✓	P/W	V	-	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	MANUFACTURER'S DRG./STD.	INSPECTION REPORT		P/V	-	-	
		2. PHYSICAL COND.	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	INSPECTION REPORT		P/V	-	-	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	INSPECTION REPORT		P/V	-	-	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	TEST REPORT		P/V	-	-	

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Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

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Sign & Date	
Seal	

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					M	C/N				D	M	C	N	
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS	TEST REPORT		P/V	-	-	
		2.DIMENSION(BORE DIA, WALL THICKNESS, BDV AS RECEIVED, BDV AFTER FOLDING AT 180°	MA	TEST	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK AND OR SUPPLIER'S TC		P/V	-	-	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK		P	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG. .	MANUFACTURER'S DRG.	LOG BOOK		P/V	-	-	
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	SAMPLE	-	MANUFACTURER'S DRG./ STD.	MANUFACTURER'S DRG./ STD.	TC		P/V	-	-	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		*P/V	-	-	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY
		2.ELECT. PROP. & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	TC & VENDOR'S TEST REPORTS		P/V	-	-	

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					M	C/N				D	M	C	N
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	LOG BOOK		P/V	-	-
		1.MAKE & TYPE	MA	VISUAL	100%	-	MANUFACTURER'S DRG./ APPROVED DATASHEET	MANUFACTURER'S DRG./ APPROVED DATASHEET	LOG BOOK		P/V	-	-
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	APPROVED DATASHEET	APPROVED DATASHEET/ BEARING MANUF'S CATALOGUES	LOG BOOK		P/V	-	-
		3.SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P/V	-	-
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-
		3.TEMP WITH-STAND CAPACITY	MA	ELECT.TEST	SAMPLE	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-
		4.HV/IR	MA	-DO-	100%	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	-	MANUFACTURER'S DRG/SPECS	MANUFACTURER'S DRG./ SPECS.	LOG BOOK		P	-	-
		2.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-

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					M	C/N				D	M	C	N	
2.0	IN PROCESS													
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-	MANUFACTURER'S DRG	GOOD FINISH	LOG BOOK		P/W	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	100%	-	MANUFACTURER'S STD./ ASTM-E165	MANUFACTURER'S STD./ APPROVED DATASHEET.	LOG BOOK	✓	P	V	-	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.SHADE	MA	VISUAL	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	

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					M	C/N				D	M	C	N	
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.CLEANLINESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	100%	-	IS-325//IS-12615//IEC-60034 PART-1	IS-325//IS-12615//IEC-60034 PART-1	TEST/INSPC. REPORT	✓	P	V	-	
		4.RESISTANCE	CR	ELECT. TEST	100%	-	IS-325//IS-12615//IEC-60034 PART-1	IS-325//IS-12615//IEC-60034 PART-1	TEST/INSPC. REPORT	✓	P	V	-	
		5.INTERTURN INSULATION	CR	ELECT. TEST	100%	-	IS-325//IS-12615//IEC-60034 PART-1	IS-325//IS-12615//IEC-60034 PART-1	TEST/INSPC. REPORT		P	-	-	
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		2.TEMP. PRESSURE VACCUUM	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		3.NO. OF DIPS	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK	✓	P	V	-	THREE DIPS TO BE GIVEN

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					M	C/N				D	M	C	N	
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION 1.COMPACTNESS & CLEANLINESS	MA MA	PROCESS CHECK VISUAL	CONTINUOUS 100%	- -	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	LOG BOOK LOG BOOK	✓ -	P P	V -	- -	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS 2.SOUNDNESS	CR CR	VISUAL MALLET TEST & UT	100% 100%	- -	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	LOG BOOK TEST/INSPC. REPORT	- ✓	P P	- V	- -	
2.9	COMPLETE ROTOR ASSEMBLY	3.HV 1.RESIDUAL UNBALANCE	MA CR	ELECT. TEST DYN. BALANCE	100% 100%	- -	MANUFACTURER'S STANDARD MANUFACTURER'S SPEC./ ISO 1940	MANUFACTURER'S STANDARD MANUFACTURER'S DWG.	TEST/INSPC. REPORT LOG BOOK	✓ -	P P	V -	- -	
2.10	ASSEMBLY	2.SOUNDNESS OF DIE CASTING 1.ALIGNMENT 2.WORKMANSHIP 3.AXIAL PLAY 4.DIMENSIONS 5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE 6. RTD, BTD & SPACE HEATER MOUNTING.	CR MA MA MA MA MA	ELECT. (GROWLER TEST) MEAS. VISUAL MEAS. MEAS. VISUAL	100% 100% 100% 100% 100%	- - - - -	MANUFACTURER'S SPEC. MANUFACTURER'S SPEC. MANUFACTURER'S SPEC. MANUFACTURER'S DRG./ MANUFACTURER'S SPEC. MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC. MANUFACTURER'S SPEC. MANUFACTURER'S SPEC. MANUFACTURER'S DRG./ MANUFACTURER'S SPEC. MANUFACTURER'S SPEC.	TEST/INSPC. REPORT LOG BOOK LOG BOOK LOG BOOK LOG BOOK	✓ - - ✓ -	P P P P P	V - - V -	- - - - -	

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					M	C/N				D	M	C	N	
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS	MA	ELECT.TEST	1/TYPE/SIZE	1/TYPE/SIZE	IS-325//IS-12615/APPROVED DATASHEET	IS-325//IS-12615/APPROVED DATASHEET	TEST REPORT	✓	P	W*	-	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST	MA	ELECT.TEST	100%	-	IS-325//IS-12615/APPROVED DATASHEET	IS-325//IS-12615/APPROVED DATASHEET	TEST REPORT	✓	P	V ^s	-	^s NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	ELECT.TEST	100%	-	IS: 12075 / IEC 60034-14 & IS-12065	IS: 12075 / IEC 60034-14 & IS-12065	TEST REPORT	✓	P	V ^s	-	^s NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET &	TEST/INSPC. REPORT	✓	P	W	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	-	IEC 60034-5/IS-12615	APPROVED DATASHEET	TC	✓	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	ELECT. & MECH. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1/IS: 12802	IS-325//IS-12615/IEC-60034 PART-1/IS: 12802	TC	✓	P	V ^s	-	^s NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	ELECT. & MECH. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1	IS-325//IS-12615/IEC-60034 PART-1	TC	✓	P	V ^s	-	^s NOTE - 2
		8. NAME PLATE DETAILS	MA	VISUAL	100%	-	IS-325//IS-12615& DATA SHEET	IS-325//IS-12615 & DATA SHEET	TEST/INSPC. REPORT	✓	P	V ^s	-	^s NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	-	IS 2148 / IEC 60079-1	IS 2148 / IEC 60079-1	TC	✓	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	SAMPLE	APPROVED DATASHEET	APPROVED DATASHEET	TC	✓	P	W ^s	-	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY ^s NOTE - 2

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4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MANUFACT. STANDARD / (#)	AS PER MANUFACT. STANDARD / (#)	INSPC. REPORT	✓	P	W	-

NOTES:

- 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.
- 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.
- 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THE SAME IS VALID FOR 5 YEARS.
- 4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
- 5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL PURCHASE GROUP FOR REVIEW.
- 6 IN CASE , ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/ CUSTOMER.
- 7 PROJECT SPECIFIC QP TO BE DEVELOPED BASED ON CUSTOMER REQUIREMENT.
- 8 FOR EXPORT JOB, BHEL TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING TO BE FOLLOWED.
- 9 PACKING SHALL BE SUITABLE FOR STORAGE AT SITE IN TROPICAL CLIMATE CONDITIONS.
- 10 LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ ASME/ IEC ETC.) INDICATED IN QP SHALL BE REFERRED.

LEGENDS:

*RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, C: CUSTOMER,
 P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL
 D: DOCUMENT

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ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE:	
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02		DATE: 17.04.2020	
		PROJECT:		PO NO.:		DATE:	
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))		SYSTEM:		SECTION: II	

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**		
					M	C/ N				D	M	C	N
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	LOG BOOK		P	-	-
		2.DIMENSIONS	MA	VISUAL	100%	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	LOG BOOK		P	-	-
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	LOG BOOK		P	-	-
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	MFG. SPEC/ APPROVED DATASHEET	LOG BOOK	✓	P	V	-
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	VISUAL	100%	-	IS-325 / IS-12615/ APPROVED DATA SHEET	IS-325 / IS-12615/ APPROVED DATA SHEET	TEST/ INSPN. REPORT	✓	P	V*	-
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V*	-

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI			Reviewed by:			
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		RITESH KUMAR JAISWAL			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 2 of 2

		3.NAMEPLATE DETAILS	MA	VISUAL	100%	-	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT	✓	P	V	-	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-8

NOTES:

1. Routine tests on 100% motors shall be done by the vendor. However, BHEL/ Customer shall witness routine tests on random samples. The sampling plan shall be mutually agreed upon.
2. For exhaust/ventilation fan motors of rating up to 1.5 KW, only routine test certificates shall be furnished for scrutiny.
3. In case test certificates for these tests on similar type, size and design of motor from independent laboratory are available, the same is valid for 5 years.
4. BHEL reserves the right to perform repeat test, if required.
5. After packing and prior to issue MDCC, photographs of items to be despatched shall be sent to BHEL for review.
6. In case of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
7. Project specific QP to be developed based on customer requirement.
8. For export job, BHEL technical specification for seaworthy packing to be followed.
9. Packing shall be suitable for storage at site in tropical climate conditions.
10. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:

*RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

** **M:** SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B:** MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C:** CUSTOMER,

P: PERFORM, **W:** WITNESS, **V:** VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI:** MINOR, **CR:** CRITICAL

D: DOCUMENTATION

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI			Reviewed by:			
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		RITESH KUMAR JAISWAL			Approved by:			

	Technical specification for CONTROL & INSTRUMENTATION 5x800 MW YADADRI TPS, NALGONDA	SPEC NO.: PE-TS-417-145-I	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 04.03.2020
		SHEET OF	

C&I SPECIFICATION FOR FUEL OIL HANDLING SYSTEM

SECTION -IC

	5X800 MW YADADRI TPS, NALGONDA CONTROL & INSTRUMENTATION Technical specification for FUEL OIL HANDLING SYSTEM		SPEC NO.: PE-TS-417-145-I	
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	5X800 MW YADADRI TPS, NALGONDA CONTROL & INSTRUMENTATION Technical specification for FUEL OIL HANDLING SYSTEM	SPEC NO.: PE-TS-417-145-I	
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1. SPECIFIC TECHNICAL REQUIREMENT
2. DRIVE CONTROL PHILOSOPHY
3. ACTUATOR SPECIFICATION
4. ACTUATOR DATA SHEET
5. INSTRUMENT DATASHEET
6. ERECTION HARDWARE
7. KKS PHILOSOPHY
8. JUNCTION BOX SPECIFICATION
9. CABLE BOQ
10. INSTRUMENT STUB DETAILS

	Technical specification for CONTROL & INSTRUMENTATION 5x800 MW YADADRI TPS, NALGONDA	SPEC NO.: PE-TS-417-145-I	
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SPECIFIC TECHNICAL REQUIREMENT



Specific Technical Requirement For
**FUEL OIL UNLOADING &
STORAGE SYSTEM**

5X800 MW
YADADRI TPS, NALGONDA

1. The bidder shall provide complete Instrumentation for control, monitoring and operation of entire FUEL OIL UNLOADING & STORAGE SYSTEM. The requirements given are to be read in conjunction with detailed Technical specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre bid clarification. In absence of any pre bid clarification, the more stringent requirement as per interpretation of customer/owner shall prevail without any commercial and time implication.
2. FUEL OIL UNLOADING & STORAGE SYSTEM shall be operated & controlled from DCS based control system (BHEL Scope). Operation & Control shall be through Local Control Panel(LCP), which is also being referred as Backup Panel. The back up panels along with DCS panels shall be placed in Control Rooms (One in HFO Unloading Pump House near railway track & another in Pressurizing & heating pump house near tank farm area for HFO & LDO unloading pumps). Both the backup panels (2 nos.) will be in BHEL scope.
3. LCP shall have the provision of command (start/stop, load/unload) & feedback interface with plant DCS. Local control panel shall have provision for hardwired annunciation facia, push buttons, digital indicators, lamps, colored mimics etc.
4. Back up panel shall include following minimum details but not limited to:
 - a. Start & Stop push button for all discharge valves
 - b. Tank Levels & Tank Temperature
 - c. Auxiliary Steam Inlet temp
 - d. Fuel Oil Outlet temp
 - e. Fuel oil unloading pumps for both HFO & LDO current (currents shall be connected to DCS also)
 - f. Alarm facia
 - g. Color Mimic
5. **Redundancy of sensors shall be provided, irrespective of instrumentation shown in the PID, by bidder as per following:**
 - (i) Triple redundancy for all analog and binary inputs required for protection of system /drives.
 - (ii) For all other control functions & alarms, dual redundancy of the sensors shall be provided by the bidder.
6. The quantity of instruments mentioned in tender P & ID is minimum and redundancy shall be in line with point no. 5 mentioned above. Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any implication.
7. All the instruments shall be supplied along with necessary fittings, accessories, valve



Specific Technical Requirement For
**FUEL OIL UNLOADING &
STORAGE SYSTEM**

5X800 MW
YADADRI TPS, NALGONDA

manifold, root valves, Junction box, Canopy & Structural steel as required. Instrument Installation, along with hardware shall be in bidder scope.

8. The junction boxes/LIEs for termination of instruments, solenoid valve, limit switches etc. are in bidder's scope. All instruments shall be terminated on JB in field and both instrument and JB are in bidder scope.
9. Double root valves shall be provided where pressure is above 40 Kg/cm².
10. The solenoid operated valves/ damper/gates shall have limit switches for open/ close feedback. Solenoid valve shall be rated for 24 V DC only.
11. PG/DPG/PS/PT/LT/LS etc. shall have chemical/diaphragm seal.
12. All pneumatic operated regulating control valves shall be envisaged with smart positioner.
13. Power supply derived for Transmitters, contact interrogation, interposing relay and solenoid shall generally be ungrounded 24V D.C only. In all cases redundancy in power modules shall be considered.
14. All transmitters & electronics items including JB's will be explosion proof / intrinsically safe as per hazardous area classification.
15. The make shall be as per approved vendor list. The model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict or repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
16. All Instruments must have separate tapping lines. Sharing of the same tapping pipe for redundant instruments or various different instruments is not acceptable.
17. Electronic instruments shall not be located close to hot lines, vessels or other hot equipment. Ambient temperatures exceeding 80 °C shall not result in calibration difficulties or rapid deterioration of electronic components.
18. Mandatory spares as per specification, shall be supplied by bidder.
19. The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards eg. ANSI, ASME, IEEE, ISO, IEC, IGCI, AWS, NFPA, AISC, IGS, SAMA, UBC, UL, NESC, NEMA, ISA, DIN, VDE, IS etc.
20. Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be



Specific Technical Requirement For
**FUEL OIL UNLOADING &
 STORAGE SYSTEM**

5X800 MW
 YADADRI TPS, NALGONDA

provided with a grounding terminal and shall be suitably connected to the panel grounding bus.

21. Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.
22. Bidder to note that all the transmitters/instruments supplied by Bidder shall be rack mounted. The racks shall be preassembled and provided by Bidder. Also no instruments / analyzers & JBs/Racks should be protruding on the walkway.
23. Each valve/instrument shall be fitted with a stainless steel or aluminum nameplate indicating the valve/instrument service and reference number in accordance with the approved equipment coding system.
24. The equipment shall be of modern, compact design incorporating the latest developments in proven technology.
25. Generally, equipment shall be supplied from one composite range of measurements and control equipment as marketed by a reputable manufacturer of international standing and shall have a minimum of three years' operational use on similar projects.
26. Transmitters shall be provided instead of switches.
27. Solenoid valves shall be kept in pneumatic junction boxes only. Air distribution for SOV's shall be through SS manifold with SS isolation valves and auto drain traps and SS tubing from SOV to valves shall not be more than 6 meters.
28. All the instruments/equipment/electrical items shall be provided & designed with maximum star rating in line with energy conservation policies as per latest international standards at the time of supply.
29. Bidder to provide erection hardware including canopies, structural steel as required.
30. Bidder to perform tests of C&I items/instruments/systems as per quality plans/type test attached in the specification.
31. Each valve/instrument shall be fitted with a stainless steel or aluminium nameplate indicating the valve/instrument service and reference number in accordance with the approved equipment coding system.



Specific Technical Requirement For
**FUEL OIL UNLOADING &
 STORAGE SYSTEM**

5X800 MW
 YADADRI TPS, NALGONDA

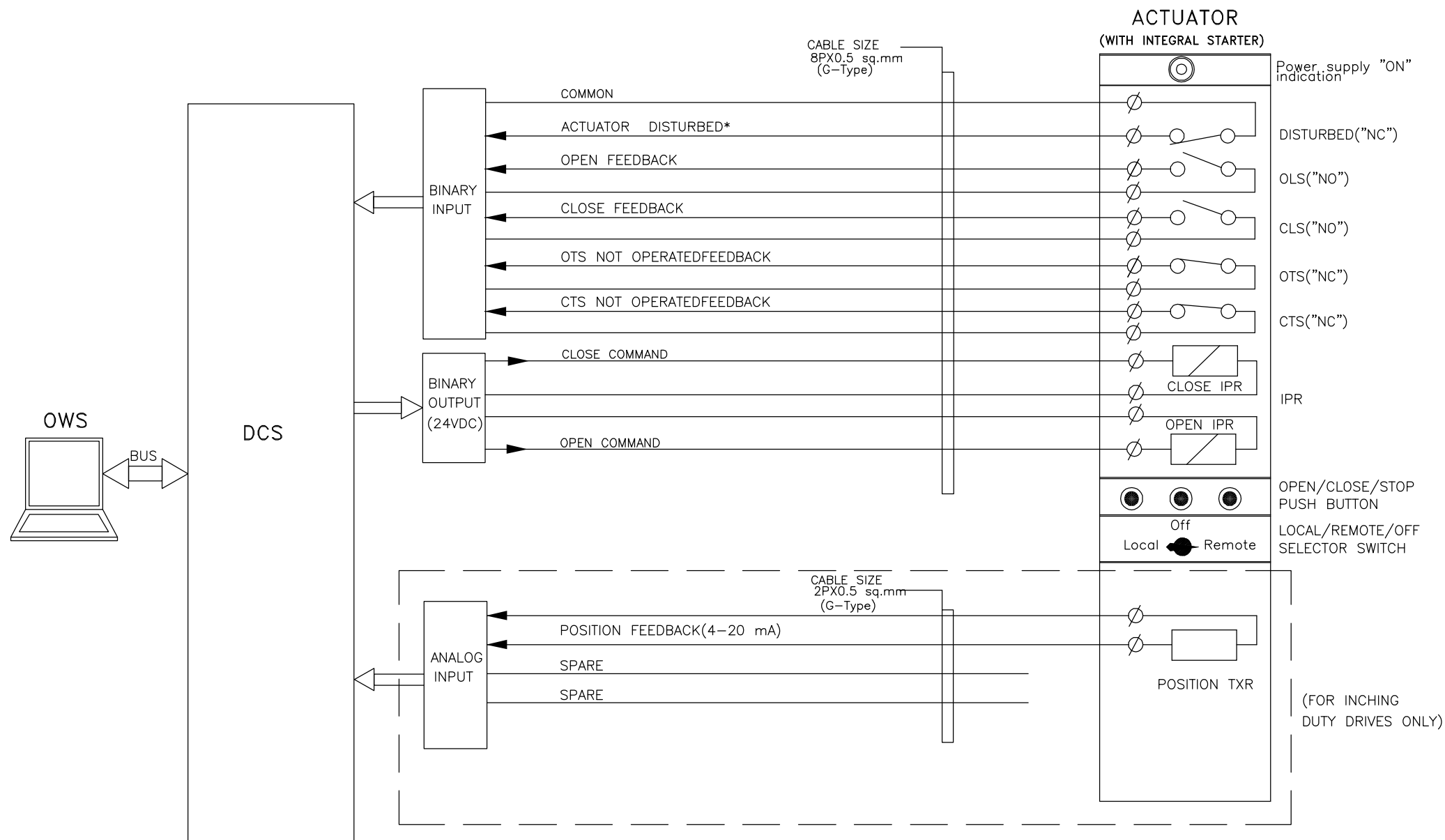
Notes:

1. All equipment items shall be of latest design with proven on track record from reputed experienced manufacturers of specified type and range of equipment. The make/model of various instruments/items/systems and instrument sub-vendor shall be subject to approval of BHEL/Customer during detailed engineering stage.
2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.
3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication.
4. Uniformity of make and type of instruments and control components shall be followed throughout for rationalization of spares' inventory, except for certain proprietary items where this requirement cannot be met.

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		SHEET	OF

Drive Control Philosophy

DCS INTERFACE FOR BIDIRECTIONAL DRIVE (WITH INTEGRAL STARTER)



NOTE:

* DISTURBED= Loss of Power supply (1 Phase/3 Phase)/
Loss of control supply/ Motor thermostat trip/
Thermal over load/Torque open/close cutoff
Local/Off/Remote Sel. switch
Stop PB optd.



PROJECT:

5X800 YADADRI THERMAL POWER STATION
UNIT # 1 TO 5

TITLE:

DDCMS INTERFACE FOR
BIDIRECTIONAL DRIVE

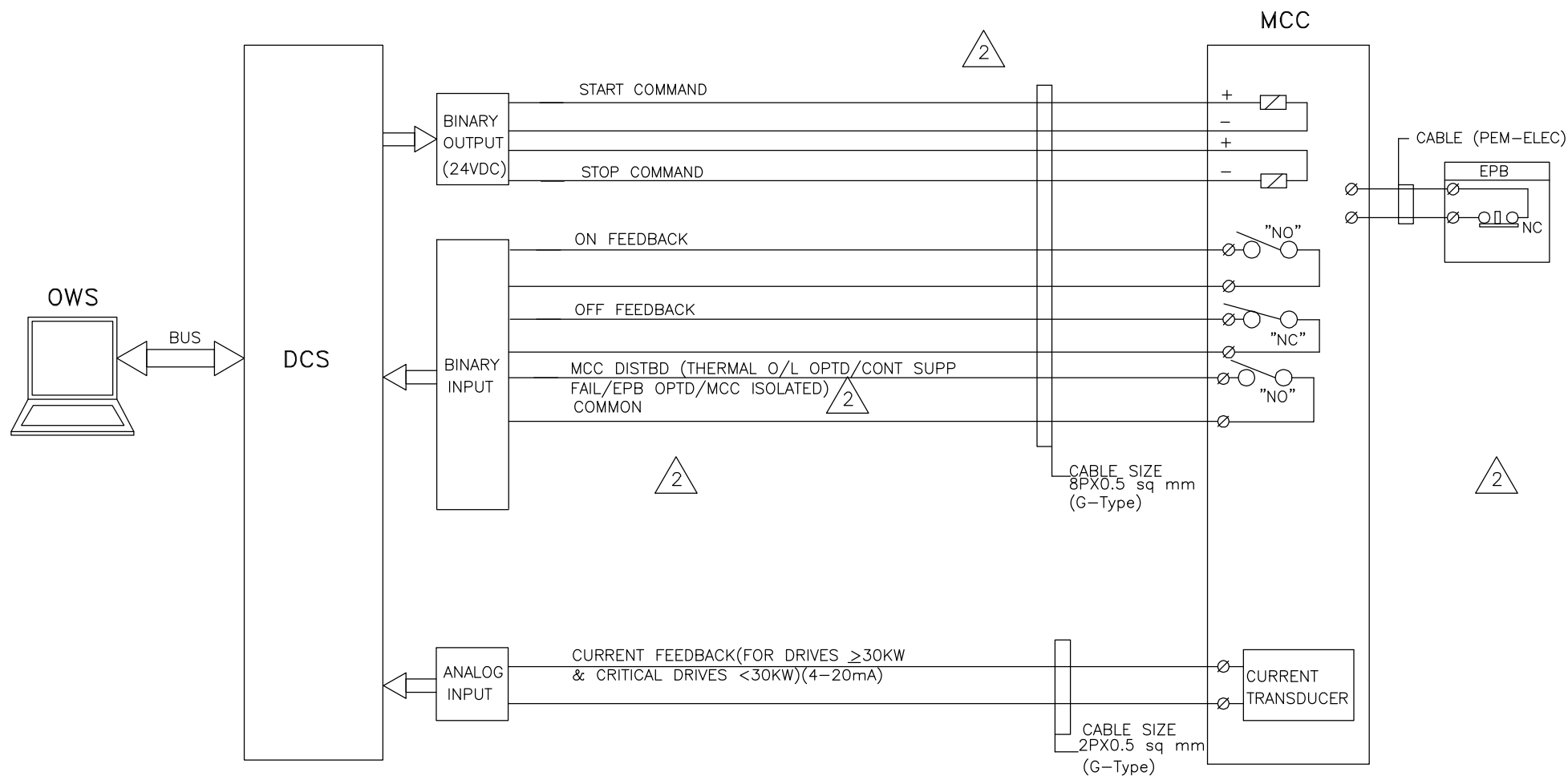
DRG.NO. PE-DM-417-145-I002

DATE 06.12.2019

REV.NO. 03

SHT 7 OF 11

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE



NOTE:-

1) EPB OF RESPECTIVE DRIVE WILL BE MOUNTED NEAR TO DRIVE ONLY.

2) 4-20mA CURRENT TRANSDUCER SHALL BE CONSIDERED. FOR LTUDs $> 30\text{ KW}$ AND IMPORTANT DRIVES, LUBE OIL PUMPS (REFER CLAUSE D, SHEET 6 OF 11)



PROJECT:

5X800 YADADRI THERMAL POWER STATION
UNIT # 1 TO 5

TITLE:

DDCMIS INTERFACE FOR
UNIDIRECTIONAL LT DRIVE

DRG.NO.

PE-DM-417-145-I002

DATE

06.12.2019

REV.NO.

03

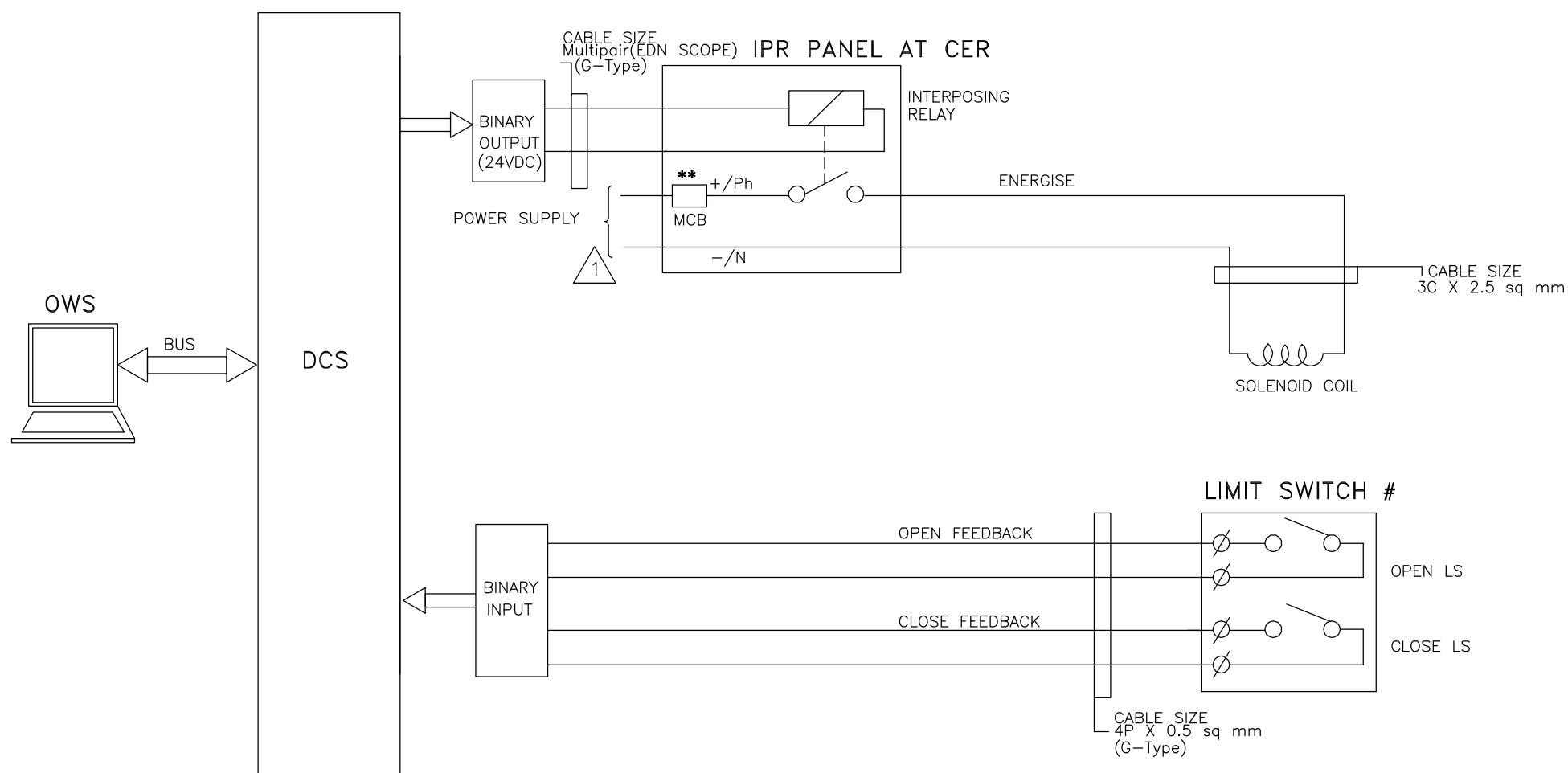
SHT

8

OF

11

DCS INTERFACE FOR SOLENOID DRIVE (24V DC / 240V AC UPS)



NOTES:

** MCB SHALL BE PROVIDED FOR EACH SOLENOID

FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.



PROJECT:

5X800 YADADRI THERMAL POWER STATION
UNIT # 1 TO 5

TITLE:

DDCMIS INTERFACE FOR
SOLENOID DRIVE (SINGLE COIL)

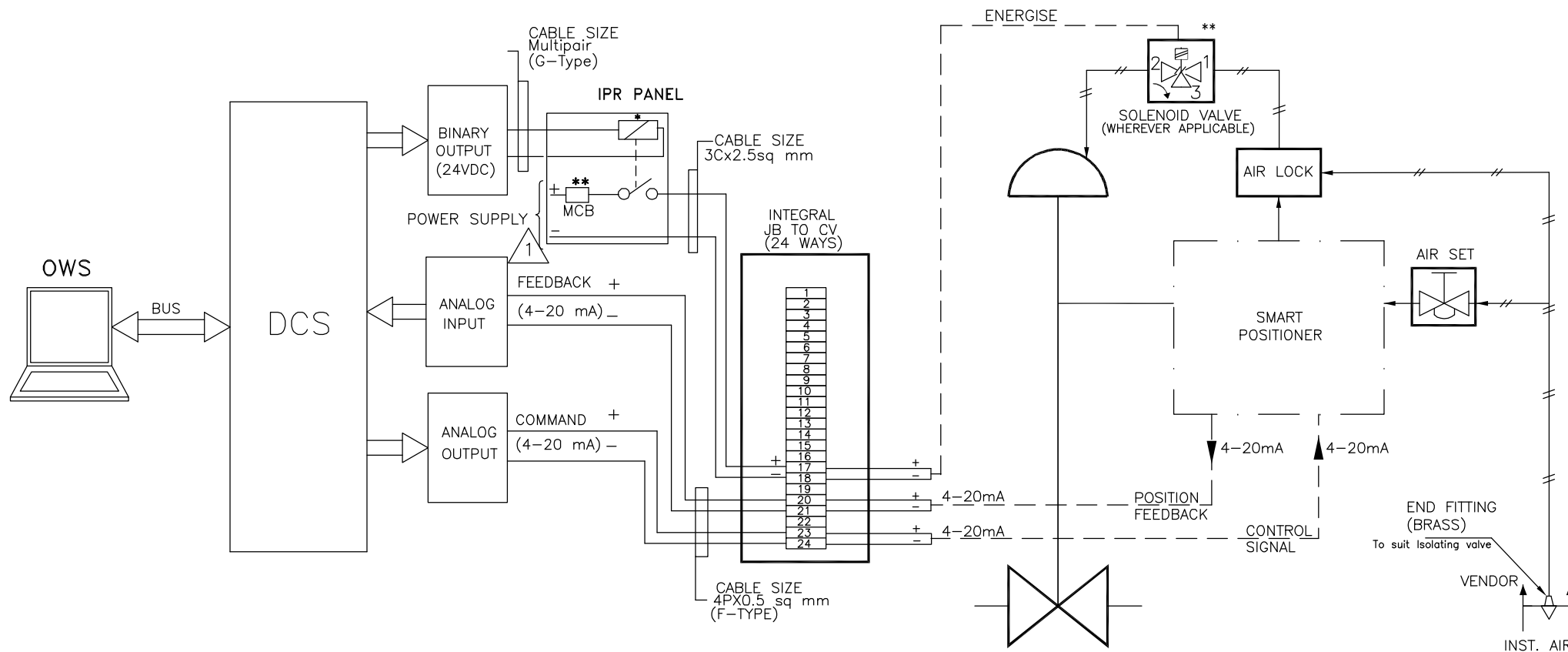
DRG.NO. PE-DM-417-145-I002

DATE 06.12.2019

REV.NO. 03

SHT 9 OF 11

DCS INTERFACE FOR ANALOG DRIVE (WITH SMART POSITIONER)



NOTES:

** APPLICABLE TO VALVES WHERE PROTECTION OPEN/CLOSE ACTION FOR CONTROL DEMAND OVERRIDING IS REQUIRED.



PROJECT:

5X800 YADADRI THERMAL POWER STATION
UNIT # 1 TO 5

TITLE:

TYPICAL HOOK-UP DIAGRAM
ANALOG DRIVE (WITH SMART POSITIONER)

DRG.NO. PE-DM-417-145-I002

DATE 06.12.2019

REV.NO. 03

SHT 11 OF 11

FORM NO. PEM-8868-0

	Technical specification for CONTROL & INSTRUMENTATION 5x800 MW YADADRI TPS, NALGONDA	SPEC NO.: PE-TS-417-145-I	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 03.04.2018
		SHEET	OF
ACTUATOR SPECIFICATION			

VOLUME: V-A

SECTION-III

**TECHNICAL SPECIFICATION
FOR
ELECTRIC MOTOR ACTUATORS**

1.00.00 SCOPE

- 1.01.00 This Section covers the general requirements of Electric Motor Actuators for valves/dampers.
- 1.02.00 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification. All the electrical actuators shall be INTEGRAL type only.

2.00.00 STANDARDS

- 2.01.00 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in driven equipment specification.
- 2.02.00 Major standards, which shall be followed, are listed below. Other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed
- i) IS -9334
- ii) IS-325

3.00.00 SERVICE CONDITIONS

- 3.01.00 The actuator shall be suitable for operation in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.
- 3.02.00 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the general specification.
- 3.03.00 For actuator motor installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

4.00.00 RATING

- 4.01.00 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer.
- 4.02.00 For regulating service, the actuator shall be suitably time-rated for the duty cycle involved with necessary number of starts per hour, but in no case less than 150 starts per hour.

**Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

5.00.00 PERFORMANCE

The actuator shall meet the following performance requirements:

- 5.01.00 Open and close the valve completely and make leak-tight valve closure without jamming.
- 5.02.00 Attain full speed operation before valve load is encountered and imparts an unseating blow to start the valve in motion (hammer blow effect).
- 5.03.00 Operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.
- 5.04.00 The motor reduction gearing shall be sufficient to lock the shaft when the motor is de-energised and prevent drift from torque switch spring pressure.
- 5.05.00 The entire mechanism shall withstand shock resulting from closing with improper setting of limit switches or from lodging of foreign matter under the valve seat.

6.00.00 SPECIFIC REQUIREMENT

6.01.00 Construction

- 6.01.01 The actuator shall essentially comprise the drive motor, torque/ limit switches, gear train, clutch, hand wheel, position indicator/ transmitter, in-built thermostat for over load protection, space heater and internal wiring.
- 6.01.02 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy. Degree of protection of enclosure for motor actuator shall be IP-65.
- 6.01.03 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- 6.01.04 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

6.02.00 Motor

- 6.02.01 The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service. Canopy shall be provided for outdoor service.
- 6.02.02 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.
- 6.02.03 The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated voltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each.
- 6.02.04 Motor leads shall be terminated in the limit switch compartment.
- 6.02.05 Motor actuators for valves/dampers shall be with integral starter with 3phase/3wire, 415V AC and operable from remote.

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 6.02.06 Earthing terminals shall be provided on either side of the motor.
- 6.03.00 **Limit Switches**
- Each actuator shall be provided with following limit switches: -
- 6.03.01 2 torque limit switches, one for each direction of travel, self-locking, adjustable torque type.
- 6.03.02 4 end-of-travel limit switches, two for each direction of travel.
- 6.03.03 2 position limit switches, one for each direction of travel, each adjustable at any position from fully open to fully closed positions of the valve/damper.
- 6.03.04 Each limit switch shall have 2 NO + 2 NC potential free contacts. Contact rating shall be 5A at 240V A.C. or 0.5A at 220V D.C.
- 6.04.00 **Hand Wheel**
- Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall declutch automatically when the motor is energized.
- 6.05.00 **Position Indicator/Transmitter**
- The actuator shall have:
- 6.05.01 One (1) built-in local position indicator for 0-100% travel.
- 6.05.02 One (1) position transmitter, 4-20 mA current signal as position feedback, for remote indicator.
- 6.06.00 **Space Heater**
- A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply.
- 6.07.00 **Wiring**
- All electrical devices shall be wired up to and terminated in a terminal box. All wiring shall be done with 1100 V grade fire resistance PVC insulated stranded copper conductor of not less than 2.5 Sq.mm cross section. All wiring shall be identified at both ends with ferrules. All the electrical actuators shall have uniform wiring.
- 6.08.00 **Terminal Box**
- The terminal box shall be weather proof, with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 Sq.mm copper conductor.
- 7.00.00 **ACCESSORIES**

**Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

As required for the driven equipment, the actuator shall be furnished with starting equipment mounted on the actuator. This shall include:

- 7.01.00 One (1) triple pole MCCB
- 7.02.00 One (1) reversing starter with mechanically interlocked contactors, 3 thermal overload relays, 2 NO + 2 NC auxiliary contacts for each contactor.
- 7.03.00 One (1) remote-local selector switch.
- 7.04.00 CLOSE-STOP-OPEN oil tight push buttons with indication lights.
- 7.05.00 415/240 V control transformer with primary & secondary fuses.
- 8.00.00 **TEST**

The actuator and all components thereof shall be subject to tests as per relevant Standards. In addition, if any special test is called for in equipment specification, the same shall be performed.
- 9.00.00 **DRAWINGS, DATA & MANUALS**
- 9.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.
- 9.02.00 **To be submitted with Bid**

Data sheet for each type of actuator shall be furnished along with internal wiring diagram, suggested control schematic and torque limit switch contact development and manufacturer's catalogues. Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.
- 9.03.00 **To be submitted for Owner / Purchaser's Approval and Distribution**

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, BOM, control & schematics, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

DESIGN DATA

1.0 AUXILIARY POWER SUPPLY

S	upply	Description	Consumer
	L.V. Supply (i)	415V, 3Ø, 3W, 50 Hz Effectively earthed	u Motors above 0.2kW pto less than 175kW.
		Fault level 50 kA symm. for 1 sec.	
	(ii)	240V AC/415V AC	Motors upto 0.2kW.
		240V, 1Ø, 2W, 50 Hz effectively earthed	o Lighting, Space heat- ing , A.C supply for Contr- l & protective devices.
	D.C. Supply	220V, 2W, unearthed	& D.C. alarm, control protective devices
		Fault level 25* kA. for 1 sec.	

* Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation.

2.0 RANGE OF VARIATION

A.C. Supply :

V	oltage	:	± 10%
	Frequency	:	+3% to -5%.
	Combined Volt + frequency	:	10% (absolute sum)

During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.

D.C. Supply :

Voltage	:	187 to 242
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		SECTION	
		REV. NO. 00	DATE : 03.04.2018
		SHEET	OF
Actuator Data Sheet			

7336/2020/PS-PEM-MAX

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		DOCUMENT NO. : PE-ID-417-145-I902	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE:15/05/2019
			SHEET 1	OF 4
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL *	* PROJECT	5 X 800 MW YADADRI TPS, NALGONDA		
	OFFER REFERENCE			
	* TAG NO. SERVICE			
	* DUTY	☐ ON / OFF ** ☐ INCHING		
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY		
	* OPENING / CLOSING TIME			
	* WORKING PRESSURE			
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%		
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY		
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY		
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY		
	CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:68	
MECHANICAL POSITION INDICATOR		TO BE PROVIDED FOR 0-100% TRAVEL		
BEARINGS		DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.		
GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION		METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.		
SIZING		OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.		
HANDWHEEL as per standard EN 12570:2000	* REQUIRED	☒ YES ☐ NO		
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED		
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.			
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY		
	MOTOR MAKE / MODEL / TYPE / RATING (KW) (REFER NOTE NO. 6 & 7)	BIDDER TO SPECIFY		
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF I.S. TOLERANCE		
	ACTUATOR APPLICABLE WIRING DIAGRAM	☒ ENCLOSED (BIDDER TO CONFIRM) DRG. NO. 3-V-MISC-24227 R00		
	COLOUR SHADE	☐ BLUE (RAL 5012) ☐		
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☐ EPOXY CONFIRMING TO CORROSION CATEGORY C5-I		
	SHAFT RPM	BIDDER TO SPECIFY		
	OLR SET VALUE	BIDDER TO SPECIFY		
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY		
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY		
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V		
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 67 ☐ IP 68 ☐ FLAME PROOF		
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B		