



STANDARD CHECK LIST
STANDARD CHECK LIST FOR: CS-FITTINGS (FORGED/SEAMLESS)
PACKAGE-FULE OIL SYSTEM
PROJECT-
CHECK LIST NO.:PE-QP-XXX-166-A817
REV.NO. 0
DATE: 31/03/2012

Sheet 1 of 1

SL. NO.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOCUMENT./ ACCEPTANCE NORMS	AGENCY				REMARKS
1	2	3	4	M	C	N	D	6
1	Visual and Dimensional Checks for each size and type	100% by Manufacturer and 10% by BHEL	Appd. Data Sheet/ Relevant Standard	P	W	W	✓	Inspn. Report shall be furnished
2	Check for Logo mark & Specification	-do-	-do-	P	V	V		
3	Check for TC of mother pipe/forgings	100%	-do-	P	V	V	✓	Manufacturer's TCs of mother pipe/forgings shall be furnished
4	Cross check for Mech/Chem properties of mother pipe/forging	One/Heat	-do-	P	V	V	✓	-do-

LEGEND:

RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

M= MANUFACTURER/SUB-CONTRACTOR

C= CONTRACTOR/NOMINATED INSPECTION AGENCY,

N= CUSTOMER

P= PERFORM; W= WITNESS; V= VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

CHECK LIST

Check list for item : Dished-end for Flash Tank
 Check list No. :
 Project :
 Package : Fuel Oil Handling
 Contract No. :
 Contractor : BHEL
 Sub-Contractor :

SL. NO.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOCUMENT/ ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY				REMARKS
					D	S	C	N	
A.	<u>RAW MATERIAL</u>								
	Plate - conforming to IS 2002 Gr.A								
	Chemical Composition & Physical Properties	1 sample/heat	IS:2002 Gr.A	Material TC	√	V	V	V	
B	<u>IN PROCESS INSPECTION</u>								
	UT on Plate	100%	ASTM A388 (Defect giving echo height more than 20% on total CRT Screen height shall be treated unacceptable. Defect causing reduction in backwall echo less than 80% of Screen height shall be treated as unacceptable)	UT Report	√	P	V	V	
C.	<u>FINAL INSPECTION</u>								
	1 Visual Exam.	100%	Appd.Drg.	Inspn. Report	√	P	V	V	
	2 Dimensional Check	100%	Appd.Drg.	-do-	√	P	V	V	
	3 DP on Knuckle	100%	ASTM E165	-do-	√	P	V	V	

Legend

S = SUB-CONTRACTOR
 C= CONTRACTOR
 N= CUSTOMER
 P= PERFORM; W= WITNESS; V= VERIFICATION
 " √ " Marked document to be furnished along with QA Doc. Pkg.



TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM
1x660 MW BHUSAWAL TPP UNNIT # 6

SPECIFICATION NO. PE-TS-415-166-A001

SECTION 'I-A'

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SECTION: I-A

**FUNCTIONAL / PERFORMANCE / DEMONSTRATION / GUARANTEE
TESTS**



**TECHNICAL SPECIFICATION FOR
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- A) Following test to be conducted by vendor on completion of FOHS for ascertaining performance of the system:
- 1) Shop test report shall be considered for pump guaranteed for capacity and total dynamic head.
 - 2) Unloading pump vibration and noise within limit at site.
 - 3) Drain oil pump and sump pump noise and vibration under limit at site.
 - 4) Water filled test on tank and other test as indicated in IS803 / API650 for tank leakage etc. will be carried out for tank stability.
 - 5) Tank temperature and suction heater outlet temperature measurement.
 - 6) Entire piping and support for smooth operation: Hydro test shall be carried out for checking the weld tightness and support checking. Hydro test shall be carried out at 1.5 times of design pressure for fuel oil lines.
 - 7) Operation of the complete system as per Control philosophy.

Above test will be demonstrated at the time of commissioning of FOHS and based on same system performance will be ascertained.

- B) In case during performance guarantee test(s) it is found that the equipment / system has failed to meet the guarantees, the contractor shall carry out all the necessary modifications and / or replacements to make the equipment / system comply with the guaranteed requirements at no extra cost to the employer and re-conduct the performance guarantee test(s) with employer's consent.
- C) If the demonstrated Noise level continued to be beyond the stipulated acceptable limits even after the above modifications / replacements, the employer will have the right to
- (i) Reject the equipment/system/plant and recover from the contractor the payments already made.
- OR
- (ii) Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the employer. Such damages shall, however be limited to the cost of replacement of the deficiency so as to achieve the guarantee performance.
- D) Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or IS 9779. Sound pressure shall be measured all around the equipment at a distance of 1.0m horizontally from the nearest surface of any equipment / machine and at a height of 1.5m above the floor level in elevation. Correction for background noise shall be considered in line with the applicable standards.

1x660 MW BHUSAWAL TPP UNIT 6

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM

ANNEXURE - A

(TERMS & CONDITION FOR MS PLATE FREE ISSUE)



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

**TITLE:****TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM
1X660 MW BHUSAWAL TPP UNIT 6****SPECIFICATION NO.: PE-TS-415-166-A001****SECTION - IA****ANNEXURE A****REV. NO. 01****DATE: 18.03.2020**

1.0 SCOPE OF SUPPLY

Bidder's Scope of work shall be as per technical specification no PE-TS-415-166-A001. MS Plates required for Shell, roof and bottom of HFO storage tank and LDO storage tank shall only be free issued by BHEL as specified in this Annexure. Any other plates required for RF pad plates, manholes, wind girder (plate fabricated), anchor chairs, saddle supports, gusset plates, stiffener plates, weir plates, interconnecting platform, etc shall be supplied by bidder.

The bidder shall furnish quantities of MS plate, required from BHEL (free issue), along with his offer as per "Format for MS Plate" attached with Section III. In case the quantities of MS plate quoted by the bidder, exceeds the base quantities as specified, the bidder's bid shall be loaded for the excess quantity at the specified evaluation rate.

During detailed engineering while furnishing the fabrication drawing for BHEL's & Customer Review/approval, Bidder shall furnish the theoretical quantities of MS Plate in Drawing/Documents.

If the total quantity of MS Plate during contract execution is found to be more than the quantities quoted at tender stage or base values, whichever is higher, the additional cost for excess quantity of MS Plate shall be deducted from the bidder's payments at penal rate. No Benefit will be given to bidders, in case of reduction in actual quantity of MS Plate with respect to the quantities considered in bid evaluation.

2.0 FREE ISSUE OF MS PLATE CONDITIONS:

A) GENERAL NOTES:

- 1) MS Plate shall be issued free of cost by BHEL as per approved fabrication drawings. The contractor shall collect these materials from BHEL stores/store yard at specified places at his own cost and store the same at the work site or in his stores as per standard norms. Materials issued will be used only for construction of HFO and LDO storage Tanks as per contract requirement.
- 2) BHEL reserves the right to recover from the contractor any loss arising out of damage/ theft or any other causes or during verification/stacking or at any time under the custody of the contractor.
- 3) The contractor shall take care of material issued by BHEL and shall protect the same from damage and weathering.
- 4) The contractor shall in no case be entitled for any compensation on account of any delay in supply or non-supply thereof for all or any such materials. However, in case of non-availability of any specific section(s) which delays the completion of work, such cases shall be recorded separately in monthly planning format) and shall be considered for time extension of contract.
- 5) Contractor will have to make his own arrangement at his own cost for procurement of any other materials except as mentioned above, as required for the works and of such quality as acceptable to BHEL.
- 6) Contractor shall also carryout in complete association with BHEL, the material management functions and execution like day-to-day update of materials, issued to contractor.
- 7) The contractor shall solely be responsible for the safety & security of material after it is handed over and issued to contractor by the BHEL.
- 8) BHEL issued materials, shall not be under any circumstances whatsoever, and shall be taken out of the project site unless otherwise permitted by BHEL for outside job.

B) HANDLING OF MATERIALS ISSUED BY BHEL:

- 1) Materials shall be issued by BHEL based on the weighment basis/linear measurements & sectional weight. However, on specific request of the contractor "as a special case to expedite the job" the consignment received at BHEL stores can directly be diverted to the work site following issuance procedure of BHEL. Such direct issues



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shall be as per the Challan/dispatch document/LR received with the consignment. In such cases, Contractor shall do unloading of materials from trucks/lorry at their own cost.

- 2) All materials issued by BHEL shall be stacked, stored above ground level by use of concrete or wooden sleepers. No materials shall remain on ground at any time. All concrete or wooden sleepers required for stacking the materials shall be arranged by contractor (successful bidder of this package) at his own cost within the quoted rates. All other equipments like winches, D-Shackles, slings of various sizes, max puller, pulley blocks, jacks, trucks, trailers etc. Required for such handling of MS plates from BHEL stores/storage yard etc. Shall be arranged by contractor within quoted/accepted rates.
- 3) The contractor shall take delivery of the materials from the designated place within the project premises at his own cost and store the same at his stores as per standard norms. Open land for such purposes shall be provided by BHEL on free of cost basis. Temporary barbed wire fencing of the open storage yard is to be done by the contractor and is included under the scope of his work. Contractor shall also remove grass, bushes, trees etc wherever required off the land provided to him and shall make proper continuous up keeping of the open yard /land by removing grass, bushes trees etc and same is included under the scope of his work & No extra payment shall be made to the contractor in this regard. The bidder shall make complete arrangement of necessary security personnel's to safeguard all such materials in his custody. Materials issued will be used only for construction of HFO and LDO storage tanks as per the scope specified in this specification. The contractor shall take care of material issued by BHEL and shall protect the same from theft, damage and weathering. Excessive rusting of steel in custody of agency/contractor must be avoided. In case, due to any cause attributable to the contractor, such rusting of steel occur rendering the same unusable, then such quantity of steel shall be recovered from the interim payment as per the contract conditions specified.i.e.as per the bid evaluation Price.

C) ISSUE OF MS PLATES FREE OF COST:

- 1) The MS Plates shall be issued to the contractor on the following basis:

- i. MS Plate: Weighment basis (Unit-MT)

- 2) All the MS Plate issued by BHEL shall be properly accounted for. The total quantity of MS Plate required for the work will be calculated from the approved fabrication drawings as per contract.

In case any such sectional weights are not available in the applicable drawing/documents, the manufacturer recommendation shall be binding.

- 3) The MS Plate issued to the contractor shall be mainly in standard length as received from the supplier. However, the contractor shall be bound to accept the MS Plate in length / width as available in the project stores, no claims for extra payment because of issue of non-standard length will be entertained.
- 4) The contractor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL stores. No claims whatsoever will be entertained by BHEL because of quality or quantity after the materials are taken by the contractor from BHEL stores.
- 5) The contractor shall submit to BHEL, a statement indicating estimated quantity MS Plate required during a quarter. In addition, the contractor shall also furnish the estimated requirement of MS Plate during a month by the third week of the previous month indicating his requirement.
- 6) Following shall be limit for the maximum quantity of BHEL issue materials that would be with the contractor at any point of time when work is in progress (excluding what has already been incorporated in the works).

SL No.	ISSUE OF MATERIALS	MAX QUANTITY IN CONTRACTORS STORE
01	MS Plate	ONE MONTH

- 7) Bidders shall ensure that no lamination material is taken over by them from BHEL.

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- 8) The contractor must note that MS Plate required for other parts shall be arranged by the contractor at his own cost.
- 9) Bidder to give requirement of Material in BHEL Scope well in advance of before Three month from requirement. Any delay in raising the requirement of these item leading to delay in placement of order, will be Contractor responsibility and its attributable delay in erection will be responsibility of Bidder only.

D) RETURN OF MATERIAL:

- 1) All surplus MS steel and wastage materials will be taken back on weightment basis.
- 2) Surplus, unused and untampered MS steel shall be sorted section-wise and returned separately for a place directed by BHEL within the project area. Return of such material will not be entitled to any handling and incidental charges.
- 3) All wastages / scrap shall be promptly returned to the BHEL store and a receipt obtained for material accounting purposes. Return of such material will not be entitled to any transportation and incidental charge.

E) CONSUMPTION AND WASTAGE:

- 1) The theoretical consumption of various thickness / sections of MS plate shall be based on approved fabrication drawings. Weight shall be calculated considering the sectional weights as per Indian standards.
- 2) Actual consumption = Issue – Surplus.
- 3) Surplus = Untampered and unused quantity of MS plate returned by the contractor to BHEL store along with relevant documents.
- 4) Wastage = Actual consumption – Theoretical consumption.
- 5) Allowable wastage: Ten percent (10%) of the theoretical consumption shall be considered. Wastage shall be considered as cut pieces and scrap material, measured as per actual weightment basis. Invisible wastage, if any, shall be considered to be included in the specified 10% allowable wastage.
- 6)

S.No.	MS Plate	Basis of issue & penal recovery
S-1	Theoretical consumption (without considering any wastage, scrap or loss) as per approved fabrication drawing or Quantity mentioned in "FORMAT FOR REQUIRED MS PLATE" whichever is less.	Free
S-2	Wastage limited to plus ten percent (+10%) of the aforesaid theoretical consumption (S-1) towards allowable wastage.	Free
S-3	Wastage beyond ten percent (10%) of the aforesaid theoretical consumption (S-1)	Penal rate.

F) RECOVERY OF MATERIAL:

If wastage exceeds the specified limit, the recovery of excess wastage shall be at the Penal rate. Penal rate of MS plate shall be Rs 50,000/- per MT (Ex-works).

1x660 MW BHUSAWAL TPP UNIT 6

TECHNICAL SPECIFICATION
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ANNEXURE - B
(SUB-VENDOR LIST)



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



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**ANNEXURE-B
LIST OF MAKES OF SUB-VENDOR ITEMS
FUEL OIL UNLOADING AND STORAGE SYSTEM**



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SUB-VENDOR LIST - FUEL OIL UNLOADING AND STORAGE SYSTEM

SL. NO	ITEM	SUB-VENDORS	PLACE	TECHNICAL LIMIT
1	MECHANICAL GATE, GLOBE AND CHECK (CARBON STEEL VALVES)	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		MICON VALVES (INDIA) PVT LTD	MUMBAI	Gate Valves: Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 600 NB- Class up to 600 with MOC as CCS/CSS. Check valves: Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 700 NB- Class up to 600 with MOC as CCS/CSS. Globe valves: Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 80 NB- Class 150 with MOC as CCS.
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C) SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.	MUMBAI	LIMIT AS PER VD FILE AS ATTACHED IN SHEET 2
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CC/CSS-GATE-BBT-UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500,GLV-BBT-UPTO300NB CL UPTO600,SCNRV-BBT-UPTO600NB CL UPTO150,SCNRV-BBT-UPTO300NB CL 300,SCNRV-PSBT-UPTO150NB CL UPTO900
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900,GV/300/400, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300,GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	



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		WEIR BDK VALVES	NEW DELHI	
		AUDCO -L&T	CHENNAI / COIMBATORE	
		OSWAL INDUSTRIES		
		HITECH	AHMEDABAD	
		KSB WATER PUMPS / VALVES	COIMBATORE	
		KBL	KONDHAPURI	
		HAWA ENGINEERS	AHMEDABAD	
		BHEL	GOINDWAL	
		FOURESS ENGG	MUMBAI	UPTO 600 NB, CL-300 & 300NB CL-600
		FOURESS ENGG	AURANGABAD	
2	CS BALL VALVES	A.V. VALVES LTD	AGRA	
		AKAY INDUSTRIES PVT.LTD.	DHARWAD	
		BELGAUM AQUA VALVES PVT. LTD.	BELGAUN	
		MICON VALVES (INDIA) PVT LTD	MUMBAI	Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 200 NB- Class 150/300 with MOC as CCS/CSS.
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHAR	(1) BALL VALVES: FCS/FSS - 1/2" TO 2" #800 & CCS/CSS - 2.1/2" TO 4" #150 (2) BALL VALVES: GUN METAL VALVES SIZE 15 NB TO 80 NB - UPTO PN16.0
		DEMBLA VALVES LTD.	THANE	
		M/S GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	THANE	SIZE UP TO 2" & #800 WITH MOC AS FCS & FSS AND FOR SIZE FROM 65 NB TO 150 NB & #150 WITH MOC AS CCS AND CSS.
		INTERVALVE (INDIA) LTD.	PUNE	STEEL BALL VALVES UPTO 50NB, #800 AND 65NB TO 150NB. #150
		LEADER VALVES LTD.	JALANDHAR	CAST STEEL UPTO 200 MM, CLASS 150/300.
		MICROFINISH VALVES PVT LTD.	HUBLI	
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	FOR CARBON STEEL/STAINLESS STEEL UPTO SIZE 200NB.
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	FORGED CARBON & ALLOY STEEL BALL VALVES, SCREWED TYPE BALL VALVES RATING 800, SIZES UPTO 50 & CC& ALLOY STEEL BALL VALVES RATING 150 , SIZES 65 TO 200 FLANGED TYPE.
		VAAS AUTOMATION PVT. LTD.	DELHI	



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		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	DELHI	
		PEC	NASHIK	(UPTO 400 NB CLASS 150)
		L&T VALVES	COIMBATORE	
		L&T VALVES (AUDCO)	CHHENNAI	
		FLOW CHEM	AHMEDABAD	(UPTO 350 NB CLASS 150)
		BELGUAM AQUA VALVES	BELGAUM	UPTO 200 NB, CL 150
3	CS PLUG VALVES	FLOWSERVE (AUDCO)	CHENNAI	
		MICON VALVES (INDIA) PVT LTD	MUMBAI	Up to 50NB – Class-150 with MOC as CCS. Size 150 NB to 400 NB- Class 150 with MOC as CCS.
		MICROFINISH	HUBLI	
		WEIR BDK	HUBLI	UPTO 150 NB CLASS 300 & UPTO 400 NB CLASS 150
		FISHER XOMOX	CHENNAI	
		LEADER VALVES LTD.	JALANDHAR	UPTO 150 NB CLASS 300 & UPTO 200 NB CLASS 150
4	SUMP PUMP (VERTICAL CENTRIFUGAL)	DARLING PUMPS PVT. LTD	INDORE	
		FLOWMORE LTD.	GURGAON	
		SU MOTORS PVT. LTD.	MUMBAI	
		VARAT PUMP AND MACHINERY PVT. LTD.	KOLKATA	
		WPIL LIMITED	KOLKATA	
		SAM TURBO INDUSTRY LTD	COIMBATORE	
		KISHORE	PUNE	
		AQUA MACHINERY	AHMEDABAD	
		FLOWMORE PUMP	GHAZIABAD	
		M&P	PUNE	
		B & C ENGG(BECON WEIR)	CHENNAI	
5	SCREW PUMPS	ROTO PUMPS	NOIDA	
		TUSHACO	MUMBAI	
		DELTA PD PUMPS LTD	VAPI, GUJRAT	
		UT PUMPS	FARIDABAD	
		ROVAR PUMPS PVT LTD	SHINOLI, KOLHAPUR	ONLY FOR SINGLE SCREW AND TWIN SCREW PUMPS.
6	API 5L ERW PIPE	TISCO	JAMSHEDPUR	
		SURYA ROSHNI	BAHADURGARH	UP TO 400 NB
		JINDAL	GHAZIABAD	UP TO 350 NB
		MSL	RAIGAD	200 TO 500 NB
		SAIL	ROURKELA	
		RATNAMANI	KUTCH	UP TO 400 NB
7	ASTM A 106, CS SEAMLESS PIPE	ISMT	AHMED NAGAR	UP TO 150 NB
		MSL	RAIGAD	UP TO 350 NB
		JINDAL SAW LTD	NASHIK	
		REMI METAL GUJRAT LTD	BHARUCH	UP TO 150 NB HOT FINISH & UPTO 100NB COLD FINISH



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		ISMT	BARAMATI	UP TO 200 NB
8	CS ERW PIPE (IS 1239 / 3589)	SURYA ROSHNI	BAHADURGARH	UPTO 400 NB ERW PIPES AS PER IS 1239/3589 AND SAW AS PER IS 3589
		JINDAL	GHAZIBAD/HISSAR	UP TO 350 NB
		MSL	RAIGAD	200-500 NB ERW PIPES AS PER IS 3589
		SAIL	ROURKELA	
		WELSPUN	ANJAR/BHARUCH	UPTO 400 NB ERW PIPES AS PER IS 1239/3589 AND SAW AS PER IS 3589
		INDUS TUBE	GAUTAM BUDDH NAGAR	UP TO 300 NB
		RATNAMANI	KUTCH /AHMEDABAD / CHHATRAL	UPTO 400 NB ERW PIPES AS PER IS 3589 AND SAW AS PER IS 3589
		TATA TUBE	JAMSHEDPUR	UPTO 150 NB ERW PIPES AS PER IS 1239
		PSL	CHENNAI/VIZAG/ KUTCH/DAMAN	SPIRAL WELD SAW AS PER IS 3589
		LALIT PROFILE	THANE	SPIRAL WELD SAW AS PER IS 3589
		SAMSHI PIPES INDUSTRIES	VADODARA	SPIRAL WELD SAW AS PER IS 3589
		MUKUT PIPES	RAJPURA	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589
		INDUS TUBES	G B NAGAR	UPTO 300 NB ERW PIPES AS PER IS 1239/3589
		MANN IND	INDORE	SPIRAL WELD SAW AS PER IS 3589
		SURENDRA ENGG	RAJPURA	SPIRAL WELD SAW AS PER IS 3589
		PRATIBHA PIPES & STRUCTURE PVT LTD	THANE	SPIRAL WELD SAW AS PER IS 3589
		JCO GAS PIPE	CHINDWARA	SPIRAL WELD SAW AS PER IS 3589
		NUKAT TANKS AND VESSELS	TARAPUR	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589
		DADU PIPES	SIKRANDRABAD	UPTO 300 NB ERW PIPES AS PER IS 1239/3589
		APL APOLLO TUBES LTD	SIKRANDRABAD	IS3589 UPTO 250 NB
9	SUCTION HEATER	PARKAIRE	DELHI	
		MVS	DELHI	
		MELCON	DELHI	
		GASO ENERGY	PUNE	
		INDCON	DELHI	
		TEMASME	NOIDA	
10	PRESSURE REDUCING VALVE & DESUPERHEATER	CIRCOR (EARLIER MAZDA)	AHMEDABAD	
		SPIRAX MARSHALL	PUNE	
		LEADER VALVES LTD.	JALANDHAR	
		SPX CORPORATION, USA	M/S SPX FLOW TECHNOLOGY INDIA PVT. LTD, GUJARAT	



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		CONTROL COMPONENT INDIA PVT. LTD.	NOIDA	
		DAUME REGELARMATUREN GMBH,	GERMANY	
		HOLTER REGELARMATUREN GMBH & CO.	GERMANY	
		INSTRUMENTATION LTD.	PALAKKAD	
		SAMSON CONTROLS PVT LTD	PUNE	
11	STRAINERS (DUPLEX / SIMPLEX BASKET TYPE)	GENERAL MECHANICAL WORKS PVT LTD	VADODARA	
		GRAND PRIX	FARIDABAD	
		GUJARAT OTOFILT	VATVA , AHMEDABAD	
		FILTRATION ENGRS	MUMBAI	
		JAYPEE INDUSTRIES PVT. LTD.	NEW DELHI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI	
		OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		BHATIA ENGINEERING CO.	NEW DELHI	SIMPLEX ONLY
		FILTRATION ENGINEERS (I) PVT. LTD.	MUMBAI	SIMPLEX ONLY
		SUNGOV ENGINEERING PVT. LTD.	CHENNAI	
		SAROJINI ENTERPRISE	HOWRA	SIMPLEX ONLY
12	STEAM TRAP	SPIRAX MARSHALL	PUNE	MAIN CONTRACTOR COC +MANUFACTURER STANDARD TC SHALL BE SUBMITTED FOR ISSUING DESPATCH CLEARANCE
		UNIKLINGER	PUNE	
		LEADER	JULLANDHAR	
		CRECENT VALVE MFG CO LTD	MUMBAI	
		PENNANT ENGINEERING	PUNE	
13	THERMAL INSULATION	GOENKA ROCKWOOL (INDIA) PVT.LTD.	RAIPUR	
		LLOYD INSULATIONS (INDIA) LTD.	NEW DELHI	
		MINWOOL ROCK FIBRES LTD.	RAJNANDGAON	
		POLYBOND INSULATION PRIVATE LIMITED,	BHILAI	
		ROCKWOOL (INDIA) PVT. LTD.	HYDERABAD	
		SHREERAM EQUITECH PRIVATE LIMITED	DURG	
		THERMOCARE ROCKWOOL INDIA PRIVATE LTD.	CHATTISGARH	
		LOPINUS ROCKWOOL	GWALIOR	
14	STRUCTURAL STEEL / MS-PLATE	SAIL		
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		
		M/S UTTAM VALUE STEEL (LLOYDS)		



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		ISPAT		
		JSW		
		INDIAN IRON & STEEL CO. LTD		
15	SAFETY RELIEF VALVE	SPIRAX MARSHALL	PUNE	
		FISCHER SANMAR	CHENNAI	
		BHEL	TRICHY	
		KEYSTONE	BARODA	
		LEADER	JULLANDHAR	
16	PAINT	ASIAN PAINT		
		BERGER		
		KANSAI NEROLAC		
		JOTUN		
		SHALIMAR		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		AKZONOBEL COATINGS		
17	FITTINGS (MS/SS)	PIPE FIT ENGINEERS	VADODARA	
		GUJRAT INFRA PIPES	VADODARA	
		MS FITTINGS	KOLKATA	
		TUBE PRODUCT	VADODARA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
		NL HAZRA	KOLKATA	
		EXCEL METAL		
		INTERTECH		
		FITTECH		
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
18	OIL HOSE	D WREN & CO	KOLKATA	
		SUDEEP INDUSTRIES	KOLKATA	
		HYDROKRIMP	MUMBAI	
		PRESIDENCY RUBBER	KOLKATA	
19	STEAM AND CONDENSATE HOSE	ALLZFLEX ENGINEERS	VADODARA	
		SUDEEP INDUSTRIES	KOLKATA	
20	ALUMINUM CLADDING	BHARAT ALUMINIUM COMPANY LTD	DELHI	
		CHONGQING LANREN ALUMINIUM CO. LTD., CHINA	CHINA	
		HINDALCO INDUSTRIES LTD	MUMBAI	
		NATIONAL ALUMINIUM COMPANY LTD.	ODISHA	



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21	METALLIC EXPANSION BELLOWS	AEROSUN TOLA EXPANSION JOINT CO. LTD.,	CHINA	
		B. D. ENGINEERS	AHMEDABAD	
		FLEXICAN BELLOWS AND HOSES PVT. LTD.	BARODA	
		FLEXATHERM EXPANLLOW PVT. LTD.	VADODARA	
		LONESTAR INDUSTRIES	CHENNAI	
		MB METALLIC BELLOWS PVT. LTD.	CHENNAI	
		METALLIC BELOWS INDIA PVT. LTD.	CHENNAI	
		QINHUANGDAO NORTH METAL HOSE CO. LTD.,	CHINA	
		TEDDINGTON ENGINEERED SOLUTIONS LTD.	UK	
ELECTRICAL AND C&I				
1	LT MOTORS	CROMPTON GREAVES LIMITED	AHMEDNAGAR	
		KIRLOSKAR ELECTRIC COMPANY	BANGALORE / HUBLI	
		SIEMENS	MUMBAI	
		ABB	BANGALORE / FARADABAD	
		BHARAT BIJLEE	MUMBAI	
		JYOTI	VADODARA	
		MARATHON	KOLKATA	
		NGEF	BANDALORE / HUBLI	
		BHARAT ELECTRIC (BHEL)		
		LHP	SOLAPUR	
2	LEVEL TRANSMITTER (RADAR AND ULTRASONIC TYPE)	K TEK (ABB)	FARIDABAD	
		E & H	AURANGABAD	
		MEGNETROL	BELGIUM	ONLY RADAR TYPE
		EMERSON PROCESS MGT	PAWANE	
		MOORE INDUSTRIES INTERNATIONAL INC.	USA	
		SIEMENS LIMITED	MUMBAI	
		SMART INSTRUMENTS LTD, BRAZIL	MUMBAI	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.
		HONEYWELL AUTOMATION INDIA LIMITED	DELHI	
		TOSHNIWAL INDUSTRIES PVT. LTD.,	AJMER	
		V. AUTOMAT & INTRUMENTS (P) LTD.	DELHI	
		YOKOGAWA INDIA LIMITED,	BANGALORE	
		SIEMENS MILTRONICS	CANADA	ONLY RADAR TYPE
		NIVELCO	HUNGARY	ONLY RADAR TYPE
		HAWK	AUSTRALIA	ONLY RADAR TYPE
3	PRESSURE / DP /	SOR	USA	



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	TEMP.SWITCH	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
4	LEVEL INDIA TOR FLOAT AND BOARD TYPE	FLOW STAR	FARIDABAD	
		SCIENTIFIC DEVICES	MUMBAI	
		GAUGES BOURDEN	PANVEL	
		PUNE TECHTROL	PUNE	
		SBEM	PUNE	
		LEVCON	KOLKATA	
		SIGMA	MUMBAI	
		CHEMTROL		
		DK INSTRUMENT	KOLKATA	
5	PRESSURER / DP GAUGE / TEMPERATURE GAUGE (DIAL TYPE)	V AUTOMAT	DELHI	
		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	
		BOSE PANDA INSTRUMENTS PVT.LTD.	KOLKARA	ONLY PRESSURE AND DP GAUGE
		BUDENBERG GUAGE CO.LTD.	UK	ONLY TEMPERATURE GAUGE
6	CONTROL VALVE	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	GOA	
		SPX CORPORATION, USA	M/S SPX FLOW TECHNOLOGY INDIA PVT. LTD. (AHMEDABAD)	
		CONTROL COMPONENT INC.	USA	
		DRESSER VALVE INDIA PVT. LTD	COIMBATORE	
		DAUME REGELARMATUREN GMBH,	GERMANY	
		EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	CHENNAI	



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		FORBES MARSHALL ARCA PVT.LTD.	PUNE	
		WEIR VALVES & CONTROLS UK LTD.	UK	
		HOLTER REGELARMATUREN GMBH & CO.KG	GERMANY	
		INSTRUMENTATION LTD.	PALAKKAD	
		KOSO INDIA PRIVATE LIMITED,	NASHIK	
		LESLIE CONTROLS, INC	USA	
		MIL CONTROLS LTD.	THRISSUR	
		METSO SINGAPORE PTE. LTD.,	SINGAPORE	
		PARCOL S.P.A	ITALY	
		R.K.CONTROL INSTRUMENTS PVT. LTD.	THANE	
		RINGO VALVULAS S.L,	SPAIN	
		SEVERN GLOCON INDIA PVT. LTD.	CHENNAI	
		SHENJIANG VALVE CO. LTD.	CHINA	
		SAMSON CONTROLS PVT LTD	PUNE	
		VALVITALIA S.P.A. ,	ITALY	
		WALDEMAR PRUSS ARMATURENFABRIK GMBH	GERMANY	
7	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	
8	ELECTRICAL ACTUATORS	ROTORK	BANGALORE	
		ROTORK	CHENNAI	
		AUMA	BANGALORE	
		LIMITORK	FARIDABAD	
9	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	
10	TEMPERATURE	EMERSON PROCESS MGT	PAWANE	



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	TRANSMITTER	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	
11	PRESSURE TRANSMITTER	ABB INDIA LIMITED		
		V. AUTOMAT & INSTRUMENTS (P) LTD.	NEW DELHI	
		TOSHNIWAL INDUSTRIES PVT. LTD.,	AJMER, RAJASTHAN	
		PANAM ENGINEERS	NAVI MUMBAI	
		ENDRESS + HAUSER (INDIA) PVT. LTD.,	AURANGABAD MAHARASTRA	
		YOKOGAWA INDIA LIMITED,	BANGLORE	
		SBEM PVT. LTD.	PUNE	FOR CAPACITANCE TYPE ONLY
		NIVO CONTROLS PVT. LTD.	INDORE, M.P	FOR CAPACITANCE TYPE ONLY
		EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	NAVI MUMBAI	
		MOORE INDUSTRIES INTERNATIONAL INC.	CALIFORNIA, USA	
		SIEMENS LIMITED	MUMBAI	
		SMART INSTRUMENTS LTD	BRAZIL	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.
12	FLOWMETER (CORIOLIS TYPE)	EMERSON PROCESS MANAGEMENT	CHENNAI	
		E&H	CHENNAI	
		RHEONIK MASSTECHNIK Gmbh	GERMANY	With Indian Agent as ROCKWIN FLOWMETER INDIA PVT. LTD, Ghaziabad
		KROHNE MARSHALL	PUNE	
13	FLOWMETER (TURBINE TYPE)	ROCKWIN FLOWMETER INDIA PVT. LTD.	GHAZIABAD	
14	AIR FILTER REGULATOR	PLACKA INSTRUMENT	CHENNAI	
		SHAVO NORGEN	MUMBAI	
		FISHER SANMAR	CHENNAI	
15	SOLENOID VALVE	AVCON	MUMBAI	
		ROTEX	BARODA/VV NAGAR	



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		SMC	NOIDA	
		NUCON	HYDERABAD	
		ASCO	CHENNAI	
16	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	
17	JUNCTION BOX	PYROTECH	UDAIPUR	
		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	
18	CABLE LUGS (NON FLAME PROOF)	3D	UMERGAON	
		DOWELL	MUMBAI	
		CHITRA	NASIK	
19	CABLE GLANDS (NON FLAME PROOF)	ARUP	KOLKATA	
		SUNIL	KOLKATA	
		QPIE	KOLKATA	
		COMMET	MUMBAI	
20	CABLE GLAND, LUGS, JB (FLAME PROOF)	AJMERA	MUMBAI	
		BALIGA	CHENNAI	
		FLEXPRO	NAVSARI	
21	BATTERY CHARGER FOR PLC	CHLORIDE POWER	KOLKATA	
		CHABBI	JALGAON	
		AMAR RAJA	TIRUPATI	
		STATCON	NOIDA	



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		HBL POWER SYSTEM	HYDERABAD	
		JEMA ENERGY	SPAIN	
		MASS-TECH CONTROLS PVT.LTD.	MUMBAI	
		DUBAS	BANGALORE	
		CALDYNE	KOLKATA	
22	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	
23	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	
24	PLC BASED PANELS	SIEMENS	NASIK	
		SCHNEIDER	NASIK	
		ROCKWELL	SAHIBABAD	
		GE INTELLIGENT PLATFORM	BANGALORE	
		HONEYWELL AUTOMATION INDIA LIMITED ,	PUNE	
		ABB	BANGALORE	
25	OWS/PC	HP/COMPAQ /DELL/HCL/IBM/LENOVO		
26	PRINTER	HP/CANNON/EPSON/XEROX/IBM/L EXMARK		
27	INSTRUMENT FITTINGS	AURA INCORPORATED	DELHI	
		ASTEC VALVES & FITTINGS PVT. LTD.,	MUMBAI	
		ARYA CRAFTS & ENGINEERING PVT. LTD.	MUMBAI	
		COMFIT & VALVE PVT. LTD.	NANDASAN	



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		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	
		VIKAS INDUSTRIAL PRODUCTS	NOIDA	FINANCIAL LIMIT REVIEWED ON 05.06.2014
28	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	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	
		STEELITE ENGINEERING LTD.	MUMBAI	
29	CABLE TRAY SUPPORT SYSTEM- WELDED(GALV)	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 ROAD SEUNDRABAD	
		PASSIVE INFRA PROJECTS PVT. LTD.	VAISHALI, PITAMPURA DELHI-	
	CABLE TRAY	RUKMANI ELECTRICAL & COMPONENTS PVT LTD	KOLKATA-WEST BENGAL-INDIA	GALVANISATION TO BE DONE AT ITS OWN PLANT OR FROM BHEL-PEM APPROVED GALVANIZERS.



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	SUPPORT SYSTEM- WELDED(GALV)	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.
30	CABLE TRAY SUPPORT SYSTEM- WELDED(UNGALV)	RASHTRIYA ISPAT NIGAM LIMITED	AMBAWADI AHMEDABAD-	
		STEEL AUTHORITY OF INDIA LTD.	ISPAT BHAWAN LODI ROAD NEW DELHI-	
31	CABLE TERM.& JOINT KITS	3M ELECTRO AND COMMUNICATION INDIA P.LTD	RAJENDRA PLACE, DELHI	
		HARI CONSOLIDATED PVT.LTD.,NEW DELHI	JHANDEWALAN, NEW DELHI-DELHI	HEAT SHRINKABLE TYPE ONLY.
		RAYCHEM RPG PRIVATE LIMITED	JANAKPURI NEW DELHI	
		YAMUNA CABLE ACCESSORIES PVT. LTD.	AMBALA ROAD, JAGADHRI YAMUNANAGAR-HARYANA	
32	LIMIT SWITCH	BCH	NEW DELHI	
		SIEMENS	NEW DELHI	
		JAIBALAJI	NEWDELHI	
33	ANNUNCIATOR	IIC	MUMBAI	
		MINILEC	AHEMDABAD	
		PROCON	CHENNAI	
34	INTERPOSING RELAY	ECONIX	MUMBAI	
		PHEONIX	DELHI	
35	SELECTOR SWITCH	SCHENIDER	INDIA	
		SIEMENS	INDIA	
		L&T	INDIA	
		KAYCEE	INDIA	
36	INDICATION LAMPS, PUSHBUTTON, AUX.	SCHENIDER	INDIA	
		SIEMENS	INDIA	



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	CONTACTOR, AUX. RELAYS	ABB	INDIA	
		L&T	INDIA	
37	TIMER	BCH	INDIA	
		EAPL	INDIA	
38	PNEUMATIC ACTUATOR/CYLINDER(METALLIC)	SCHRADDER	MUMBAI	
		NUCON	HYDERABAD	
		ROTEX	MUMBAI	
		VAAS	CHENNAI	

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 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.

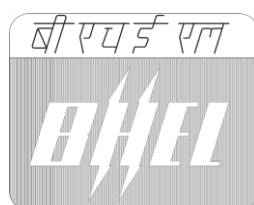
Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges; counter flanges etc. from approved sub vendor only.

1X660 MW BHUSAWAL TPP UNIT 6

**TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM**

ANNEXURE - C

**(ENGINEERING SERVICES AND DRWG/DOC DISTRIBUTION
SCHEDULE)**



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

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
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1.0 <u>GENERAL</u> 1.1 As part of the overall project management activity, the Contractor shall be responsible for proper engineering and co-ordination of activities during various phases of execution of the contract. The Contractor shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Engineer or the Review Consultant shall interact on matters related to engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Contractor and shall be responsible for all engineering co-ordination. The Owner/Consultant/ Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Contractor or on matters involving the Contractor, his manufacturing units and sub-vendors. For the purpose of expediting, the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the contractors. However, such interaction will not, under any circumstance, dilute the responsibility of the Contractor to provide a fully engineered and co-ordinated package under this contract. 1.2 On finalization of the contract, a procedure for exchange of engineering information will be mutually agreed and finalized between the Owner and the Contractor. 2.0 <u>DESIGN COORDINATION MEETING</u> The Contractor and his sub-vendors will be called upon to attend design co-ordination meetings with the Engineer, other Contractors and the Consultants of the Owner during the period of execution of contract. The Contractor including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Mumbai or at Bhusawal site or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions. 3.0 <u>GUIDELINES FOR ENGINEERING SERVICES</u> 3.1 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz criteria for selection and sizing of all equipment and systems, design margins etc including that for structural steel		

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and civil work shall be outlined and these shall form the basis for the detailed engineering work. 3.2 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor. 3.3 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/drawing/other documents which are applicable to any unit of 660 MW individually or severally, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date (s) or feedback (s) received during execution/operation of similar units. Such changes/modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor. 3.4 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner. 3.5 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires, the Bidder shall submit such data and information to the Owner. 3.6 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as		

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specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work: 4.6.1 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations/ floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's/ Consultant's approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work. 4.6.2 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items and also finalisation of corresponding sub-contractors. 4.6.3 Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner /Consultant for approval. 4.6.4 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis, as necessary. 4.6.5 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant. 4.6.6 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting. 4.6.7 Sizing of all piping and equipment as per the stipulated design criteria, carrying out the flexibility analysis/dynamic analysis as necessary, hangers & support engineering.		

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4.6.8	Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.0 for the specific requirement in this regard.	
4.6.9	Certification and submission of final as-built drawings for all areas.	
4.6.10	Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.	
4.6.11	All erection and assembly drawings which may be required at site.	
4.6.12	For all bought out item packages, the Contractor shall provide complete material/ component list along with detail specification, drawings, component part number etc during detail engineering stage prior to final approval. Such approved drawing / document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/drawing shall be provided in soft form (CD).	
4.6.13	Preparation of necessary documentation, design calculations etc required for submission to statutory authorities like IBR, Chief Electric Inspector etc.	
4.0	<u>OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS</u>	
4.1	The Contractor shall provide all necessary maintenance manuals and operating instructions at least six (6) months before the time of commissioning and before taking over of the plant and equipment. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies.	
4.2	The information provided, which shall be contained in loose leaf stiff backed covers, shall include :	
4.2.1	A complete inventory of all main items of plant, with identification details.	
4.2.2	Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps etc.	

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4.2.3	A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.	
4.2.4	A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.	
4.2.5	A lubrication schedule with all necessary drawings, diagrams to identify the lubrication points.	
4.2.6	Manufacturer's literature.	
4.3	The instruction manual shall be subject to the approval of Owner.	
4.4	The contractor shall submit the complete equipment list. The list shall be updated every three (3) months.	
5.0	<u>PLANT HANDBOOK</u> The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems, covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the Letter of Award. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted in the form of two (2) soft copy in CD/DVD (one to Owner and one to Consultant) and twenty five (25) hard copies in decent bound forms.	
6.0	<u>CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE</u>	
6.1	Within fifteen (15) days of issue of Letter of Award (LOA) by the Owner, the Contractor shall furnish a schedule of drawings and design document to be submitted by him to the Owner/Engineer indicating dates against each document. The documents shall be divided into two categories:	

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(a) for approval and (b) for information/further engineering and co-ordination by the Owner. This document submission schedule shall require approval by the Owner/Engineer. 6.2 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation. All dimensions shall be in metric units. All notes, markings etc. shall be in English. 6.3 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval/information of the Owner/Engineer. 6.4 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Consultant: 6.4.1 List of sub-vendors (from Owner only) 6.4.2 System scheme and instrumentation diagrams 6.4.3 Design basis justifying selection of equipment & process parameters where not specified in the Contract 6.4.4 Equipment data sheets and general arrangement drawings 6.4.5 Predicted performance curves of equipment** 6.4.6 Materials of construction 6.4.7 Layout drawings		

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6.4.8	Operation logic diagrams	
6.4.9	Typical control circuit	
6.4.10	Drawings of Instrumentation and Control	
6.4.11	Any deviation from contract (by Owner)	
	** For all critical equipments (boiler and turbine auxiliaries etc), submission of this data shall be mandatory for approval of equipment data sheets / GA drawings.	
6.5	Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents/ drawings as and when desired by the Owner/Engineer.	
6.5.1	Equipment foundation drawings	
6.5.2	Equipment cross-section drawings, product literature etc which are of proprietary nature	
6.5.3	Various bills of quantity, schedules etc	
6.5.4	Piping fabrication drawings, isometrics etc	
6.5.5	Panel wiring diagrams	
6.5.6	Instruction/Operation manuals	
6.5.7	Service manuals and troubleshooting guide for C & I system including field instruments	
6.5.8	Cable schedule and interconnection chart	
6.5.9	Drive/feeder wise control scheme showing all external interfaces.	

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In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category. 6.6 Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document: 6.6.1 Approved 6.6.2 Approved except as noted, forward final drawing 6.6.3 Approved except as noted, resubmission required 6.6.4 Disapproved 6.6.5 For information/reference only For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner / Engineer. For action stamp in category (b), further review by Owner / Engineer would not be necessary provided the Contractor agrees & incorporates the minor comments made on the document. Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer. The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements. The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.		

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6.7	Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.	
6.8	For review by the Consulting Engineer, the Contractor shall furnish three (3) prints of each drawing. Two (2) prints of such submission shall also be sent to the Owner. After review, one (1) stamped print will be returned to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CD's of all as built/final drawings for Owner / Consultant site.	
6.9	In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.	
6.10	For details of documentation for Civil, Structural and Architectural works, Volume VI may be referred.	
7.0	<u>TENDER STAGE DOCUMENT SUBMISSION</u>	
8.1	The Bidder shall submit along with his bid all documents/drawings as requested in respective specifications. The documents shall include but not be limited to the following:	
8.1.1	All Bid proposal sheets duly filled up. (The data mentioned in Bid proposal sheets is minimum required only. The Bidder shall submit the additional data asked for at any later stage).	
8.1.2	Detailed experience list and financial resources of the prime bidder, his collaborators/ associates in this bid as well as the sub-vendors proposed.	
8.1.3	Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.	

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8.1.4 List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces. 8.1.5 Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/ literature etc as required for clear understanding of the bid submitted. 8.1.6 L-1 network indicating target dates for intermediate milestones and final commissioning of equipment supplied. This network shall be supplemented by a detailed write-up on proposal procedure of project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc. 8.1.7 List of suppliers for all bought out items.		

CONSULTANT : PROCON ENGINEERS

1X660 MW BHUSAWAL TPP UNIT 6

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

1x660 MW BHUSAWAL TPP UNIT 6
TECHNICAL SPECIFICATION FOR FUEL OIL HANDLING SYSTEM
TECHNICAL SPECIFICATION NO: PE-TS-415-166-A001, SECTION IA, ANNEXURE D
DRAWINGS DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

S.No.	Drawing No	Drg Title	Scheduled Submission, Days from LOI
1	PE-V0-415-166-A044	O&M MANUAL OF FOHS	140
2	PE-V0-415-166-A014	DATASHEET OF FOHS INSTRUMENTS	70
3	PE-V0-415-166-A007	DESIGN CALCULATION AND GAD OF SUCTION HEATER FOR FOHS	70
4	PE-V0-415-166-A012	PAINTING SCHEDULE OF FOHS	70
5	PE-V0-415-166-A048	DATASHEET & GAD OF SUMP PUMPS & MOTORS IN FOHS	98
6	PE-V0-415-166-A010	DESIGN CALCULATION AND GAD OF OWS FOR FOHS	98
7	PE-V0-415-166-A026	QAP OF SCREW PUMP & MOTORS FOR FOHS	98
8	PE-V0-415-166-A053	CIVIL INPUT DRAWING IN UNLOADING PUMP HOUSE OF FOHS	112
9	PE-V0-415-166-A005	DATASHEET & GAD OF SCREW PUMPS & MOTORS FOR FOHS	84
10	PE-V0-415-166-A003	DESIGN CALCULATION OF TANKS FOR FOHS	42
11	PE-V0-415-166-A052	PIPING LAYOUT IN YARD AREA OF FOHS	91
12	PE-V0-415-166-A002	CONTROL PHILOSOPHY OF FOHS	28
13	PE-V0-415-166-A056	QAP OF VALVES, HOSE AND STRAINER FOR FOHS	84
14	PE-V0-415-166-A017	PIPING LAYOUT IN UNLOADING PUMP HOUSE OF FOHS	70
15	PE-V0-415-166-A013	DS AND GAD OF PRS, TCV, TRAP, INSULATION AND CLADDING FOR FOHS	98
16	PE-V0-415-166-A050	DS AND GAD PIPES, PLATES AND FITTINGS ETC FOR FOHS	56
17	PE-V0-415-166-A066	DS OF OTHER MISCELLANEOUS ITEMS IN FOHS	140
18	PE-V0-415-166-A006	NPSH AND PUMP HEAD CALCULATION OF PUMPS FOR FOHS	42
19	PE-V0-415-166-A049	DS AND GAD OF VALVES, HOSE AND STRAINER	70
20	PE-V0-415-166-A035	SUB-VENDOR LIST WITH INSPECTION CATEGORIZATION LIST FOR FOHS	28
21	PE-V0-415-166-A018	GAD OF FOHS (COMPOSITE LAYOUT)	84
22	PE-V0-415-166-A060	DS & GAD OF UPS / BATTERY CHARGER / BATTERY & SLD INCLUDING SIZING CALCULATION FOR FOHS	112
23	PE-V0-415-166-A004	SIZING CALCULATION OF UTILITIES OF FOHS	28
24	PE-V0-415-166-A030	QAP OF CONTROL PANEL	84
25	PE-V0-415-166-A028	QAP OF SUMP PUMP & MOTORS FOR FOHS	98

1x660 MW BHUSAWAL TPP UNIT 6
TECHNICAL SPECIFICATION FOR FUEL OIL HANDLING SYSTEM
TECHNICAL SPECIFICATION NO: PE-TS-415-166-A001, SECTION IA, ANNEXURE D
DRAWINGS DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

26	PE-V0-415-166-A045	DEMONSTRATION TEST PROCEDURE OF FOHS	112
27	PE-V0-415-166-A015	CONTROL SCHEME, I/O LIST and MIMIC DIAGRAM FOR DDCMIS.	84
28	PE-V0-415-166-A027	QAP OF PRS, TCV, TRAP, INSULATION AND CLADDING FOR FOHS	112
29	PE-V0-415-166-A001	P&ID'S OF FOHS	28
30	PE-V0-415-166-A021	GAD OF FOHS TANKS INCLUDING ROOF STRUCTURE & NOZZLE ORIENTATION	70
31	PE-V0-415-166-A057	QAP OF PIPES, PLATES AND FITTINGS ETC FOR FOHS	56
32	PE-V0-415-166-A067	QAP OF OTHER MISCELLANEOUS ITEMS IN FOHS	140
33	PE-V0-415-166-A036	INSTRUMENT INSTALLATION DIAGRAM OF FOHS	140
34	PE-V0-415-166-A029	QAP OF FOHS INSTRUMENTS	112
35	PE-V0-415-166-A016	PIPING LAYOUT IN TANK FARM AREA OF FOHS	56
36	PE-V0-415-166-A024	DESIGN CALCULATION & GAD OF MISCELLANEOUS TANKS FOR FOHS	70
37	PE-V0-415-166-A065	GAD OF OTHER MISCELLANEOUS ITEMS IN FOHS	140
38	PE-V0-415-166-A068	FABRICATION DRAWING FOR HFO TANK	56
39	PE-V0-415-166-A069	FABRICATION DRAWING FOR LDO TANK	56
40	PE-V0-415-166-A070	FLOOR COIL HEATER GA DRAWING FOR HFO TANK	56

Notes:

- 1 Drawing / Document shall be uploaded by the successful bidder on WRENCH /DMS. Procedure for the same will be informed after award of contract.
- 2 Resubmission of drawing/ documents shall be done within 7 days upon receipt of customer/BHEL comments by Bidder.

1x660 MW BHUSAWAL TPP UNIT 6

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM

ANNEXURE - E
(INPUT DRAWINGS & DOCUMENTS OF TENDER)



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

COMPOUND WALL
EXISTING PLANT BOUNDARY
MSPool PROPERTY FENCING
GREEN BELT
PIPE/CABLE RACK
400KV TRANSMISSION LINE
RAILWAY LINE
PITCHING LINE FOR LEVEL DIFFERENCE
BELT CONNECTOR
PENT HOUSE
PRIMARY CRUISHER HOUSE
SECONDARY CRUISHER HOUSE
JUNCTION TOWER
EMERGENCY RECLAIM HOPPER
WATCH TOWER
400KV LINE TOWER
SUB STATION FOR CONSTRUCTION POWER
HIGH WAST (HM)
WELL

FACILITY	DESCRIPTION OF FACILITIES
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TOMER'S DRAWING No.

1.0	POWER BLOCK AREA	139,624.48
1.1	30 BUILDING	2,133.35
1.2	30 BUILDING EQUIPMENT ROOM/STP	2,133.35
1.3	30 ROOF	826.53
1.4	30 PAVES PAVS	2 No. Esh
1.5	30 CS & BUNDERS	8 bunders
1.6	30 STP	8 bunders
1.7	30 CONTROL ROOM	52,850.06
1.8	30 PAVS	-
1.9	1.0 SPACE FOR FGD (REFER FACILITY No.10)	-
1.10	1.11 REFLECT SOIL	7,565.0
1.11	1.12 AIR COMPRESSOR BUILDING/PAUL REFLECT	14,468
1.12	1.13 AIR COMPRESSOR BUILDING/PAUL REFLECT	410
1.13	1.14 CONDENSATE STORAGE TANK	28,675
1.14	CONDENSATE STORAGE TANK PUMP HOUSE	28,675
1.15	10 BUILDING/PAUL WAREHOUSE BLOCK	22,516
2.0	ELECTRICAL FACILITIES	-
2.1	GENERATOR TRANSFORMER	-
2.2	UNIT TRANSFORMER	-
2.3	UNIT TRANSFORMER	-
2.4	UNIT TRANSFORMER	-
2.5	2.50N ALUMINIUM TRANSFORMER	-
2.6	2.50N ALUMINIUM TRANSFORMER	-
2.7	2.50N ALUMINIUM TRANSFORMER (SCOPE)	40,938.50
3.0	WATER SYSTEM	-
3.1	RAW WATER & FINE WATER STORAGE TANK	11,942
3.2	RAW WATER PUMP HOUSE	30,65
3.3	RAW WATER PUMP HOUSE	30,65
3.4	RAW WATER PUMP HOUSE	30,65
3.5	RAW WATER PUMP HOUSE	30,65
3.6	RAW WATER PUMP HOUSE	30,65
3.7	RAW WATER PUMP HOUSE	30,65
3.8	RAW WATER PUMP HOUSE	30,65
3.9	RAW WATER PUMP HOUSE	30,65
3.10	RAW WATER PUMP HOUSE	30,65
3.11	RAW WATER PUMP HOUSE	30,65
3.12	RAW WATER PUMP HOUSE	30,65
3.13	RAW WATER PUMP HOUSE	30,65
3.14	RAW WATER PUMP HOUSE	30,65
3.15	RAW WATER PUMP HOUSE	30,65
3.16	RAW WATER PUMP HOUSE	30,65
3.17	RAW WATER PUMP HOUSE	30,65
3.18	RAW WATER PUMP HOUSE	30,65
3.19	RAW WATER PUMP HOUSE	30,65
3.20	RAW WATER PUMP HOUSE	30,65
3.21	RAW WATER PUMP HOUSE	30,65
3.22	RAW WATER PUMP HOUSE	30,65
3.23	RAW WATER PUMP HOUSE	30,65
3.24	RAW WATER PUMP HOUSE	30,65
3.25	RAW WATER PUMP HOUSE	30,65
3.26	RAW WATER PUMP HOUSE	30,65
3.27	RAW WATER PUMP HOUSE	30,65
3.28	RAW WATER PUMP HOUSE	30,65
3.29	RAW WATER PUMP HOUSE	30,65
3.30	RAW WATER PUMP HOUSE	30,65
3.31	RAW WATER PUMP HOUSE	30,65
3.32	RAW WATER PUMP HOUSE	30,65
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3.43	RAW WATER PUMP HOUSE	30,65
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3.45	RAW WATER PUMP HOUSE	30,65
3.46	RAW WATER PUMP HOUSE	30,65
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3.84	RAW WATER PUMP HOUSE	30,65
3.85	RAW WATER PUMP HOUSE	30,65
3.86	RAW WATER PUMP HOUSE	30,65
3.87	RAW WATER PUMP HOUSE	30,65
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3.89	RAW WATER PUMP HOUSE	30,65
3.90	RAW WATER PUMP HOUSE	30,65
3.91	RAW WATER PUMP HOUSE	30,65
3.9		
4.0	COAL HANDLING PLANT (SG SCOPE)	-
4.1	WAGON TIEPHER WCC ROOM	-
4.2	CONTROL ROOM FOR WAGON TIEPHER	-
4.3	CRUSHER HOUSE	-
4.4	CRUSHER HOUSE	39,330
4.5	CRUSHER HOUSE	270,851.17(266.3)
4.6	CRUSHER HOUSE	62,426.2
4.7	CRUSHER HOUSE	62,426.2
4.8	CRUSHER HOUSE	62,426.2
4.9	CRUSHER HOUSE	62,426.2
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4.97	CRUSHER HOUSE	62,426.2
4.98	CRUSHER HOUSE	62,426.2
4.99	CRUSHER HOUSE	62,426.2
5.0	ASH HANDLING PLANT (SG SCOPE)	-
5.1	HSD SIO	-
5.2	H.S.D. PUMP HOUSE & CONTROL ROOM	10,340
5.3	TRITTO	-
5.4	TRITTO	-
5.5	TRITTO	-
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5.97	TRITTO	-
5.98	TRITTO	-
5.99	TRITTO	-
6.0	FUEL OIL SYSTEM	-
6.1	FUEL OIL TRANSFER PUMP HOUSE	9,255
6.2	FUEL OIL TRANSFER PUMP HOUSE	9,255
6.3	FUEL OIL TRANSFER PUMP HOUSE	9,255
6.4	FUEL OIL TRANSFER PUMP HOUSE	9,255
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6.66	FUEL OIL TRANSFER PUMP HOUSE	9,255
6.67	FUEL OIL TRANSFER PUMP HOUSE	9,2

NOTES:

1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN METERS.
2. THE GRID AND CO-ORDINATES ARE SHOWN IN METERS.
3. BUILDINGS OUTER LINES SHOWN ARE COLUMNS GRID LINES.
4. ALL ELEVATIONS ARE REFERRED TO POWER HOUSE FINISHED GROUND FLOOR
5. ELEVATION ± 0.00M WHICH CORRESPONDS TO RL(+209.0M)
6. ELEVATION ± 0.00M WHICH CORRESPONDS TO RL(+198.20M)
7. PROPOSED ROX BOX CULVERTS SHALL BE AS PER INDIAN RAILWAY STANDARD.
8. RAILWAY LAYOUT IS INDICATIVE AND THE SAME SHALL BE PROVIDED AS PER RAILWAY'S APPROVAL.
9. EXISTING FIRE STATION OF 2,500SQM SHALL BE USED FOR 1x660MM.
- 10.CO-ORDINATES OF EXISTING FIRE STATION SHALL BE N 352.6, S/E 20.5X4.0(M)
11. LAYOUT/SIZE OF VARIOUS EQUIPMENTS/FACILITIES IS TENTATIVE ONLY AND SHALL BE FINALIZED DURING DETAIL ENGINEERING.

OWNER
MAHARASHTRA
MAHARASHTRA STATE POWER GENERATION CO. LTD.
CONSULTANT
DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
VASHI, NAVI MUMBAI

	INVOICE	MAYF	PVAL	PV
1x660 MW BHUSAWAL TPS UNIT-6				

TITLE		PROJECT ENGINEERING MANAGEMENT		NODIA	
POWER SECTOR	CODE	DRN	JK	-84/	19.02/
		DES	AMT	-84/	19.02/
		QHD	SP	-84/	19.02/
		APRD	JJ	-84/	19.02/

CUSTOMER PACKAGE CODE		-		SCALE 1:250		DRAWING No.	
DISCIPLINE	M	C	E	I	L		
						PE-DG-415-100-M001 SHEET 01 OF 01 REV 03A	
						SIZE	

PROGRESSIVE COPY DATED 05.03.2020

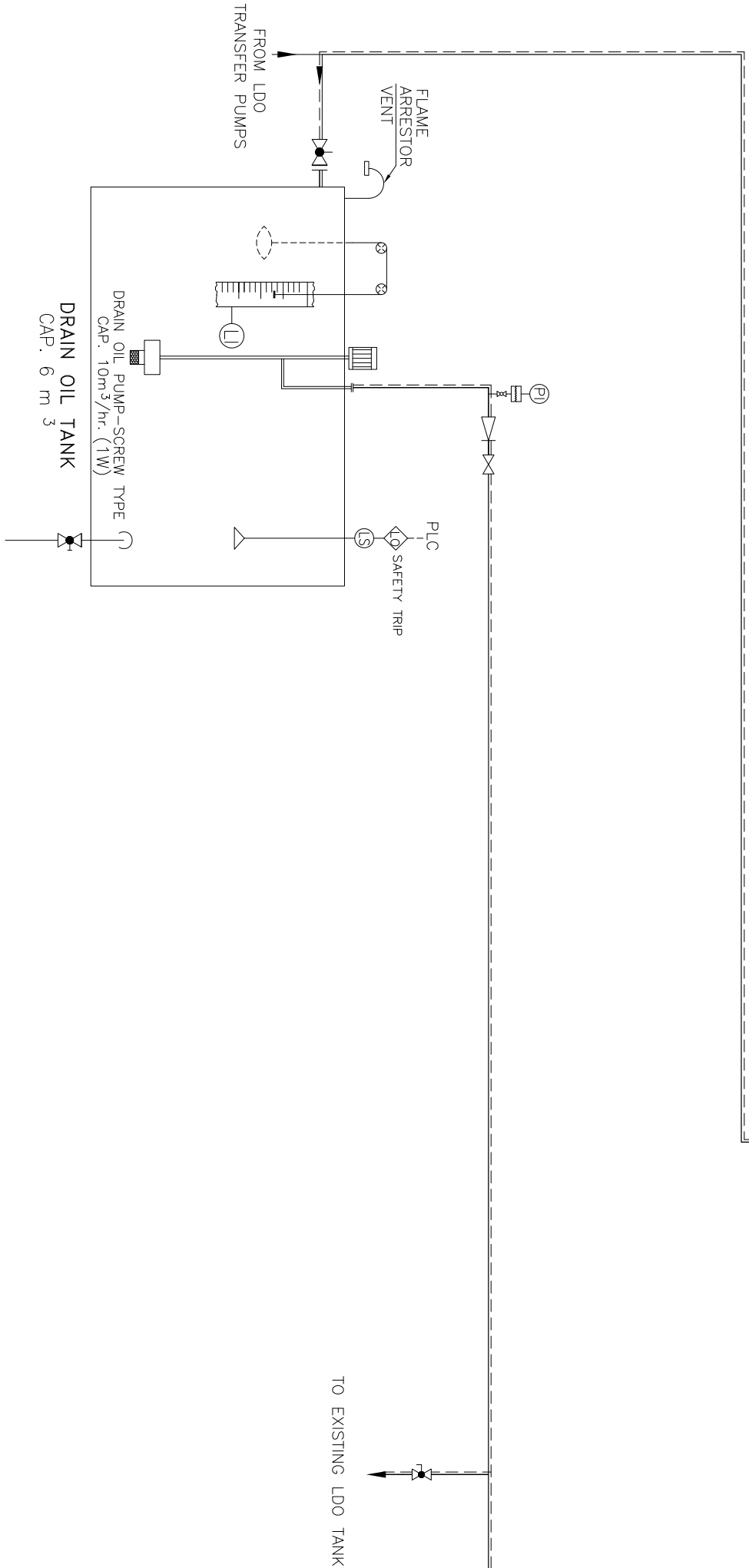
REFERENCE DRAWINGS:

1. CUSTOMER PLOT PLAN (GENERAL LAYOUT)
2. PLOT PLAN BOUNDARY MARKING

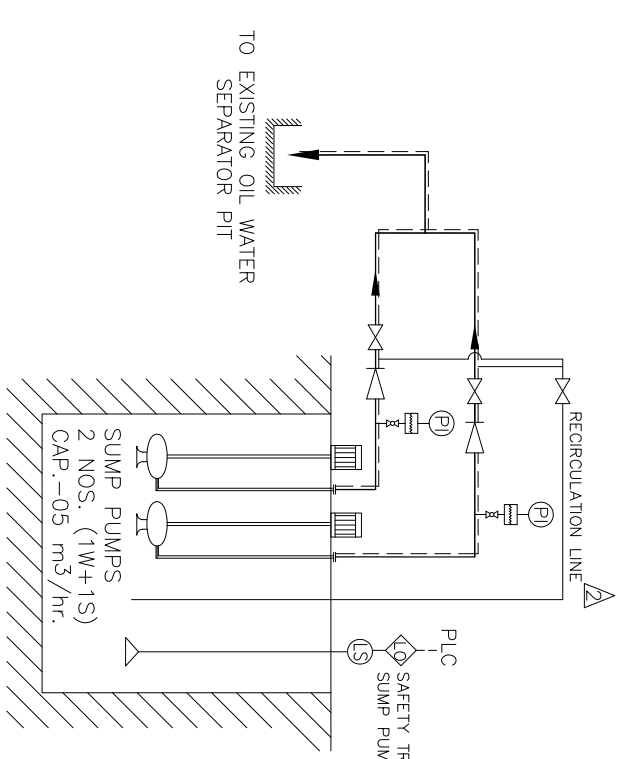
PE-189-GA-101-REV.09
DG/253-NEW-001/REV.0
(189-MAHAGENCO-05/R0)

LEGEND	
SYMBOL	DESCRIPTION
	PRESSURE INDICATOR/PRESSURE GAUGE
	PRESSURE SWITCH
	DIFFERENTIAL PRESSURE SWITCH
	DIFFERENTIAL PRESSURE GAUGE
	LEVEL SWITCH
	LEVEL TRANSMITTER (RADAR TYPE)
	LEVEL INDICATOR
	TEMPERATURE INDICATOR
	TEMPERATURE SWITCH
	STEAM CONTROL VALVE
	STEAM TRAP
	DUPLEX STRAINER
	PLUG / BALL VALVE
	GATE VALVE
	RELIEF VALVE
	NON RETURN VALVE
	GLOBE VALVE
	LOCAL DRAIN
	ELECTRIC TRACED HFO PIPE
	COIL HEATER
	HOSE
	FLAME ARRESTOR VENT
	REDUCER
	DAPHRAGM SEAL
	MOTOR
	GEAR/SCREW PUMP
	TEMPERATURE ELEMENT
	FLOW METER (CORIOLIS TYPE FOR HFO PUMPS)/TURBINE FLOW TYPE FOR LDO PUMPS
	VERTICAL SINGLE SCREW PUMP WITH STRAINER
	VERTICAL CENTRIFUGAL PUMP WITH STRAINER
	LDO LINE
	HFO LINE WITH TRACING AND INSULATION
	INSTRUMENT AIR LINE
	MOTORIZED VALVE WITH LIMIT SWITCH

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It must not be used directly or indirectly in any way detrimental to the interest of the company.

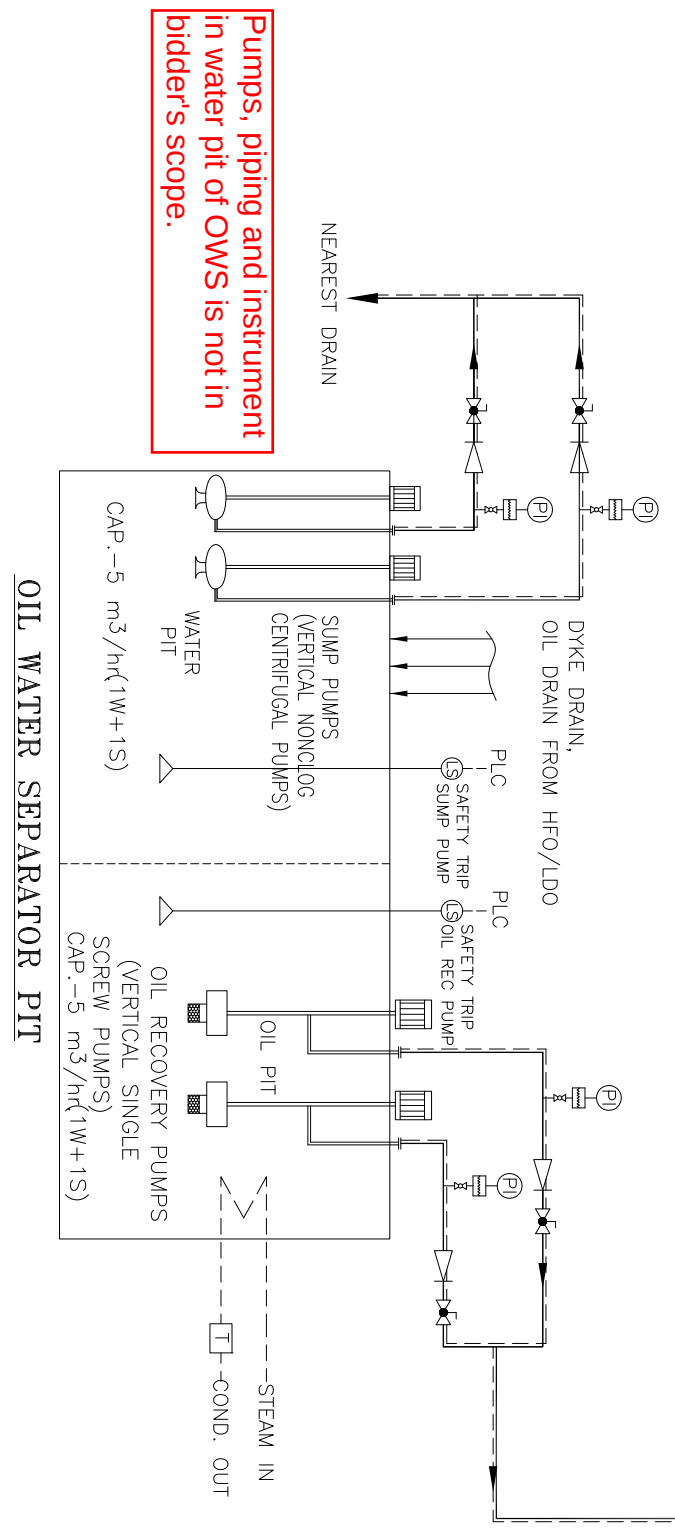
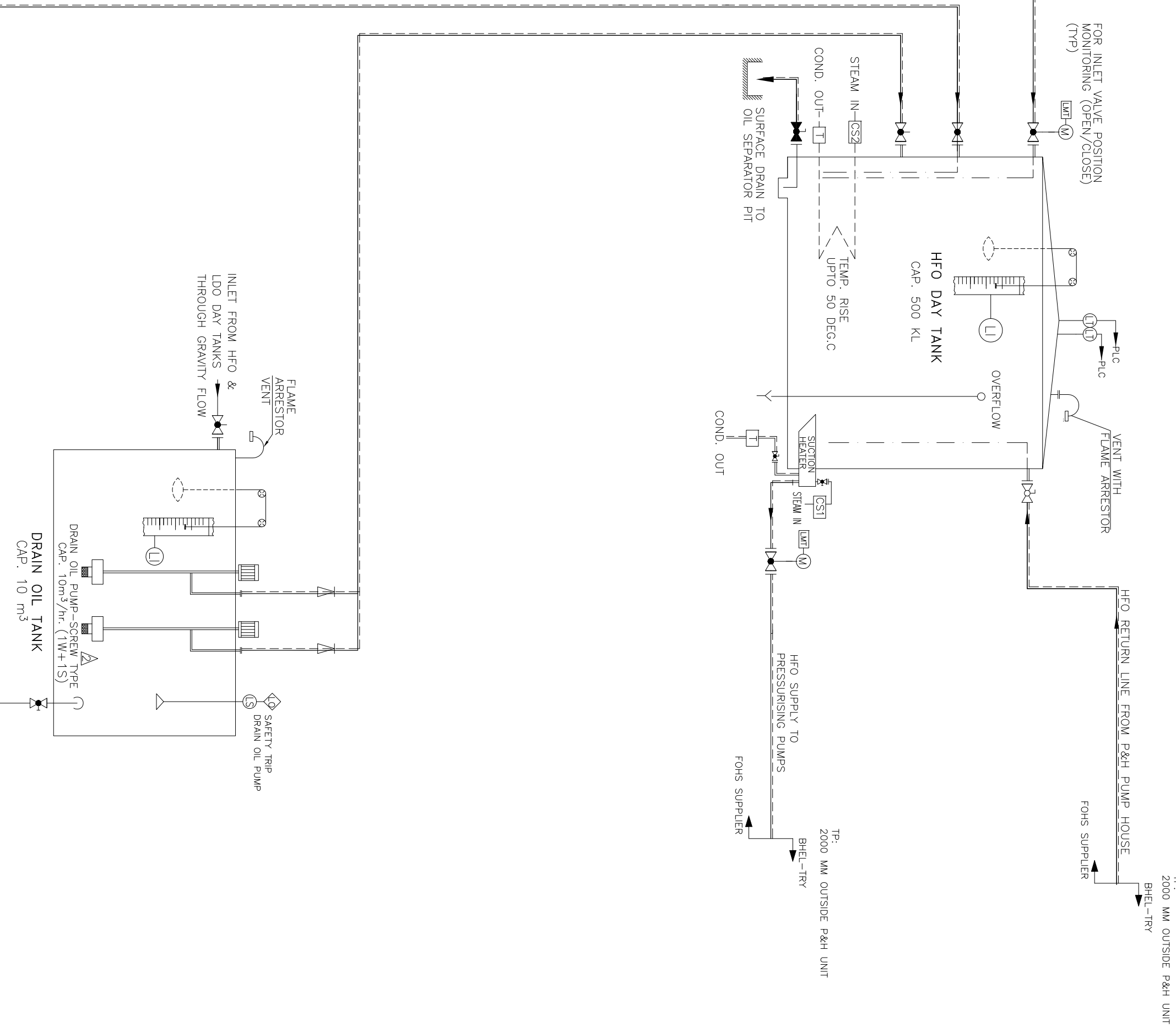


LOC-FUEL OIL TRANSFER PUMP HOUSE)



SUMP IN HFO/LDO TRANSFERING PUMP HOUSE

LOC-FUEL OIL DAY TANK FARM AREA(UNDERGROUND)



Pumps, piping and instrument in water pit of OWS is not in bidders scope.

- NOTES:
1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH TECHNICAL SPECIFICATION.
 2. VENTS AND DRAINS SHALL BE PROVIDED AT THE HIGHEST AND LOWEST POINTS RESPECTIVELY.
 3. THE PIPE SIZING SHALL BE DONE DURING DETAIL ENGINEERING BASED ON PIPE SIZING CRITERIA.
 4. ALL INSTRUMENTS ISOLATION VALVES SHALL BE GLOBE VALVE.
 5. TANK DRAIN VALVES ARE IN NORMALLY CLOSE CONDITION.
 6. HFO TRANSFER PUMPS SHALL BE LOCATED INSIDE TRANSFER P/H
 7. PRIMARY SENSOR REDUNDANCY FOR CONTROL / MEASUREMENT SHALL BE DECIDED BASED ON FOLLOWING CRITERIA:
(A) CRITICAL CONTROL AND RESPECTIVE MEASUREMENTS – TRIPLE REDUNDANT.
(B) NON CRITICAL BUT IMPORTANT CONTROL & MEASUREMENT – DUAL REDUNDANT.
(C) ONLY MEASUREMENT – NO REDUNDANCY.

FOR TENDER ESTIMATION ONLY

OWNERS
MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT
CONSULTANT

JOB No.		415		PROJECT	
STATUS					
DISTRIBUTION					
REV	DATE	APPD	REV	DATE	APPD
1	2020.12.10		1	2020.12.10	

CONTRACTOR

BHARAT HEAVY ELECTRICALS LTD

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

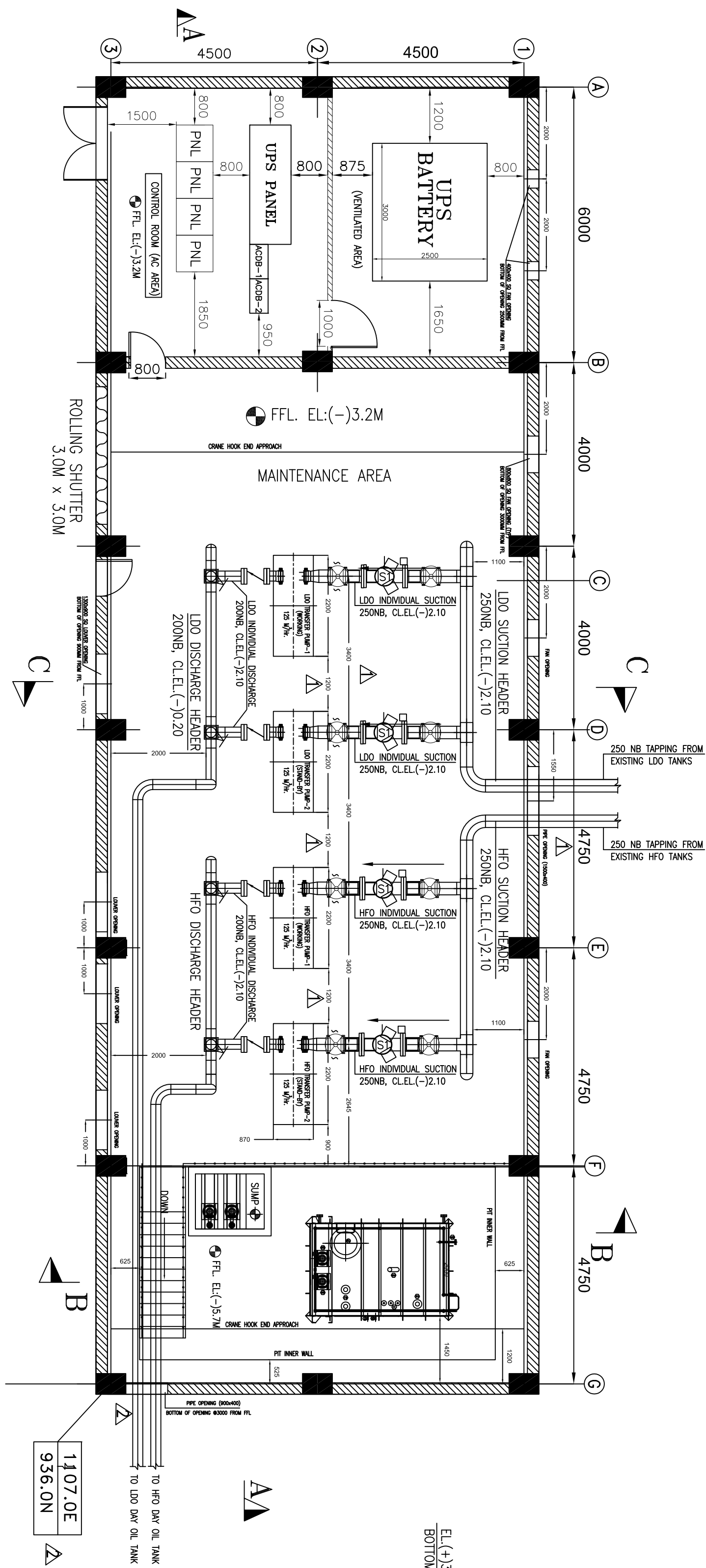
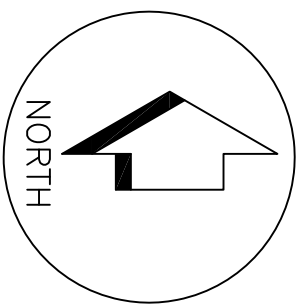
INDIA

ISSY	NAME	SSN	DATE
0001	DEVI RY	763183	2020.12.10
0002	MA	226218	2020.12.10
0003	MA	282018	2020.12.10

CONSULTANT
BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT
INDIA

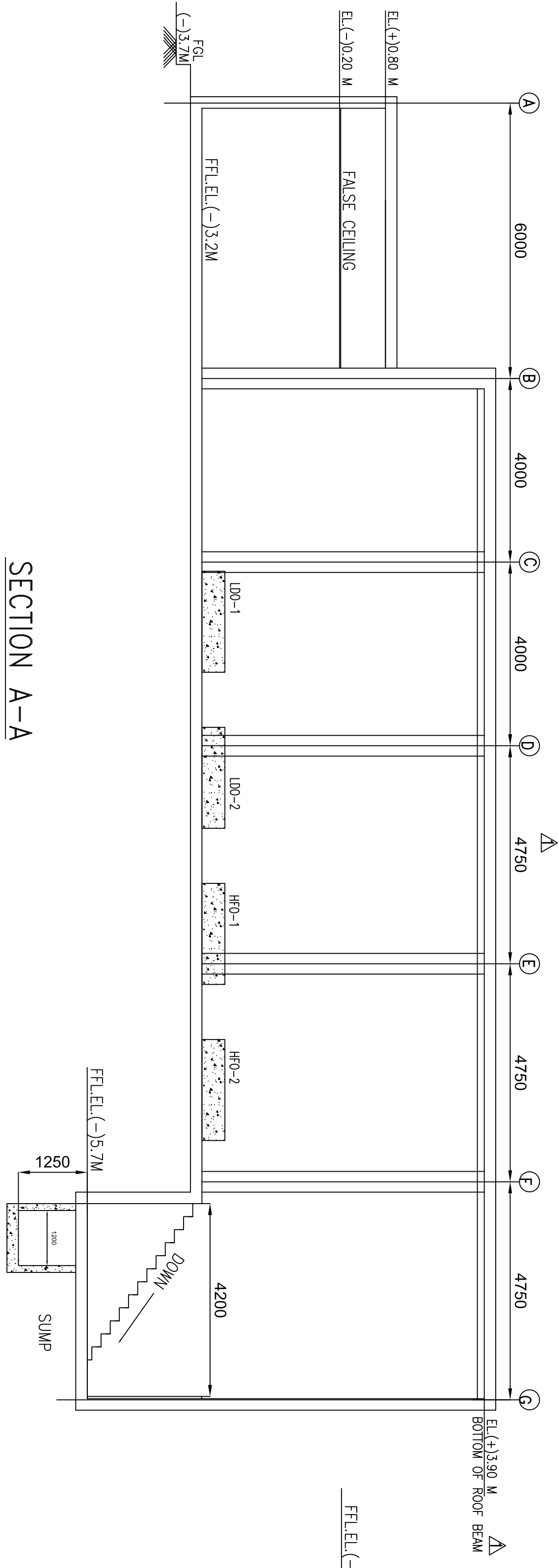
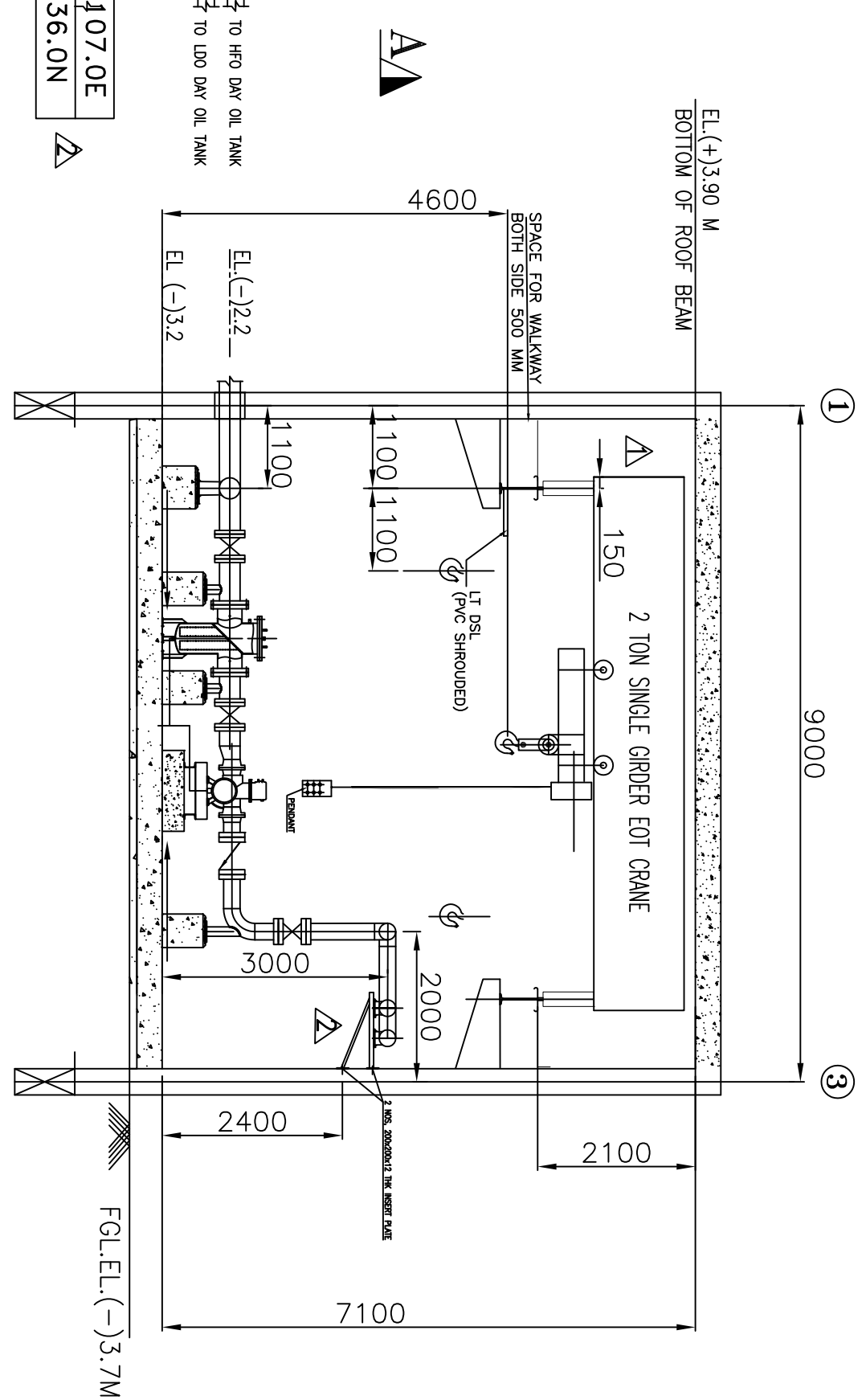
TITLE
FLOW DIAGRAM FOR HFO TRANSFER AND STORAGE SYSTEM
DRAWING No. PE-DO-415-166-1001
SHEET 1 OF 1

COMPUTER FILE NAME:

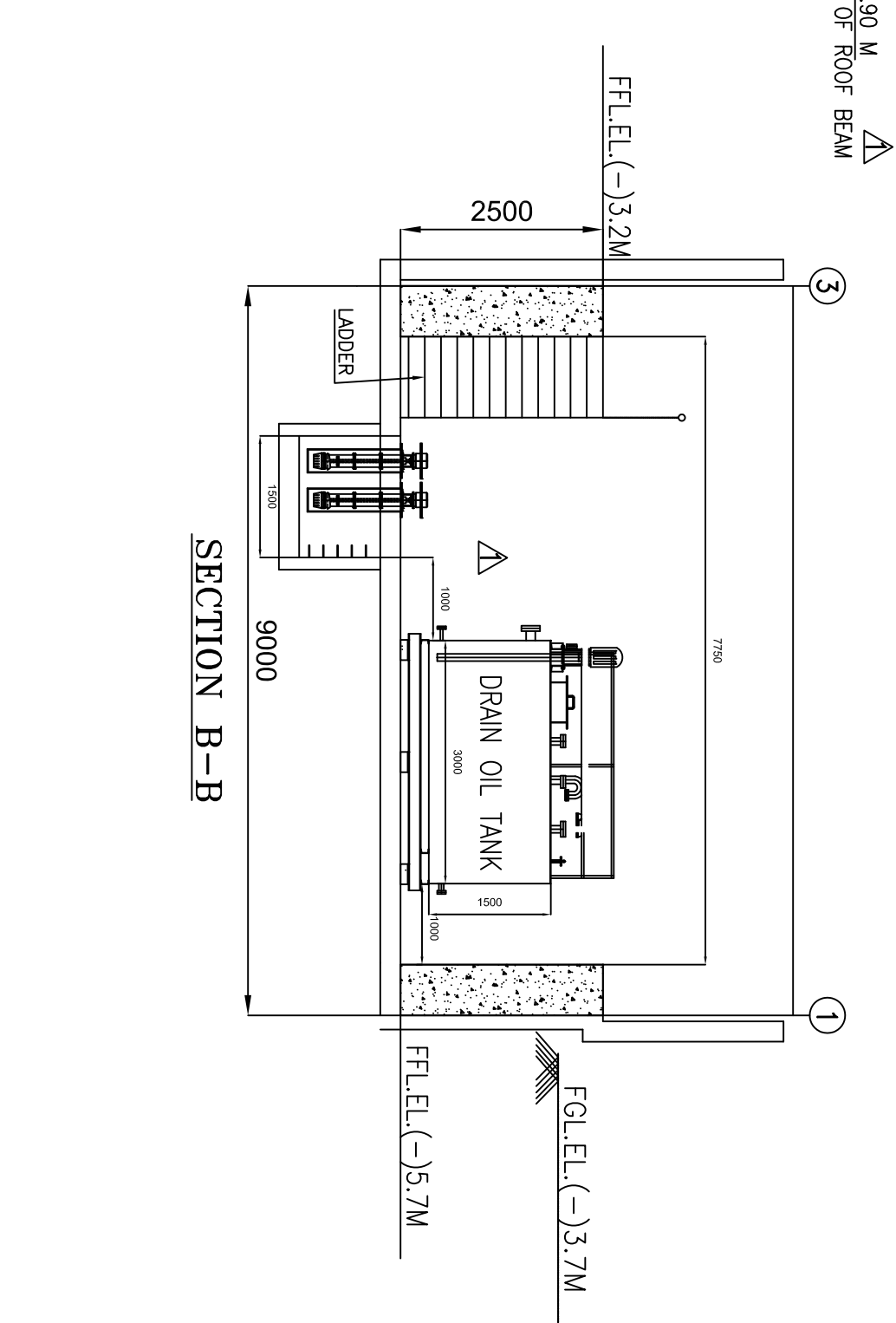


PLAN AT EL (-) 3.2M

VIEW C-C



SECTION A-A



SECTION B-B

NOTES :-

- 1) ALL ELEVATIONS ARE MARKED WRT TG HALL FFL WHICH CORRESPONDS TO RL (+)209.0M.
- 2) ALL DIMENSIONS ARE IN MM.
- 3) DIMENSION FOR EOP. LOCATED IN FO UNLOADING PH HAVE BEEN CONSIDERED MAXIMUM W.R.T. ALL PROSPECTIVE SUPPLIERS AND SHALL NOT CHANGE BUILDING DIMENSION (27.5MX9.0M) AT LATER DATE.
- 4) EQUIPMENT DETAILS, VALVES & INSTRUMENTS SHALL BE INCORPORATED AFTER FINALISATION OF FOHS SUPPLIER.
- 5) EQUIPMENT FOUNDATION DETAILS ARE PUT ON HOLD. HOLD SHALL BE REMOVED AFTER APPROVAL OF VENDOR SPECIFIC PUMP AND TANK GA.
- 6) AIR CONDITIONING IN CONTROL ROOM SHALL BE WITH SPLIT AC. CONTROL ROOM SHALL WITH FALSE CEILING AND UNDER DECK INSULATION.

REFERENCE DRAWINGS:

01. PLOT PLAN	PE-DC-415-100-M001
02. DESIGN MEMORANDUM OF FOHS (TRANSFER & STORAGE)	PE-DC-415-166-A001
03. COD OF FOHPH - 2T SINGLE GIRDER EOT CRANE	PE-DC-415-524-A002

OWNERS
MAHARASHTRA STATE POWER GENERATION CO. LTD.
CONSULTANT
DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
YASHIL NAYI MUMBAI

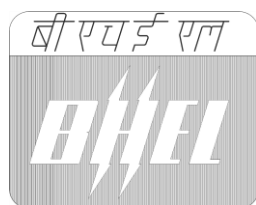
JOB No.	415	PROJECT				
STATUS	CONTRACT					
DISTRIBUTION		CONTRACTOR				
REV	DATE		TO	BY	CHK	APP
01	08.05.18	NT	HK	SBH	08	01
02	08.05.18	NT	HK	SBH	08	01
BHARAT HEAVY ELECTRICALS LTD		997				
POWER SECTOR		0001				
PROJECT ENGINEERING MANAGEMENT		0001				
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13	PROJECT ENGINEERING MANAGEMENT INDIA										- INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA		INDIA	
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1X660 MW BHUSAWAL TPP UNIT 6

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

NAME OF PROJECT:		1x660 MW BHUSAWAL TPS UNIT 6
NAME OF PACKAGE:		FUEL OIL HANDLING SYSTEM
TECHNICAL SPECIFICATION:		PE-TS-415-166-A001, SECTION IA, ANNEXURE F
LIST OF MANDATORY SPARES		
S. No.	DESCRIPTION	QTY
1	Valves (gate, globe, check plug and ball valves)	1 Lot (For each type and size) (a) One (1) where total quantity of particular type and size of valve is less than or equal to 10. (b) Two (2) where total quantity of a particular type and size of valve is less than 40 but more than 10
2	Steam trap	1 Lot (Five (5) % of total number of each type and size of trap (in case of fractional quantity lower whole quantity shall be taken min qty.))
3	Pressure reducing valve	1 No
4	Drain oil pump	
(a)	Complete cartridge assembly	1 Set
(b)	Mechanical seals	2 Sets
(c)	Bearing (pump)	1 Set
(d)	Set of all type of bushes and sleeve	2 Sets
(e)	Set of 'O' rings and seals	2 Sets
(f)	Set of gaskets	2 Sets
(g)	Relief valve complete with accessories	1 Set
5	SUCTION HEATER GASKETS	
(a)	For HFO day tank	1 Lot (Four (4) sets)
6	SUCTION HEATER NUTS AND BOLTS	
(a)	For HFO day tank	1 Lot, 10 % of population used.
7	Pump suction Strainer Basket	1 Lot(Three (3) for each type whichever applicable)
8	Pump suction Strainer Gasket	1 Lot (Six (6) for each type whichever applicable)

NAME OF PROJECT:	1x660 MW BHUSAWAL TPS UNIT 6
NAME OF PACKAGE:	FUEL OIL HANDLING SYSTEM
TECHNICAL SPECIFICATION:	PE-TS-415-166-A001, SECTION IA, ANNEXURE F

LIST OF MANDATORY SPARES

S. No.	DESCRIPTION	QTY
9	Pump O-Ring and Gasket	1 Lot (Twelve (12) for each type whichever applicable)
10	Various types of Gland packing for valves	1 Lot (Ten (10) each type whichever applicable)
11	Pump Screw	1 Lot (Ten (10) each type whichever applicable)
12	PUMP AND MOTOR BEARING	
(a)	For HFO & LDO transferring pump	Two (2) sets for each type
(b)	For Drain Oil Pump	Two (2) sets
13	Plug valves for various sizes used	1 Lot (Two (2) each)
14	Temperature Switch	Two (2)
15	Pressure Gauge	Three (3)
16	Temperature Gauge	Three (3)
17	Relief Valve Spring	Two (2) sets
18	Flame Arrestor	Two (2)
19	Hoses with end fittings	1 lot (Five (5) for each type)
20	Adaptor	1 lot (Five (5) for each type)
21	Suction Heater Heating Element	1 No
22	Mat Coil Heater – Heating Element	2 Sections
23	Thermodynamic traps	5 Nos
24	Inverted Bucket type traps	2 Nos
25	Mechanical seals for all HFO and LDO pumps	2 Two (2) sets for each type.

NAME OF PROJECT:		1x660 MW BHUSAWAL TPS UNIT 6
NAME OF PACKAGE:		FUEL OIL HANDLING SYSTEM
TECHNICAL SPECIFICATION:		PE-TS-415-166-A001, SECTION IA, ANNEXURE F
LIST OF MANDATORY SPARES		
S. No.	DESCRIPTION	QTY
26	415V MOTORS	
(a)	Terminal plates for motors upto 30kw for each rating	1 Lot (1 no. For each type & rating of Motor)
(b)	Terminal plates for motors above 30kw for each rating	1 Lot (1 no. For each type & rating of Motor)
(c)	Heaters	1 Lot (1 set For each type & rating of Motor)
(d)	Greasing arrangements	1 Lot (1 set For each type & rating of Motor)
(e)	Motor of each type and rating	1 Lot (10% of the installed quantity or minimum 1 number whichever is higher)
(f)	Bearings (DE and NDE)	1 Lot (1 set For each type & rating of Motor)
(g)	End shield cover driving and non driving end	1 Lot (1 set For each type & rating of Motor)
(h)	Cooling fan	1 Lot (1 set For each type & rating of Motor)
(i)	Motor terminal block	1 Lot (1 set For each type & rating of Motor)
(j)	Complete set of coupling	1 Lot (1 set For each type & rating of Motor)
27	C&I SPARES	
(a)	Terminal block	1 Lot (10% of total quantity used for each type and rating)
(b)	MCBs	One number of each type & rating.
(c)	Relays - Interposing relay	1 Lot (10% or 2 nos of each type and model whichever is more)
(d)	Fuses	1 Lot (100 % of each type and rating)
(e)	Cooling fans for power supply	1 Lot (10% or 2 nos. of each type and model whichever is more)
28	CONDUCTIVITY TYPE LEVEL MONITORING SYSTEM	
(a)	Electrodes	1 Lot (50% of population)

NAME OF PROJECT:		1x660 MW BHUSAWAL TPS UNIT 6
NAME OF PACKAGE:		FUEL OIL HANDLING SYSTEM
TECHNICAL SPECIFICATION:		PE-TS-415-166-A001, SECTION IA, ANNEXURE F
LIST OF MANDATORY SPARES		
S. No.	DESCRIPTION	QTY
(b)	Electronic cards	1 Lot (20% or 2 nos. of each type and model whichever is more)
(c)	Lamps / LEDs of display units	1 Lot (100 %)
29	MEASURING INSTRUMENTS	
29.1	ELECTRONIC TRANSMITTERS	
(a)	Transmitters of all types, ranges and model no. (for the measurement of	10% or 2 no. of each type and model, whichever is more
(b)	Electronic cards / PCB's for each type and model and model of transmitters	10% or 5 nos. of each type, whichever is more
29.2	TEMPERATURE ELEMENTS	
(a)	RIDs of each type & length	10% or 2 nos. whichever is more
(b)	Thermocouples of each type like K-type, R-type, metal etc and length	10% or 2 nos. whichever is more
(c)	Thermowell for T / C & RIDs	10% or 1 no. of each type, rating, length used in the system whichever is more
(d)	Process actuated switch devices Including all types of pressure, differential pressure,	10% or 1 no. of each type and model whichever is more
29.3	INDICATORS / RECORDERS	
(a)	Digital Indicators of each model, type & range (including relevant digital indicators	10% or 2 nos. min. whichever is more
(b)	Vertical Indicators of each type & model.	5% or 1 no. of each model whichever is more
(c)	Recorders for each type and model	5% or 1 no. whichever is more.
(d)	Consumables for continuous recorders Charts Ink capsules	25 rolls per recorder/ 25 nos per recorder / 20 nos. per recorder / Ink Pads /Pens.
(e)	Consumables for multi point recorders:	(i) 5 nos per recorder. (ii) 5 nos per recorder.
29.4	Level transmitters (displacer type)	
(a)	Electronic cards / PCB's of level transmitters	10% of total quantity used or 1 for each type/rating whichever is more

NAME OF PROJECT:		1x660 MW BHUSAWAL TPS UNIT 6
NAME OF PACKAGE:		FUEL OIL HANDLING SYSTEM
TECHNICAL SPECIFICATION:		PE-TS-415-166-A001, SECTION IA, ANNEXURE F
LIST OF MANDATORY SPARES		
S. No.	DESCRIPTION	QTY
(b)	Level transmitters	10% of total quantity used or 1 for each type/rating whichever is more
(c)	Electronic water level indicator	10% or 2 nos. min. whichever is more
(d)	PD type flow transmitters	10% of total quantity used or 1 for each type/rating whichever is more
29.5	SWITCHES	
(a)	Switches (Pressure, DP, Level, Flow, temperature etc)	10% of each type of total nos. used in the system or minimum 1 no. of each type, model & range whichever is more
29.6	Rotameter	10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more
29.7	Solenoid Valve	10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more
(a)	Assembly	10% of total quantity used or minimum 2 no. of each type whichever is more
(b)	Coil	10% of total quantity used or 5 no. whichever is more
29.8	E/P Converter	10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more
29.9	Special Instruments	
(a)	Nucleonic / non-nucleonic density meter, solid flow meter etc.	1 no. and spare parts as per manufacturer
29.10	Electrical Transducers	10% of total quantity used or minimum 1 no. of each type and range whichever is more
30	PROCESS CONNECTION PIPING (for impulse plpmg /tubing, sampling	
30.1	Valves of all types and models	10% or 2 no. of each type, class, size and model whichever is more.
30.2	2 way, 3way, Sway valve manifolds	10% or 2 no. of each type, class size and model whichever is more.
30.3	Fittings	10 nos. of each type
30.4	Purge meters	10 % of each model or 2 Nos. whichever is more
30.5	Filter regulators	10% of each model or 2 Nos. whichever is more

NAME OF PROJECT:	1x660 MW BHUSAWAL TPS UNIT 6
NAME OF PACKAGE:	FUEL OIL HANDLING SYSTEM
TECHNICAL SPECIFICATION:	PE-TS-415-166-A001, SECTION IA, ANNEXURE F

LIST OF MANDATORY SPARES

S. No.	DESCRIPTION	QTY
30.6	Impulse pipe & tubing of all type	20 mtrs each type & size
30.7	Impulse line root valve	10% of total quantity used or 4 no. whichever is more for each type and
30.8	SS tube	40 mtrs of each type/ size
30.9	Fitting for SS tube	40 nos of each type/ size
31	INSTRUMENTATION CABLE, INTERNAL WIRING AND ELECTRICAL FIELD	
31.1	Pre fabricated cable of each type	10% of installed quantity
31.2	Pre fabricated cable connector	10% or 1 no. of each type and model whichever is more.
31.3	Other cables	10% of each type, pair and size of actual installed quantity
32	ELECTRICAL ACTUATORS	
32.1	Actuators	10% or 1 no. of each type, model and rating, whichever is more.
32.2	Power unit for modulating actuator	10% or 2 nos. of each type, whichever is more.
32.3	DC-DC unit/power pack units	10% or 2 nos. of each type, whichever is more.
32.4	Electronic cards	10% or 5 nos. of each type, whichever is more
32.5	Brake assembly	10% or 2 nos. of each type, whichever is more ..
32.6	Brake coils	10% or 2 nos. of each type whichever is more.
32.7	Position feed back transmitters	10% or 2 nos. of each type whichever is more.
32.8	Control Unit	10% or 2 nos. of each type whichever is more.
32.9	Torque and limit switch assembly of each unit	10% or 2 nos. of each type whichever is more.
32.10	O-ring	1 set of each size

NAME OF PROJECT:		1x660 MW BHUSAWAL TPS UNIT 6
NAME OF PACKAGE:		FUEL OIL HANDLING SYSTEM
TECHNICAL SPECIFICATION:		PE-TS-415-166-A001, SECTION IA, ANNEXURE F
LIST OF MANDATORY SPARES		
S. No.	DESCRIPTION	QTY
32.11	Motor	1 no. of each type & rating
32.12	Auxiliary contact	10% of total quantity used or 2 nos. whichever is more for each type and
32.13	Seal Kit	1 set of each type & size
33.00	Interposing Relay	10% of total nos. used in the system or minimum 4(four) nos. whichever is more.
34.00	RADAR TYPE LEVEL TRANSMITTER	
34.1	Transmitter / Receiver	10% or 1 no. of each type transmitter/ receiver
34.2	Electronic card	10% or 1 no. of each type electronic card
35	NON-CRITICAL CONTROL VALVE	
(a)	Control valve stem packing.	Set for each control valve.
(b)	Moulded rubber diaphragms	Set for each control valve.
(c)	Gasket	Nos for each type / size.
(d)	Lubricants for gaskets	100% quantity for gaskets for each control valve on one year consumption basis.
(e)	Limit switches	Set for each control valve.
(f)	Valve trims (such as plug, stem, seat ring/cage, guide bushing, stem lock pin,	Set for each control valve.
(g)	Complete actuator.	One number of each type or minimum 10% for each type and size whichever is more.
36	CRITICAL CONTROL VALVE (PRDS STEAM PRESSURE REDUCING VALVE)	
(a)	Soft goods kit valve	1 Set
(b)	Mrtal Seat	1
(c)	Seat Ring	1

NAME OF PROJECT:		1x660 MW BHUSAWAL TPS UNIT 6
NAME OF PACKAGE:		FUEL OIL HANDLING SYSTEM
TECHNICAL SPECIFICATION:		PE-TS-415-166-A001, SECTION IA, ANNEXURE F
LIST OF MANDATORY SPARES		
S. No.	DESCRIPTION	QTY
(d)	Spindle	1
(e)	Actuator soft goods kit	1 Set
37	COMMON SPARES AND ACCESSORIES FOR ABOVE VALVE	
(a)	Feed back transmitter unit	10% of total quantity used or 2 nos. whichever is more for each type/ rating
(b)	Electronic positioner	10% of total quantity used or 2 nos. whichever is more for each type/ rating
(c)	Solenoid valve	10% of total quantity used or 2 nos. whichever IS more for each type/ rating
(d)	Air filter regulator	2 nos
(e)	Air lock relay	4 nos of each type
(f)	Complete actuator for each type and model	1 set
(g)	Volume Booster	2 no each type/size
38	CONTROL PANEL AND LOCAL REMOTE CONTROL DESK (AS APPLICABLE)	
(a)	Recorder	1 (one) No. each type and model
(b)	Bar graph indicator	10% of total quantity used in the system or minimum 1 (one) no. whichever is more for each type and model.
(c)	Digital Indicator	10% of total quantity used in the system or minimum 1 (one) no. whichever is more for each type and model.
(d)	Mosaic/Conventional Type Push button Station	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(e)	Mosaic Type Push button Station with LED Indication	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(f)	Mosaic Type LED Indication Station	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(g)	Simaphore Indicator	2(two)Nos. each type
(h)	ANNUNCIATION SYSTEM (For offsite / Auxiliary Plants)	

NAME OF PROJECT:	1x660 MW BHUSAWAL TPS UNIT 6
NAME OF PACKAGE:	FUEL OIL HANDLING SYSTEM
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LIST OF MANDATORY SPARES

S. No.	DESCRIPTION	QTY
(h) -1	Each type of PCB (for non-PLC driven system)	1 (one) No. each
(h) -2	Lamp Box with Facia & Lamps (LED type)	10% with minimum 2 nos.
(h) -3	Hooter	1 (one) No.
39	Gauges of all types	10% of total quantity used or 1 nos. whichever is max. for each type/rating.
40	POWER CYLINDER	
(a)	Actuator Seal Kit	2(two) nos. for each type of Power Cylinder
(b)	Gasket	2(two) nos. for each type of Power Cylinder
(c)	Complete Set of Power Cylinder	1 (one) no. each type for all application
(d)	Position Transmitter complete set	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(e)	Power Cylinder Positioner complete set	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(f)	Complete Set of Solenoid Valve for power cylinder	2Nos. for each type & ratings
(g)	Solenoid Coil for Pneumatic type power cylinder	5Nos. for each type & ratings
(h)	Position Limit Switch for Pneumatic type Power Cylinder	10 Nos. for each type & ratings
(i)	Air lock relay	10 Nos for each type
(j)	Signal Air Booster Unit	2 Nos for each type.

Note:

1) Mandatory spares listed above is 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 bidders scope of supply.

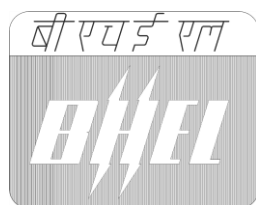
2) Wherever the quantity is mentioned as percentage, it shall mean percentage of total population of that item in package/system unless specified otherwise, and the fraction will be rounded off to the next higher whole number.

3) A "Set" would mean the requirement for the single equipment and would include all components required to

1X660 MW BHUSAWAL TPP UNIT 6

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM

SECTION - IB
ELECTRICAL PORTION SPECIFICATION.



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



**TECHNICAL SPECIFICATION FOR
FUEL OIL SYSTEM
(ELECTRICAL PORTION)**

SPECIFICATION NO.
SECTION-C
REV 00 DATE 28.01.19
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SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

- 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 equipments.
- d) Electrical load requirement for FUEL OIL 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.
- k) Technical requirements shall be as per specifications listed in Clause 4.1, 4.2, 4.3, 4.4 & 4.5 below.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:
 - a) A copy of this sheet "Electrical Equipment Specification for FUEL OIL SYSTEM and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
 - b) Electrical load requirement in the load data format.
- 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.

4.0 LIST OF ENCLOSURES

- 4.1 Electrical scope between BHEL & vendor (Annexure-A).
- 4.2 Technical specification for Motors DG/BSL U-6/2011/T-1
- 4.3 Data Sheet- A along with Annexure-I.
- 4.4 Conduits and pipes specification & constructional details of cables.
- 4.5 Quality Plan
- 4.6 Load data format (Annexure-B).

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:1 X 660 MW BHUSAWAL TPP

ANNEXURE-A

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.
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.
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) &	BHEL	BHEL	Refer note no. 4 for electronic earthing

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:1 X 660 MW BHUSAWAL TPP

ANNEXURE-A

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
	lightning protection			
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 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

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:1 X 660 MW BHUSAWAL TPP****ANNEXURE-A**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
				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.

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1.0 <u>SCOPE</u> 1.1 This section covers the general requirements of the drive motors for power station auxiliary equipment. 1.2 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification. 1.3 In case of any discrepancy, the driven equipment specification shall govern etc. 2.0 <u>STANDARDS</u> 2.1 All motors shall conform to the latest applicable IS, IEC and CBIP Standards/ Publications except when otherwise stated herein or in the driven equipment specification. 2.2 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 (a) IS-325 (b) IS-12615 (c) IEC-34 3.0 <u>SERVICE CONDITIONS</u> 3.1 The motors will be installed in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash canopy to be provided to all outdoor install motors. 3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.		

CONSULTANT : PROCON ENGINEERS

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3.3	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	
4.0	<u>TYPE AND RATING</u>	
4.1	<u>A.C. MOTORS</u>	
4.1.1	Motors shall be general purpose, constant speed, squirrel cage, three phase, induction type.	
4.1.2	All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.	
4.1.3	The motor name-plate rating at 50°C shall have at least 10% margin over the input power requirement of the driven HT equipment at rated duty point unless stated otherwise in driven equipment specification or in general electrical specification.	
4.1.4	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.	
4.1.5	All LT motors used in this project are proposed to be energy efficient type suitable for EFF1 efficiency rating.	
4.1.6	The motor name plate rating shall have at least 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipments at rated duty point.	
4.1.7	Motors located in hazardous area shall be flame proof type.	
4.2	<u>D.C. MOTORS</u>	
4.2.1	D.C. Motor provided for emergency service shall be shunt/compound wound type.	
4.2.2	Motor shall be sized for operation with fixed resistance starter for maximum reliability.	

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4.2.3	Starter panel complete with all accessories shall be included in the scope of supply.	
4.3	For equipment installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in determining the design ambient temperature.	
5.0	<u>PERFORMANCE</u>	
5.1	<u>RUNNING REQUIREMENTS</u>	
5.1.1	Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure.	
5.1.2	The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.	
5.1.3	The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.	
5.1.4	Motor shall not be stalled if the supply voltage drops to 70% of the rated voltage for 2 seconds duration.	
5.2	<u>STARTING REQUIREMENTS</u>	
	Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all auxiliaries except boiler feed pump where the starting current shall be limited to 4.5 times. No further tolerances are applicable on starting current specified above for HT motors	
5.2.1	The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage	
5.2.2	Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminal except BFP motor. In case of BFP motor, it shall	

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be 75% rated voltage. Minimum starting requirement for mill motor (double cage) shall be 85% rated voltage at motor terminals.		
5.2.3	Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition. Cranking motor shall be capable of six equally spread starts per hour, three starts in quick succession from cold condition and one restart from hot condition. The coal conveyor and crusher motors shall be suitable for 3 consecutive hot starts with maximum 20 starts per day. 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.	
5.2.4	HT pump motors shall be suitable to start with forward rotation.	
5.2.5	The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage	
5.3	<u>STRESS DURING BUS TRANSFER.</u>	
5.3.1	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.	
5.3.2	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.	
5.4	<u>LOCKED ROTOR WITHSTAND TIME</u>	
5.4.1	The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.	

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5.4.2	Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.	
5.4.3	Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilizing motor rated capacity	
6.0	<u>SPECIFIC REQUIREMENTS</u>	
6.1	<u>ENCLOSURE</u>	
6.1.1	All indoor motor enclosures shall conform to the degree of protection IP-55 unless otherwise specified and outdoor motor enclosure shall confirm to degree of IPW-55. Motor for outdoor or semi-outdoor service shall be of weather-proof construction.	
6.1.2	For hazardous area approved type of increased safety enclosure shall be furnished.	
6.2	<u>COOLING</u>	
6.2.1	The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air- cooled (CACA).	
6.2.2	In case water cooling is required for very large motors, prior approval of the customer is to be obtained before proceeding ahead with design & manufacture.	
6.3	<u>WINDING AND INSULATION</u>	
6.3.1	All insulated winding shall be of copper.	
6.3.2	All motors shall have class F insulation but limited to class B temperature rise.	
6.3.3	Windings shall be impregnated to make them non-hygroscopic and oil resistant.	

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6.4 <u>TROPICAL PROTECTION</u> 6.4.1 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion. 6.4.2 All fittings and hardwares shall be corrosion resistant. 6.5 <u>BEARINGS</u> 6.5.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. 6.5.2 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. 6.5.3 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area. 6.5.4 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves. 6.5.5 Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication. 6.5.6 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. 6.5.7 Forced lubricated or water cooled bearing shall not be used without prior approval of Owner. 6.5.8 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent. 6.5.9 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.		

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6.6	<u>NOISE & VIBRATION</u>	
6.6.1	The noise level shall be as per statutory acceptance (IS/IEC).	
6.6.2	The peak amplitude of the vibration shall be within IS/IEC specified limits.	
6.7	<u>MOTOR TERMINAL BOX</u>	
6.7.1	Motor terminal box shall be phase segregated (PSTB) type and located in accordance with Indian Standards clearing the motor base- plate/ foundation.	
6.7.2	Terminal box shall be capable of being turned 360 Deg. in steps of 180 Deg. For HT motors and 90 Deg. for LT motors unless otherwise approved.	
6.7.3	The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.	
6.7.4	The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.	
6.7.5	Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.	
6.7.6	The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.	
6.7.7	The terminal box shall be capable of withstanding maximum system fault current for duration of 0.25 sec.	
6.7.8	For 11kV and 3.3kV motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection.	
6.7.9	Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.	
6.7.10	The gland plate for single core cable shall be non-magnetic type.	

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6.7.11 Due to any reason, if the terminal box is found to be not suitable for the approved cable size for either HT/LT motors, then the bidder shall arrange necessary adopter box to facilitate the termination of cables. The adopter box shall be of the same short circuit rating and specifications as the main terminal box. The adopter box shall be located as near as possible to the main terminal box. The interconnecting cabling between adopter box and main terminal box along with providing suitable cable glands and termination kits as applicable shall also be done by the bidder. 6.8 <u>GROUNDING</u> 6.8.1 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GS bolts and washer 6.8.2 The grounding connection shall be suitable for accommodation of ground conductors as follows : <table> <tr> <td>Motor above 90 kW</td> <td>:</td> <td>75 x 10 mm GS Flat</td> </tr> <tr> <td>Motor above 30 kW up to 90 kW</td> <td>:</td> <td>50 x 6 mm GS Flat</td> </tr> <tr> <td>Motor above 5 kW up to 30 kW</td> <td>:</td> <td>25 x 6 mm GS Flat</td> </tr> <tr> <td>Motor up to 5 kW</td> <td>:</td> <td>8 SWG GS Wire</td> </tr> </table> 6.8.3 The cable terminal box shall have a separate grounding pad 6.9 <u>RATING PLATE</u> 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.			Motor above 90 kW	:	75 x 10 mm GS Flat	Motor above 30 kW up to 90 kW	:	50 x 6 mm GS Flat	Motor above 5 kW up to 30 kW	:	25 x 6 mm GS Flat	Motor up to 5 kW	:	8 SWG GS Wire
Motor above 90 kW	:	75 x 10 mm GS Flat												
Motor above 30 kW up to 90 kW	:	50 x 6 mm GS Flat												
Motor above 5 kW up to 30 kW	:	25 x 6 mm GS Flat												
Motor up to 5 kW	:	8 SWG GS Wire												

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(c) Bearing identification no. and recommended lubricant. (d) Location of insulated bearings. 6.10 <u>CONSTRUCTION</u> 6.10.1 Stator Core The Stator Core Lamination shall be made of high-grade silicon/magnetic steel sheet varnished on both sides and pressed to form rigid core. 6.10.2 Rotor The rotor construction shall be such that in case of dislodging of the rotor bar from the end ring, it should not come out and hit the stator core/stator winding and damage. 7.0 <u>ACCESSORIES</u> 7.1 <u>GENERAL</u> Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application 7.2 <u>SPACE HEATER</u> 7.2.1 Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement. 7.2.2 The space heater shall be rated 240 V, 1 phase 50 Hz and sized to maintain the motor internal temperature above dew point when the motor is idle. 7.3 <u>TEMPERATURE DETECTORS</u> 7.3.1 All 11kV and 3.3kV motors shall be provided with twelve (12) nos. Simplex type winding temperature detectors, four (4) nos. per phase.		

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7.3.2	11kV and 3.3kV motor bearing shall be provided with duplex type temperature detectors.	
7.3.3	The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.	
7.3.4	Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS connectivity.	
7.3.5	Five numbers of Temperature detectors / thermistors shall be provided for L.T. Motors above 90 kW (3 nos. Winding temperatures & 2 nos. bearing temperatures).	
7.4	<u>INDICATOR/SWITCH</u>	
7.4.1	Dial type local indicator with alarm contacts shall be provided for the following :	
	(a) 11kV and 3.3kV motor bearing temperature	
	(b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor	
7.4.2	Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.	
7.4.3	Alarm switch contact rating shall be minimum 0.5 A at 220V D.C. and 5A at 240V A.C.	
7.5	<u>CURRENT TRANSFORMER FOR DIFFERENTIAL PROTECTION</u>	
7.5.1	Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 nos. CT for mounting on switchgear side shall be in bidder's scope.	

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7.5.2	The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later.	
7.6	<u>ACCESSORY TERMINAL BOX</u>	
7.6.1	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.	
7.6.2	Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit cable connections.	
7.7	<u>DRAIN PLUG</u>	
	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.	
7.8	<u>LIFTING PROVISIONS</u>	
	Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.	
7.9	<u>DOWEL PINS</u>	
	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.	
7.10	<u>PAINTING</u>	
	Motor including fan shall be painted with corrosion proof paints of colour shade (RAL-7032).	
8.0	<u>TESTS</u>	
8.1	<u>ROUTINE AND TYPE TEST:</u>	

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Tests are to be conducted for HT and LT motors 60kW and above in presence of Mahagenco representative and contractor as per IS: 325 and required copies of test certificates are to be furnished for approval and despatch clearance. In addition, following tests shall have to be carried out on the motors in presence of MAHAGENCO representative & contractor on LT & HT motors. For Motors below 60kW type and routine test conducted as per IS325 shall be witnessed by contractor and test certificate shall be submitted for review of Mahagenco & Dispatch clearance

8.1.1 FOR HT MOTORS:

(a) Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-671/IS 14422,1995 test voltages as under

Voltage rating of motor	Impulse Test Voltage
3.3 kV	: 18 kV peak
11 kV	: 49 kV peak

(b) Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test

(c) Polarization Index Test as per IS:7816 as routine test

(d) Tan delta measurement on coils

(e) Surge withstand test for inter turn insulation.

(f) Test to diagnose rotor bar failure during manufacture.

Tests indicated at (d), (e), (f) shall be carried out during manufacture of the coils and shall be furnished for verification .

8.1.2 FOR HT & LT MOTORS:

(a) Test for suitability of IP55/ IPW– 55 as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test,

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provided the test motor is identical to motor being supplied. Second numeral test shall be carried out on one motor of each type and rating. (b) Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test is conducted on exactly identical terminal box within last three years. (c) Test for noise level as routine test. (d) Test for vibration as routine test. (e) Overspeed test as type test. 8.2 <u>TEST WITNESS:</u> Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.		

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<u>AC & DC MOTOR</u>			
SR. NO.	ITEM	UNIT	
1.0	<u>AUXILIARY POWER SUPPLY</u>		
1.1	<u>H.T. SUPPLY</u>		
	11kV, 3Ø, 3W, 50 Hz non-effectively earthed		Motors rated 1000 kW and above
	Fault level 44 kA symm		
	3.3kV, 3Ø, 3W, 50 Hz, non-effectively earthed		Motors above 160 kW and below 1000kW
	Fault level 40 kA symm		
1.2	<u>L.T. SUPPLY</u>		
	415V, 3Ø, 3W, 50 Hz effectively earthed		Motors below and including 160kW
	Fault level 50 kA symm		
	240V, 1Ø, 2W, 50 Hz effectively earthed		Lighting, space heating, A.C. control & protective devices
1.3	<u>D.C. SUPPLY</u>		
	220V, 2W, unearthed		D.C. alarm, control & protective devices
	Fault level 25* kA.		
	Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation		
2.0	<u>RANGE OF VARIATION</u>		

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SR. NO.	ITEM	UNIT	
2.1	<u>A.C. SUPPLY:</u>		
	Voltage		± 10%
	Frequency		± 5%
	Combined Voltage & 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		
2.2	<u>D.C. SUPPLY</u>		
	Voltage		198 to 240 Volt

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SPECIFICATION NO. PES-507-27

VOLUME II B

SECTION D

REVISION 0

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SHEET 1 OF 6

**GENERAL TECHNICAL REQUIREMENTS
OF
CONDUITS AND PIPES
SPECIFICATION NO. PES-507-27
REV 0**



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1.0 GENERAL

- 1.1 This specification covers the manufacture, inspection & testing at vendor's works and delivery to site of conduits, pipes and their fittings for electrical installation.

2.0 CODES AND STANDARDS

- 2.1 The material, constructional features and various processes involved in manufacture shall comply with currently applicable Indian Standards.
- 2.2 The following Indian Standards shall be applicable, in general. However if Data Sheet A specifies conformance to other international standards, the equivalent IEC/BS/other standards shall be considered.

- a) IS:9537 (All Parts) Conduits for electrical installation.
- b) IS:3480 Flexible steel conduits for electrical wiring.
- c) IS:6946 Flexible non-metallic conduits for electrical installation.
- d) IS:1239 Mild steel tubes, tubulars and other wrought steel fittings.
(for size above 63mm dia of rigid conduits)
- e) IS:2667 Fittings for rigid steel conduits for electrical wiring.
- f) IS:3837 Accessories for rigid steel conduits for electrical wiring.
- g) IS:3419 Fittings for rigid non-metallic conduits.
- h) IS:6005 Code of practice for phosphating iron & steel.
- i) IS:2629 Recommended practice for hot dip galvanizing on iron and steel.
- j) IS:4759 Specification for hot dip zinc coatings on structural steel and allied products.
- k) IS:6745 Methods for determination of mass of zinc coating on zinc coated iron and steel articles.

3.0 DESIGN REQUIREMENTS AND CONSTRUCTIONAL FEATURES

The conduit and conduit accessories shall include conduit plugs & caps, gaskets and box cover etc in addition to any specific requirement given in Data Sheet A. The diameter of conduits and accessories shall be uniform throughout the length.

3.1 Rigid Conduits and Fittings

- 3.1.1 Rigid conduits shall generally conform to the requirements of IS:9537 (Part I & Part II). However conduits above 63mm diameter shall conform to the requirements of IS:1239. Unless specified otherwise in Data Sheet A, all conduits and pipes shall be of medium duty.



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- 3.1.2 The rigid conduits shall be hot dip galvanized inside and outside. Weight of zinc shall be as per IS:4759. Conduits shall be thoroughly cleaned and pretreated, conforming to IS:6005.
- 3.1.3 Conduits shall be supplied in approximate length as specified below
- a) Rigid Conduits 5 metres
 - b) Flexible Conduits 10 - 30 metres
- 3.1.4 Each end of conduit length shall be threaded. The ends of conduits shall be sealed with protective caps to prevent damage to threaded portions and entrance of moisture and foreign material.
- 3.1.5 The inside surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.
- 3.1.6 Conduit fittings shall be made out of tube or cast to the shape as to match with corresponding conduit sizes and meet their purpose without any special adjustment.
- 3.1.7 All fittings shall be screwed type and hot dip galvanized inside and outside.
- 3.2 Flexible Metallic Conduits and Fittings
- 3.2.1 Flexible metallic conduits shall generally conform to the requirements of IS:3480.
- 3.2.2 Flexible conduits shall be made of strip steel which shall be of cold rolled mild steel. The strip shall be of uniform width and thickness throughout.
- 3.2.3 The strip shall be electro galvanized to a minimum thickness of 25 microns as specified in IS:3480. The surface of the strip shall be thoroughly cleaned before application of protective coating. Pretreatment, before galvanization, shall conform to IS:6005.
- 3.2.4 The strip for making flexible conduit shall be wound tightly and so overlapped in subsequent helicals that no openings are seen in normal position.
- 3.2.5 Flexible conduits shall be lead coated for application in high temperature zones, if specifically mentioned in Data Sheet A.
- 3.2.6 The conduit shall have uniform diameter throughout its length. The internal surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.
- 3.3 PVC Conduits
- 3.3.1 PVC conduits shall generally conform to the requirements of IS:9537(Part I & Part III).
- 4.0 INSPECTION
- 4.1 The following stages of manufacture shall be stage inspected by Purchaser or his duly authorized representative.
- 4.1.1 Inspection of manufacturing processes such as shearing, punching, bending, welding, galvanizing etc.
 - 4.1.2 Inspection of packing material and procedure.



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4.1.3 Inspection of finished product.

4.2 The inspection will be carried out as per agreed quality plan.

5.0 TESTING

5.1 Rigid Conduits

- a) Acceptance Tests
 - as per IS:9537 Part 1 & 2 upto 63mm OD
 - as per IS:1239 above 63mm OD
- i) Dimension checks
- ii) Bending test (below 32mm OD)
- iii) Compression test
- b) Special Tests (as acceptance test) as applicable to galvanizing.

5.2 Flexible Steel Conduits

- a) Acceptance Tests
 - as per IS:3480
- i) Dimension checks
- ii) Linear breaking test
- iii) Test for flexibility
- iv) Bend fracture test
- v) crushing test
- b) Special Tests (as acceptance test) as applicable to galvanizing.

5.3 PVC Conduits

- a) Type Tests
 - as per IS : 9537 (Part 1 & 3)
- i) Dimension checks
- ii) Bending test
- iii) Compression test
- iv) Impact test
- v) Collapse test
- vi) Resistance test
- vii) Resistance to burning