

2 X 800 MW UPPUR STPP (STAGE-I, UNIT#1&2)
IN RAMANATHAPURAM DISTRICT, TAMILNADU
Of
TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED

TECHNICAL SPECIFICATION
FOR
FUEL OIL HANDLING SYSTEM

SPECIFICATION NO.: PE-TS-425-166-A001



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA (INDIA)



TITLE

2x800 MW UPPUR STPP

**TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM**

SPECIFICATION NO.: PE-TS-425-166-A001

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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

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SECTION – I**CHAPTER – 1: INTENT OF SPECIFICATION**

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1.0 INTENT OF SPECIFICATION

- 1.1 This specification is intended to cover design, engineering, manufacture, fabrication, assembly, Inspection & testing at vendor's & sub-vendor's works, painting, forwarding, supply and delivery at site including start up and commissioning spares, chemicals, properly packed for transportation, unloading / handling and storage at site, in site transportation, assembly, erection and commissioning, minor civil works, preparation and submission of "As Built" drawings, site testing, carrying out Hydro tests at site and handover of **FUEL OIL HANDLING SYSTEM** including Condensate Storage Tanks as per the details in different sections of this specification for **2x800 MW UPPUR STPP**.
- 1.1 The bidder's scope shall also include any other services, etc. if called for in the succeeding sections of the specification.
- 1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning of **Fuel oil handlings system** including Condensate Storage Tanks within quoted price.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment / system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.
- 1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.5 Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.
- 1.6 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are hereby made part of the tender specifications. The equipment / material and works covered by this specification is subject to compliance to all the attachments referred in the specification. The tenderer shall be responsible for adherence to all requirements stipulated herein.
- 1.7 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Sec.-III of the specification within 10 days of receipt of tender documents. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice

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either by the bidder or by purchaser / customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.

1.11 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.

1.12 BHEL’s Customer’s representative shall be given full access to the shop in which the equipment’s are being manufactured or tested and all test records shall be made available to him.

1.13 Various codes and standards to be used shall be as indicated in various parts of the specification. In case bidder uses any standard other than those indicated in the specification, the onus of establishing equivalence of the same with the specified standards will rest with the bidder and acceptance of the same shall be sole prerogative of customer. The bidder will also arrange for BHEL a copy of the standards in ENGLISH language. The cost of such service will be deemed to have been included by the bidder in the total cost of the package. BHEL will not entertain any additional cost on account of the same.

1.14 All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.

1.15 The bidder’s offer shall not carry any sections like clarification, interpretations and /or assumptions.

Note:

Bidder to note that BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- Internet explorer version – Minimum Internet Explorer 7.
- Internet speed – 2 mbps (Minimum preferred).
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
- Vendor’s internal proxy setting should not block DMS application’s link (<http://dmsserver.bhulpem.com/Wrench%20Web%20Access/Login.aspx>).

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SECTION – I**CHAPTER – 2: PROJECT INFORMATION**

SPECIFICATION FOR BTG EPC CONTRACT

VOLUME II – GENERAL & SCHEDULES

CHAPTER 1

PROJECT SYNOPSIS

1.0 GENERAL BACKGROUND AND SALIENT FEATURES

1.1 Introduction

Tamilnadu Generation and Distribution Corporation owns the proposed green-field 1600 MW (2 units of 800 MW each) Coal Based Thermal Power Station. The Project Site is located in Uppur, Valamavoor and Thiruppalaikudi villages of Thiruvadanai Taluk, Ramanathapuram District.

1.2 Location

The proposed site for main power plant is located at Uppur in Ramnathpuram District of Tamil Nadu.

The nearest Railway station is Thiruppalaikudi Railway Station, 3Kms from site

ECR Connecting Ramanathapuram and Pattukottai is the nearest road access.

The nearest airport is at Madurai at a distance of 140 km.

The nearest port is Tuticorin located at a distance of 130 km.

1.3 Type of Plant

The proposed 2 x 800 MW Super-Critical Power Project consists of coal fired steam generator connected to a reheat type steam turbine generator along with all the required auxiliaries. Circulating cooling water system is envisaged for condenser cooling.

The description and salient technical data of the Steam Generator, Steam Turbine Generator, Auxiliary systems, Electrical, Control & Instrumentation, Civil etc. are explained elsewhere in the specification:

1.4 PROJECT INFORMATION



2 x 800 MW Supercritical Coal Based Uppur
Thermal Power Project
Spec. No. SE/E/T&H(P)/OT No.01 /2015-16



1.1	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)	
1.2	Project Title	:	2 x 800 MW Uppur Thermal Power Project	
1.3	Owner’s Engineer	:	Desein Private Limited; New Delhi	
1.4	Project Site Location	:	Place	Uppur
			State	Tamil Nadu
			Country	India
1.5	Nearest Railway Station	:	Ramanathapuram at 28 KM away	
1.6	Nearest City	:	Ramanathapuram	
1.7	Nearest Highway	:	ECR Connecting Ramanathapuram and Pattukottai	
1.8	Nearest Airport	:	Domestic air port at Madurai (140 KM)	
1.9	Nearest Sea Port	:	Tuticorin Port (130 KM)	
1.10	Site Elevation	:	+ 4.5 m	
1.11	CLIMATOLOGICAL DATA	:		
i.)	HIGHEST TEMPERATURE RECORDED	:	37.8°C	
ii.)	MINIMUM TEMPERATURE RECORDED	:	22.3°C	
iii.)	DRY BULB TEMPERATURE (DBT) FOR DESIGN PURPOSE	:	30 ± 10°C 50°C (for electrical equipment)	
iv.)	RELATIVE HUMIDITY FOR DESIGN PURPOSE	:	75 ± 15%	
v.)	ANNUAL RAINFALL	:	827 mm (avg.)	
1.12	Source of Water (Distance from site)	:	Sea	
1.13	Primary Fuel & Source	:	Imported Coal (Indonesia and S. Africa)	
1.14	Startup Fuel & Source	:	HFO/ L.D.O. (Domestic)	
1.15	Earthquake Data	:	Zone III as defined in IS: 1893-2002	

1.5 Access to Site

Site is well connected and located along ECR Connecting Ramanathapuram and Pattukottai. Site is well connected by rail also.

1.6 Plant Rating, Capacity, Availability, PLF



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Each of the two units shall have a Turbine maximum continuous rating (TMCR) of 800 MW at generator terminals based on the following site conditions.

- Ambient air temperature
- Condenser cooling water inlet temperature of 33°C and 9°C temperature rise across the condenser.
- Generator power factor of 0.85.
- Fuel specification as given elsewhere.
- Design temperature for electrical equipment is 50°C.

The VWO capacity of the steam turbine shall not be less than 105% of TMCR flow at rated parameters. Boiler maximum Continuous Rating (BMCR) will be established to match the steam flow at VWO conditions, but BMCR flow shall not less than 108% of TMCR flow.

The capacity of the unit is selected so as to deliver the rated output even after ageing that will occur between overhauls, as a result of deposition of salts in turbine blades, wear and tear etc.

The plant load factor (PLF) being considered is 85%.

1.7 Power Evacuation

Power will be evacuated from the proposed thermal power station at 765 KV voltage level through 765 KV transmission lines . The power evacuation lines would be double circuit 765 KV lines which will act as Line in & Line out circuit.

1.8 Site Selection

The following factors which influence the project site selection have been found very favourable to establish and operate the project.

- a. Availability of fuel.
- b. Existing power plant
- c. Availability of adequate cooling water.
- d. Availability of adequate land for locating the power plant with approach roads.
- e. Suitability of land from topographical and geological aspects
- f. Proximity of National Highways, Ports & Transport of fuel & heavy equipment.
- g. Facility for interconnection with transmission and distribution system for evacuation of power.
- h. Environmental aspects.

Total land required for the project is approx. 900 acres which is under the possession of TANGEDCO.

1.9 Fuel

1.9.1 Source of Fuel



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Coal shall sourced from Indonesia or any other source Domestic coal requirement for the power plant will be sourced from coal mines in Orissa.

The steam generator shall be designed for the following conditions :

- **Best Coal** – 100% Imported Coal
- **Design Coal** – 70% Imported & 30% Domestic Coal
- **Worst Coal** – 50% Imported & 50% Domestic Coal

The analysis of fuel is given below :

1.9.2

Coal Analysis:

Coal Quality Parameters

SL.NO	DESCRIPTION	DOMESTIC COAL	IMPORTED COAL
1.	HIGHER HEATING VALUE -As Fired basis given Kcal/kg	2800 (GCV as received basis)	6250 (GCV Air dried basis) 5642 (as received basis)
2.	TOTAL MOISTURE %	During rainy season 20% (inherent + surface)	16.5%
3.	HGI* Abrasion expected YGP Shale and sand stone content Feed coal size	45 to 55 Average 52 50 to 70 mg/kg 20% max. upto 50 mm.	51

* for SG design the belnded coal is the weighted average of the parent coal. For mill design HGI 45 shall be considered,

DOMESTIC COAL

Sr. No.	Particulars	Units	Parameters
A.	Proximate Analysis		
1.	Moisture	%	16.00
2.	Volatile Matter	%	19.00
3.	Ash	%	45.00
4.	Fixed carbon	%	20.00
	Total	%	100
B.	ULTIMATE ANALYSIS, % (As received)		
1.	Carbon	%	27.70
2.	Hydrogen	%	2.60
3.	Nitrogen	%	0.52
4.	Oxygen	%	7.26
5.	Sulphur	%	0.50
6.	Ash	%	45.00
7.	Moisture	%	16.00



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Sr. No.	Particulars	Units	Parameters
8.	Carbonates	%	0.38
9.	Phosphorous	%	0.04
10.	Others	%	-
	Total	%	100.00
C.	Ash fusion temperature	deg C	
1.	Initial deformation, IT	deg C	1100
2.	Spherical, ST	deg C	1200
3.	Hemispherical, HT	deg C	1300
4.	Fluid, FT	deg C	-
D.	Ash Analysis, %		
1.	Sio2	%	59.54
2.	Al 2 O3	%	29.00
3.	Fe2O3	%	6.42
4.	CaO	%	1.50
5.	Na2O	%	0.08
6.	K2O	%	-
7.	TiO2	%	1.60
8.	SO3	%	0.25
9.	P2O5	%	0.51
10.	MgO	%	0.50
11.	Others	%	0.60
12.	Total		100.00
E	Resistivity of fly ash	Ohm - cm	1.73x 10 ¹²

IMPORTED COAL

Sr. No.	Particulars	Units	Parameters
A.	Proximate Analysis (As received)		
1.	Moisture	%	16.50
2.	Volatile Matter	%	36.45
3.	Ash	%	6.62
4.	Fixed carbon	%	40.43
5.	Total	%	100.00
B.	ULTIMATE ANALYSIS, % (As received)		
1.	Carbon	%	60.12
2.	Hydrogen	%	4.38
3.	Nitrogen	%	1.48
4.	Oxygen	%	10.37
5.	Sulphur	%	0.53
6.	Ash	%	6.62
7.	Moisture	%	16.5
8.	Carbonates	%	-
9.	Phosphorous	%	-
10.	Others	%	-
	Total	%	100.00
C.	Ash fusion temperature	deg C	
1.	Initial deformation, IT	deg C	1230
2.	Spherical, ST	deg C	1270



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Sr. No.	Particulars	Units	Parameters
3.	Hemispherical, HT	deg C	1320
4.	Fluid, FT	deg C	-
D.	Ash Analysis, %		
1.	Sio ₂	%	36.00
2.	Al ₂ O ₃	%	13.90
3.	Fe ₂ O ₃	%	14.80
4.	CaO	%	12.70
5.	Na ₂ O	%	0.70
6.	K ₂ O	%	1.70
7.	TiO ₂	%	0.80
8.	SO ₃	%	10.60
9.	P ₂ O ₅	%	0.20
10.	MgO	%	8.60
11.	Others	%	-
12.	Total	%	100.00

The plant should be suitable to accept imported coal sourced from any country. The limiting parameters of imported coal are furnished below :

S. No.	Particulars	Unit	Parameter
1	Total Moisture (ARB)	%	Up to 23 (Max)
2	Ash (ADB)	%	Up to 20 (Max)
3	Gross Calorific Value (ADB)	Kcal / Kg	5800 - 6500
4	Sulphur (ADB)	%	Up to 1 (Max)
5	Fixed Carbon (ADB)	%	30-50
6	Volatile Matter (ADB)	%	25-45
7	HGI		45-60
8	IDT (Under Reducing Atmosphere)	Deg C	1100-1250
9	Size	Mm	< 50

Note: ADB stands for “As dried Basis” and ARB for “As Received Basis”

1.9.3

Specification of LDO

Specific gravity @ 15° C	0.8348
Gross calorific value, Kcal/kg	10400
Pour point “°C” max.	12
Flash point “°C” min.	66
Sulphur % “T” max.	0.5
K. Viscosity in Centistokes @ 50° C max.	7.5
Ash by wt. %	0.01
Water & sediment Vol. Max. %	0.25



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1.9.4 Specification of HFO

Flash point “°C” min.	66
K. Viscosity in Centistokes @ 50° C max.	370
Ash by wt. %	0.1
Water content by volume % max	1
Sediment by weight % max	0.25
Total Sulphur by weight % max	4.5
Gross calorific value, Kcal/kg	10800

1.9.5 Fuel Linkage

Coal is proposed to be imported from Indonesia or any other country and blended with domestic coal.

1.9.6 Fuel Transportation

The coal shall be received at Tuticorin port and transported by rail from there.

1.10 Source Of Water**1.10.1 Source**

The raw water intake shall be from Bay of Bengal.

1.10.2 Chemical analysis of Sea Water:

S.No.	Parameters	Value (ppm)
1.	Total Solids	35,000
2.	Dissolved solids	21,620
3.	Suspended Solids	580
4.	Ignited residue	17,500
5.	Volatiles Solids	4,700
6.	Acid Insolubles	112
7.	Chlorides (as Cl)	20,232
8.	Sulphates (as SO ₄)	1,457
9.	Iron (as Fe)	70
10.	Total alkalinity (as CaCO ₃)	525
11.	Alkalinity due to Normal Carbonates (as CaCO ₃)	Nil
12.	Alkalinity due to bi-Carbonates (as CaCO ₃)	525



13.	Total hardness (as CaCO ₃)	8,155
14.	Permanent hardness (as CaCO ₃)	6,200
15.	Temporary hardness (as CaCO ₃)	1,955
16.	Calcium hardness (as CaCO ₃)	1,255
17.	Magnesium hardness (as CaCO ₃)	6,900
18.	pH	8.2

1.10.3 Requirement

The requirement of water for the plant will be for meeting the requirement of make up for the re-circulating cooling water system, dust suppression system in coal handling plants, ash disposal system and the RO/ D.M. water plant which will be supplying the power cycle make up requirements, etc. In addition the water requirements will be for drinking and service purposes. Water requirement is estimated as approx. 18000 m³/hr.

1.11 Source of Equipment

The proposed plant will be supplied, erected and commissioned on EPC basis with BTG & BOP as separate packages..

1.12 Power Evacuation Plan

Power will be evacuated from the proposed thermal power station at 765 KV voltage level and fed to Tamil Nadu Transmission Corporation Limited (TANTRANSCO). The Karaikudi substation is about 40 KM north west of the plant.

1.13 Average Yearly Generation

The average yearly generation is calculated considering the following.

- The expected plant load factor is 85 %. With this PLF the average yearly generation will be around 11914 Million units.

1.14 INFORMATION FOR ENVIRONMENTAL APPRAISAL

1.0 GENERAL INFORMATION ABOUT THE PROJECT

- 1.1 Name / Title of the Project : 2 x 800 MW Supercritical Coal Based Uppur Thermal Power Project
- 1.2 Name of Owner : Tamilnadu Generation and Distribution Corporation (TANGEDCO)



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- 1.3 Location of the Project : Uppur, Valamavoor and Thiruppalaikudi Villages, Ramanathapuram District, Tamil Nadu
- 1.4 Capacity of the project under consideration : 2x 800MW
- 1.4.1 Govt. land / Private land / others : Land being acquired
- 1.4.5.2 Topographical feature, demographic profile & physiography : Refer Volume VI
- 1.5.3 Nature of soil : Clayey soil
- 1.5.4 Distance from the nearest town / city / major human settlements : Madurai – 140 KM
- 1.5.5 Population to be displaced : Nil
- 1.5.6 Distance from water source : Approx. 1 km
- 1.5.7 Area of forest land, if involved : Nil
- 1.5.8 Distance of forest from the site : N.A
- 1.6 Is this an extension? : No
If so indicate capacity of existing plant
- 1.7 What is the ultimate capacity envisaged : 2 x 800 MW
- 2.0 GENERAL ENVIRONMENTAL INFORMATION**
- 2.1 Area of the land proposed to be acquired : Refer Plot Plan Land already acquired
- i. Area required for plant : 900 Acres
- ii. Ash disposal : 100 % dry fly ash disposal and 100% wet bottom ash disposal is envisaged to existing ash pond.



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- iii. Plant facilities : The area is adequate for locating all the required systems for 2x800 MW.
- 2.2 Area proposed to be built-up or developed : Power station will be built-up in the proposed site as indicated in the plot plan.
- 2.3 Specify site characteristics River basin/ estuarine / coastal / others : Site is adjacent to Bay of Bengal
- 2.4 Is the site situated in the forest area? Give following details : No
- 2.4.1 Area : N.A
- 2.4.2 Type of forests : N.A
- 2.5 Is site situated near to the forests? Give the distance from the site. : N.A.
- 2.6 Give a description of the flora within 25 km of your plant site under the following heads :
- a. Crops :
b. Forest :
c. Grass land :
d. Endangered species :
e. Others (Specify) :
- 2.6.2 Give details of the following features, if they exist, within a radius of 25 km of the proposed site? :
- i. Fisheries :
ii. Sanctuary / natural park biosphere reserve :
iii. Lakes / ponds / reservoir :
iv. Stream / river :
v. Estuary / sea : Bay of Bengal is 1 km from site
vi. Hills / mountains :
vii. Historic / cultural / tourist / archaeological scenic :
- Refer details in the specification elsewhere.



sites / defence
installations

- 2.7 Human settlement :
- 2.7.1 Total number of persons :
proposed to be employed
- i. During construction : 2500
1200(0.75person/MW) TANGEDCO
- ii. During operation : direct employees



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SECTION – I**SPECIFIC TECHNICAL REQUIREMENTS****SECTION IA – Specific Technical Requirement (Mechanical)**

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A.**1.0.0 SCOPE OF WORK FOR FUEL OIL HANDLING SYSTEM**

Design, engineering, manufacture, fabrication, assembly, Inspection & testing at vendor's & sub-vendor's works, painting, forwarding, supply and delivery at site including start up and commissioning spares, chemicals, properly packed for transportation, unloading / handling and storage at site, in site transportation, assembly, erection and commissioning, minor civil works, preparation and submission of "As Built" drawings, site testing, carrying out Hydro tests at site and handover of FUEL OIL HANDLING SYSTEM including Condensate Storage tanks.

P&I Diagram and write-up for Fuel Oil Handling System (for tender purpose) is enclosed with the specification. Detailed P&I Diagrams, System write up & Control philosophy (as applicable) shall be furnished by the successful bidder during detail engineering & the same shall be subject to customer approval without any commercial implication.

1.1.0 SCOPE OF SUPPLY

Scope of supply by bidder shall comprise of but not necessarily limited to the following. P&I Diagrams may please be referred.

- 1) One nos. of fixed roof type M.S storage tanks for HSD day tank of effective capacity 80cum each along with accessories as indicated in P&ID.
- 2) Instrumentation & control System (Control panel excluded from bidder's scope) as applicable including instruments, interlocking & protection devices complete in all respects required for safe, efficient and reliable operation of the plant and to be read in conjunction with C&I portion of specification. Minimum instrument and control system requirement is mentioned in the P&ID.
- 3) Drain and vent connection along with isolation valve & associated piping at every low and high point as per layout requirement of FOHS shall be provided.
- 4) All foundation bolts/ anchor bolts required for any equipment foundation under the package. For HSD day tank, minimum 4 nos. anchor bolts (M33 grade) to be considered irrespective of calculation. However if during calculation for tank stability if number of anchor bolt are more than 4 ,then actual number of anchor bolt to be provided.
- 5) Pipes from HSD tank to FO pump house and return including inlet piping to HSD tank from FO pump house will be free issued to bidder. However E&C of same is in bidder scope. Other pipes for tank, Flanges, fasteners, gaskets with suitable hangers, supports, pipe trestle within dyke and pump house as required etc. as applicable within the terminal point will be in vendor scope. Change in location of terminal point of piping for erection within 50M shall not bear any additional implication to BHEL.
- 6) Pipe-supporting structures over the insert plates for pedestal supported pipes and also on pipe rack supported pipe.
- 7) Nozzle for foam pourer, heat detector on tank roof & details of pad plates to be welded to the tanks shall be furnished to the successful bidder including welding supports for fire water piping and same to be provided by bidder.
- 8) Platform and approach ladder to the platform for foam pourer.
- 9) All MS structures for cross overs, valve / instruments / equipment operating & maintenance platforms, approach ladders for access to platforms, trench/pit.

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- 10) Painting of equipment along with their accessories within battery limit. Final coat of paint on all the equipment's / item covered under the package shall be done at the time of handing over of package.
- 11) C&I Scope as per enclosure elsewhere in the specification.
- 12) Erection & commissioning spares as required for the complete system.
- 13) One set of special maintenance tools & tackles, if any. These tools shall not be used for erection/ commissioning purposes and shall be in an unused and new condition when they are handed over to the customer at site. Each tool shall be stamped so as to be identified easily for its use. The tools shall be supplied in a steel toolbox. This list shall be reviewed during detail engineering.
- 14) Mandatory spares as per enclosure elsewhere in the specification.
- 15) All valves, counter- flange with nuts, bolts and gaskets at all the terminal points.
- 16) Flowable non- shrink grout of one grade higher than concrete used for civil work grouting below base plate for all structure/ equipment & for grouting of foundation / anchor bolts.
- 17) Relevant scope of supply as per GTR, GCC & SCC.
- 18) Valves in pit outside dyke with limit switch as required as per latest OISD recommendation complying with requirement whichever is more stringent.
- 19) Any other instrument, equipment / item required for making the installation complete in all respect and for satisfactory operation of the system for the scope within the terminal point, as well as to meet any statutory requirement relevant to the package, unless specifically EXCLUDED from scope of supply.

1.2.0 SCOPE OF SERVICES

Scope of services by bidder will include but not necessarily limited to the following:

- 1) Unloading, Storage, handling and transportation at site.
- 2) Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of anchor bolts wherever these are not placed in the foundation during casting of foundation itself, excavation & filling of earth for buried MS pipes if and as required. To the extent possible, vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation.
- 3) Pre-Commissioning work such as flushing, hydraulic testing etc. Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities shall be arranged by the successful bidder at their own cost.
- 4) Erection & Commissioning of Fuel Oil handling System as per scope above (including pipes free issued to bidder).
- 5) Erection of all foundation bolts/ anchor bolts etc. as required for any equipment. In case these are not erected when foundation is being cast refer point no 2 above.
- 6) Inspection & testing, Performance Requirements and Performance Guarantees.
- 7) Painting of tank and all other items within scope of supply.



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- 8) Making Good/Repairing/replacement of and damaged done by bidder to adjacent structure, pipes etc. while erecting equipment's related to Fuel Oil system.
- 9) Preparation of drawing showing common facilities, if any, between BHEL & Vendor supplied equipment.
- 10) Preparation of civil assignment drawings i.e. pedestals details; insert plates / embedment's plates required for supporting pipes and equipment etc. and review of civil drawing prepared by customer based on civil assignment drawing of bidder. In case any modification is required in the civil work already done based on civil inputs given by vendor, rework shall be done at the cost and risk of the vendor.
- 11) Preparation of all drawings as per list enclosed under section III and providing soft copy of same to BHEL.
- 12) CCOE approval for HSD day tank.
- 13) Preparation of all necessary drawings/data/ documents for obtaining necessary Approval of statutory authorities like CCOE, IBR, Weight & Measures Department and any other agency/ competent authority related to installation of Fuel Oil Handling System on behalf of the customer. All expenses required to obtain the approval shall also be borne by the successful bidder. Successful bidder shall inform customer well in advance requirement of authority letter along with format for the same. After issuance of authority letter by customer, it will be vendor's responsibility to regularly follow up with the concerned authorities to obtain timely approval from these authorities. Any delay on account of the same, unless any specific information related to above approval to be furnished by customer is delayed by customer, shall be to vendor's account and shall not be used as a reason for extension in contract completion.
- 14) Layout drawing to be prepared for statutory approval apart from showing the technical requirements shall necessarily show key plan showing approach to site with mile stone, Survey No., Khesra No, Plot No. etc.
- 15) Supply of temporary equipment and services for chemical cleaning, steam blowing, energization, testing etc. as applicable.
- 16) Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
- 17) All other facilities/ services as described in section on site services in specification and related to Fuel Oil Handling System scope of work within terminal point.
- 18) Relevant requirements as per GTR, GCC, ECC & SCC.
- 19) Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system as well as to meet any statutory requirement relevant to the package, unless specifically EXCLUDED from scope of services.

2.0.0 EXCLUSION

- a) Supply of pipes from HSD day tank to FO pump house and return line including inlet piping to HSD tank. However, E&C of the same including supporting arrangement shall be in bidder's scope of supply:
- b) Civil work for fuel oil storage system including

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- i) Tank foundations
- ii) Dyke wall and barbed fencing
- iii) Encasing of buried pipes, providing culvert for the same, if required.
- iv) Hume Pipes, if any
- v) Civil works like pits, wherever required.
- vi) Handrails in Dyke wall approach staircase, Trench if any in FO unloading area. However, Handrails for tank staircase, at roof, structural crossover, staircase structures etc. shall be in bidder scope.
- vii) Various cable & pipe trenches, pipe pedestals, drains, sumps.
- viii) Pipe rack/trestle (refer definition of pipe rack/ trestle elsewhere in the specification) outside pump house and dyke area.
- c) Fire Protection system for HSD tank.
- d) Exclusion as indicated in C&I portion of technical specification.
- e) Relevant exclusion as per GTR, GCC, SCC & ECC.

3.0.0 SERVICES TO BE PROVIDED BY THE CUSTOMER

- a) Relevant services as per GCC, SCC & ECC.

4.0.0 TERMINAL POINT

HSD

:

Towards oil inlet nozzle:

Inlet valve of HSD Day tank

Towards oil Supply to pressuring pump for Aux. boiler i.e. from outlet nozzle

Up to 1000 mm outside pressurizing pump house wall for suction & return lines. Piping from this TP is being done by HPVP.

Bidder to plan the layout and size the pipe between storage tank and P&H unit in a manner so as to ensure availability of above TP pressure 1.5 Kg/cm² (a) limiting the tank foundation height for storage tanks to 1 m and the P&H unit FFL approx. 500 mm above ground level

From Return of Pressurizing Pump for Aux. Boiler– From 1000 mm outside P& H pump house, Pressure – 3.0 kg/cm² (g); Elevation- Approx. 2 m above FFL.

Bidder to match pipe elevation and orientation as per Terminal point, final details to be provided & confirmed during detail engineering.

Separator (OWS)

(under ETP scope).

Drain from dyke area:To OWS during normal condition & to plant drain during
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rainy season through two way valve pit. Valves in the valve pit along with limit switch for the same are included in bidder's scope. Min. size of the valve in dyke wall catch pit shall be 150 NB.

Change in location of terminal points by up to 50 meters in plan view and 10 m in elevation view shall have no price implication. Isolation valves at the terminal points shall be in the scope of the bidder.

5.0.0 ADDITIONAL LAYOUT REQUIREMENTS

- a) System layout shall conform to the requirements of the Petroleum Act 1934 & Petroleum Rules 2002, OISD 118 latest edition whichever is more stringent. The layout shall also confirm to all other relevant OISD specifications
- b) All established engineering practices with regard to layout of various equipment & piping shall be followed and the same shall be subject to Customer approval during detail engineering without any commercial implication.
- c) Tentative Location of items related to Fuel Oil handling System is shown in enclosed PLOT PLANS and Sketch of FOHS. This will be finalized during detail engineering based on equipment dimensions and other layout related requirements. There will however be no cost implication on account of the same.
- d) While selecting pipe size, velocity inside the pipe shall not overshoot the velocity criteria indicated elsewhere in the specification or as decided during detail engineering.
- e) To the extent possible, all valves shall be located at grade level for easy operation & maintenance. Where location at grade level is not possible, suitable operating and maintenance platform made of MS grating and access ladder/ staircase/walkways to the same shall be given by the bidder. The platform and walkways will be designed by considering load of at least 750Kg/M2.
- f) Where pipes are routed in a manner that it hampers man movement in that area, suitable no. of cross overs made of MS gratings with handrail shall be given across such pipes to facilitate easy man movement in such areas. Further, suitable access ladder of MS construction shall be given for access to equipment/ pipes located in pit/ trench. Such structures shall be designed by considering a load of at least 750Kg/M2.
- g) For all pedestal supported pipes, BHEL scope will be limited to pedestal with insert plates. Maximum height of pedestal to be provided by BHEL shall be 300 mm from FGL/FFL in the corresponding area. Structures required above these pedestals for supporting the pipes are included in the scope of the bidder. Pipe having BOP up to 2.0m from the grade level / FFL / FGL in the corresponding area shall be pedestal supported.
- h) Layout shall be prepared in a way to avoid the buried piping to the maximum possible extent.
- i) Rainwater collected inside the dyke shall be diverted to storm water drain while contaminated oily waste shall be sent to local sump. All valves required in pits outside the dyke are included in bidder's scope of supply.
- j) Instruments to be mounted on tank shall be suitably located so as to have easy access from the staircase without interfering with man movement on the staircase. Wherever this is not possible, suitable platform along with access to the same shall be provided by FO System bidder.
- k) Signals from all field instruments shall be first terminated in Junction boxes before transmitting this signal either to Control panel or to I/O rack or to DCS. Junction box is included in bidder's scope. Erection of cable between field instruments to Junction Box is also included in bidder's scope. All piping shall be arranged to provide clearance for removal of equipment requiring

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maintenance and easy access to valve and other piping accessories required for operation and maintenance. The layout drawing to be submitted by the successful bidder will necessarily show the valve orientation and access to valve and accessories.

- l) Instrument/ LIE/LIR shall not be located in space meant for walkway & maintenance space across the equipment, maintenance bay of building. Location of all instruments shall be marked in tipping layout drawing to ensure correct location of the same.
- m) Requirement given under relevant clause of specification shall also be followed.
- n) All primary Instruments, hardware's & JB's etc. used for measurement for HSD Oil system shall be flameproof (IEC-79.1, Part I).
- o) Platforms, monkey ladder inside tank, staircase (hand railing, knee guard and toe guard (in stair case and all along the periphery of roof of the tank) etc. as per the relevant design code / good engineering practice shall be included in bidder's scope of work.
- p) Bidder shall furnish the STAAD calculation along with the roof structure calculation during detail engineering for checking the stability of roof.
- q) Bidder to note that surface cleaning shall be of Blast clean type. However Grit blasting shall be decided during detail engineering for which no commercial implication shall be entertained by BHEL.

B**1.0 SCOPE OF SUPPLY FOR CONDENSATE STORAGE TANKS**

- 1.1 Steel tanks fabricated and supplied at site under this specification shall be as per enclosed DATA SHEET and sketch for Condensate Storage Tanks – 2 nos. Modifications may be made by the bidder to suit good engineering practice to the satisfaction of the customer. The customer, however, reserves the right to reject any modifications.
- 1.2
 - a) The connections and accessories which are required to be supplied with each tank by the bidder shall be as indicated in the enclosed DATA SHEET and sketch for Condensate Storage Tanks.
 - b) The piping material inside the tank shall be supplied by the bidder. All inlet piping shall be extended up to the bottom of the tank and the clearance between the bottom of the tank and the edge of the inlet piping shall be kept as 500 mm (maximum).
 - c) The inside piping shall be adequately supported and shall be provided with adequately sized vent connection at pipe top.
 - d) Weir plates of adequate thickness (minimum 8 mm) shall be provided for all inlet piping.
 - e) Pad plates on the tanks for supporting outside piping shall be provided by the bidder. Details of the pad plates (sizes, quantity etc.) shall be informed to bidder during detail engineering.
 - f) Fabrication and supply of all flanges and counter flanges for all nozzles and valves of tank connections shall be included in the scope of work of the bidder. Necessary bolts, nuts and gaskets for these connections shall also be supplied by the bidder.
 - g) The manhole shall be of hinged and bolted type with nuts, bolts and gaskets in bidder's scope of supply. The size of the manhole shall be minimum 600 mm.



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- 1.3 The scope of works shall also include supply and installation of special accessories as indicated in DATA SHEET and sketch for Condensate Storage Tanks. The necessary fixtures and other accessories for mounting these special fittings shall be included in the scope of work of the bidder.
- 1.4 Level gauge / indicator for each tank shall be provided by the bidder along with all fittings & accessories as required for mounting the level gauge / indicator on the tanks. Float and board type level gauge / indicator shall be provided unless otherwise specified in Datasheet and sketch for Condensate Storage Tanks.
- 1.5 Required number of tapings of 150 NB with 25NB instrument root valves shall be provided by the bidder for mounting instruments like level switches, level transmitters etc. The number of tapings shall be as indicated in the Datasheet and sketch for Condensate Storage Tanks.
- 1.6
 - a) Sampling Connection with isolation valve of size 25 NB for each tank (if indicated in Data sheet for Condensate Storage Tanks).
 - b) Drain valve of size 100 NB for CST tanks shall be provided by the bidder unless otherwise indicated in the Datasheet and sketch for Condensate Storage Tanks.
 - c) Quantity and size of spare nozzles and valves shall be supplied by the bidder as per Datasheet and sketch for Condensate Storage Tanks.
- 1.7 NaOH / KOH breather and seal pot shall be provided with necessary drain valve of size 25 NB with stainless steel construction unless otherwise specified in the Datasheet and sketch for Condensate Storage Tanks. Two (2) nos. NaOH / KOH breather shall be provided by the bidder for each tank out of which one shall be used for in-breathing purpose and the other shall be used for out-breathing purpose.
- 1.8 Pipes, fittings, nozzles, flanges and counter flanges shall be supplied by the bidder. The minimum requirement for above items, like quantity, size, type etc. are indicated in the Datasheet and sketch for Condensate Storage Tanks, may undergo change during detail engineering stage and these shall be supplied by the bidder as per the approved drawings / documents for which no commercial implication shall be entertained by BHEL. Material of construction of all pipes, fittings, nozzles, flanges and counter flanges shall be as per Datasheet and sketch for Condensate Storage Tanks.
- 1.9
 - a) Material of construction of all tanks shall be mild steel conforms to IS-2062 Grade – B.
 - b) All valves shall be of stainless steel construction as per section -I for Condensate Storage Tank
- 1.10 NaOH / KOH breather and seal pot shall be located in the bottom / ground level and necessary connection from tank vent to NaOH / KOH breather & to atmosphere shall be provided through 200 NB SS pipe.

Vent size calculation shall be furnished by the bidder during detail engineering stage based on the tank filling / emptying rate for approval and increase in vent size from the minimum size requirement, if any, shall be provided by the bidder without any commercial implication.

The overflow pipe from overflow nozzle to seal pot shall also be in bidder's scope of work.



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- 1.11 The minimum number of anchor bolts along with the minimum size has been specified in clause no. 3.23 of this section. However, any additional anchor bolts of higher size if found applicable during detailed Engineering shall be provided by bidder without any commercial implication.
- 1.12 Bidder shall provide adequate numbers of earthing / grounding pads for each tank. Each pad shall be made of mild steel of required size, which will be informed to the successful bidder during detail engineering stage for which no commercial implication shall be entertained by BHEL. Further, grounding of tank with the earth mat shall be in BHEL scope.
- 1.13 Internal Painting-Shall be provided as per painting specification, as specified in diffraact section ofthis specification.
- 1.14 Commissioning spares as specified under SECTION -I shall be in bidder's scope.
- 1.15 Drain pipe of seal pot and NaOH breather pots shall be provided up to the nearest drain.
- 1.16 Platforms, monkey ladder inside tank, staircase (hand railing, knee guard and toe guard (in stair case and all along the periphery of roof of the tank) etc. as per the relevant design code / good engineering practice (as indicated in the Datasheet for Condensate Storage Tanks) shall be included in bidder's scope of work. All stair tread and platforms shall be made from 8 thk. chequered plate. Roof level interconnection between CST shall be done.

2.0 SCOPE OF SERVICES

Services shall include but not be limited to the followings:

- 2.1 Design, engineering, preparation of detailed fabrication drawings, bill of material, tag and piece numbers, welding procedures etc. Stiffeners and other structural framing for supporting the tank shall be designed by the fabricator and properly shown in the fabrication drawings.
- 2.2 Erection & Commissioning of Tanks.
- 2.3 Erection of all foundation bolts / anchor bolts etc. as required for any equipment/ foundation /concrete.
- 2.4 Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of pockets, excavation & filling of earth for buried MS pipes if and as required.
- 2.5 Inspection & testing and carrying out demonstration test.
- 2.6 Painting of tank and other equipment within the battery limit.
- 2.7 Any other equipment / material / services as required to make the installation complete in all respects shall be deemed to be included in bidder's scope of work whether mentioned above or not.

3.0 TERMINAL POINTS

- Matching counter flanges for all nozzles & valves mounted on the tank and its accessories. However, counter flanges for all nozzles and valves of tank shall be provided by the bidder. Refer Condensate storage tank sketch for the same.

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4.0 EXCLUSIONS

Tank foundation & associated civil works are excluded from bidder's scope of work. However, foundation drawing along with loading data, anchor bolt details etc. shall be furnished by the successful bidder during detailed engineering stage.

5.0 DESIGN CONSIDERATIONS

5.1 The successful bidder shall furnish design calculations to BHEL during detailed engineering stage for approval along with the Xerox copies of relevant pages of authentic supporting literature e.g. Code, Hand book, National / international Standards etc. Calculation shall be necessarily done in **SI UNITS** only for the followings: -

- a) Tanks shall be designed as per IS – 803 / API – 650 Good engineering practice as applicable and referred code shall be of latest edition. However, requirement of codes and standards shall be as indicated in the Datasheet for Condensate Storage Tank.
- b) Design of roof and roof structures for vertical storage tanks shall be designed based on guidelines given in the book titled "Process equipment design" by Brownell and Young.
- d) Tank stability calculation (wind load / seismic / overturning stability) shall be done as per API – 650, latest edition. However, factors / coefficients as required for the design of tank shall be obtained from BHEL by the bidder after placement of order.
- d) Vent sizing calculation shall be done as per API – 2000, latest edition
- e) Sizing calculation for vent, NaOH / KOH breather, seal pot and breather valve.

5.2 The successful bidder shall indicate references of all the clauses indicating their page number from respective standard in the design calculation during detail engineering stage. All calculations shall necessarily be done in SI units only. All steps including formulas and abbreviations shall be clearly shown in the calculation. All inputs / assumptions shall be indicated in the first sheet of the calculation.

5.3

- a) Minimum tank plates thickness shall be as specified in the Data Sheet. Calculation for the plate thickness shall be got approved from BHEL /Customer during detailed engineering stage. However, if the addition / summation of calculated value of plate thickness (excluding tolerance on plate as per relevant IS) / nominal minimum thickness specified in the relevant design code / standard and corrosion allowance of 2 mm comes out more than 8 mm then the nearest available (higher side) plate thickness in the market shall be provided for bottom, shell and roof plates without any commercial implication. For calculating shell plate thickness IS 803 to be used.
- b) Negative tolerance on plate thickness shall not be considered in the plate thickness calculation and also shall not be provided in the tank. Only positive tolerance shall be considered.

5.4 All appurtenances and mountings shall also be designed as per relevant clauses of IS: 803 / API – 650 and as per the design code indicated in DATA SHEET for Condensate Storage Tank.



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- 5.5 Tank shall be suitably constructed for safe, proper and continuous operation under all conditions that can be expected in a plant life without undue strain, corrosion or other operating difficulties.
- 5.6 In calculating the minimum plate thickness, the specific gravity of the liquid shall not be taken less than 1.
- 5.8 Vessels seams shall be so positioned that they do not pass through vessel connections. For cylindrical vessels consisting of more than two sections longitudinal seams shall be offset.
- 5.9 Wherever possible, the inside seam weld shall be ground smooth, suitable for application of corrosion resistant primer.
- 5.10 Due consideration shall be given by the supplier for wind load and earthquake effect in the design of tanks.
- 5.11 All roofs and supporting structures shall be designed to support dead load plus a uniform live load of not less than 150 kg/m² of projected area.
- 5.12 Staircase / access ladder and hand railing shall be provided as per the relevant codes and standards.
- 5.13 Water draw off sump shall be provided as per the relevant design code, latest editions.
- 5.14 The number & size of nozzles (including flanges, counter flanges and inside piping) indicated in the sketches attached with the data sheets are tentative and bidder guidance purpose only and the same may undergo change during detail engineering stage for which no commercial implication shall be entertained by BHEL.
- 5.15 Bidder shall furnish the STAAD calculation along with the roof structure calculation during detail engineering for checking the stability of roof.
- 5.16 Provision shall be made by the bidder to minimise the air ingress in the tank through float with arrow type level gauge and details of the same shall be furnished during detail engineering stage for BHEL's approval and approved arrangement shall be provided by the bidder without any commercial implication.
- 5.17 The tank shall be designed for filled water head / atmospheric pressure and design temperature for the tank shall be as specified in the DATA SHEET for Condensate Storage Tank .
- 5.18 Bidder to note that surface cleaning shall be of Blast clean type. However Grit blasting shall be decided during detail engineering for which no commercial implication shall be entertained by BHEL.
- 5.19 Bidder to note that foundation drawing along with loading data & anchor bolt details shall be provided by bidder within two weeks' time from the LOI. **Bidder to provide minimum 24 nos., M33 anchor bolts for Condensate Storage Tank, irrespective of calculation for tank stability.** However if during calculation for tank stability if number of anchor bolt are more than 24 ,then actual number of anchor bolt to be provided.

C.

1.0 WELDING for HSD Day tank & CST tanks

- 1.1 Welding shall be in accordance with the requirement of IS: 803, 816, 817 and 823 or equivalent.

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1.2 Welding sequence shall be adopted in such a way so as to minimize the distortion due to welding shrinkage. Contractor shall indicate in his drawing the sequence of welding proposed by him, which should meet prior approval of the Engineer.

1.3 All welders shall be BHEL / customer / consultant qualified as per the approved quality plan / field quality plan which will be submitted by the successful bidder during detail engineering stage. WPS and PQR shall be submitted by the successful bidder to BHEL / customer / consultant for review and approval.

2.0 TEST AND INSPECTION

2.1 The particulars of the proposed tests and the procedure for the tests shall be submitted to the Owner / Engineer for approval before conducting the tests. The successful bidder shall submit FQP (field quality plan) and demonstration test procedure for BHEL / customer / consultant's approval during detail engineering stage. In the event of any change in the field quality plan and demonstration test procedure, the same shall be incorporated by the bidder in the document and approved document shall be adhered by the bidder without any commercial implication.

2.2 DPT / MPI on all welds (100%).

2.3 All cross / Tee joints and butt welds to be 10% Radio graphed.

2.4 For the offered tanks, fill test shall be carried out for at least 24 hours. Atmospheric storage tanks on inside surface shall be leak tested before painting.

2.5 All quality plans / checklists for various items shall be furnished during detail engineering stage for BHEL / customer's approval and any changes required by BHEL / customer shall be incorporated in the documents and adhered without any price implication. However, minimum requirement of MQP as indicated in the technical specification shall be followed. All necessary items as required for inspection and testing of the tank including instruments shall be arranged by the bidder.

3.0.0 QUALITY ASSURANCE, QUALITY PLANS, INSPECTION & TESTING PROCEDURE:

- a) The Quality plans / checklist for the previous executed jobs for the equipment's / instruments are attached under **section II**.
- b) The successful bidder shall furnish Quality Plans/ Inspection Check Lists for various item for the package in line with minimum requirement indicated in specification during detail engineering for Customer's approval.
- c) For other items for which any specific inspection requirement is not indicated in the specification but the same included in scope of work , vendor specific QPs / CLs shall be furnished by the successful bidder for Customer/Consultant's review and approval. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.
- d) The Field Quality Plan of bidder shall also be submitted by the successful bidder during detail engineering for customer's / consultant's approval. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

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- e) For flame proof actuator, motors, junction boxes, instruments etc. as per specification requirement, valid test certificate for the same shall be submitted by the vendor as part of QC documentation. In case valid test certificates are not available, necessary test shall be conducted in line with applicable standard in presence of customer and cost of such test shall be deemed to be included in the contract price

4.0.0 SUB-VENDOR ITEMS

Tentative list of makes of Sub-vendor items is enclosed under **SECTION -I**

5.0.0 DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH THE BID

The drawings and documents to be submitted with the bid shall strictly document mentioned in Document to be submitted with the bid in section-III. Any documents other than those indicated in Vol. III will not be reviewed and will not form part of contract.

6.0.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

Tentative list of drawing / document required during detail engineering is attached in Section-III. Any other drawings and documents as required by BHEL / Customer / Consultant shall be furnished by the successful bidder during detail engineering stage for which no commercial implication shall be entertained by BHEL.

7.0.0 DRAWINGS ENCLOSED WITH THE SPECIFICATION

Following drawings enclosed will form part of the specification.

- a) Main Equipment Plan: **PE-DG-425-100-M002.**
- b) P&ID for Day oil tank for Auxiliary Boiler: **PE-DG-425-166-A001.**
- c) Layout for Day oil tank farm area: **PE-DG-425-166-A002**
- d) SKETCH FOR CONDENSATE STORAGE TANK: **PE-DC-425-167-S001.**

The P&ID show the minimum requirement to be followed including minimum requirement of instruments. Any other item and instruments required (within the terminal points) to make the system complete in all respect and for satisfactory operation of the system shall also deemed to have been included by the bidder in their scope. The detailed P&I diagrams for FOHS in line with specification requirement shall be developed by the vendor during detail engineering for customer's approval and without any commercial implication to customer. Bidder to note that the while preparing PIDs after placement of order, successful bidder shall incorporate line numbers Instrument tag nos., KKS Numbering, equipment no, Line Spec, Line MOCs, legend / symbol chart, equipment capacity, relief valve capacity and set pressure, control valve capacity, range, fail position etc. in these drawing and same are subject to the customer approval.

8.0 PAINTING

System write up and customer specification to be referred for painting.

9.0 LIST OF COMMISSIONING SPARES

Section –I to be referred for Commissioning Spares

**TITLE****2x800 MW UPPUR STPP****TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM**

SPECIFICATION NO.: PE-TS-425-166-A001

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10.0.0 OTHER REQUIREMENTS

i) Site Visit before submission of offer.

Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reasons for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.

ii) Detailed erection manual for each of the equipment as well as complete system supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

iii) The O&M Manual to be submitted by the successful bidder will necessarily address the points mentioned in the checklist.

iv) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

v) In case vendor submits revised drawing/doc after approval of the corresponding drawing/doc, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at customer end, delay in review/ approval of such revised drawing beyond one month will be to customer's account.

vi) Bidder to note that the successful bidder, during detail engineering, will submit the drg. /doc through web based Document Management System in addition to hard copies to be submitted as per dwg. / document distribution schedule. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's Internal proxy setting should not block DMS application's link (<http://124.124.36.198/wrenchwebaccess/login.aspx>)

vii) DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.

For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

Viii) Bidder to review the Electrical Load list enclosed with the tender specification and give their concurrence on the same. In case of change in any load data, bidder to brought out same in their offer. Thereafter any change in the electrical load list shall be entertained only subject to its

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feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear / MCC on account of changed loads.

ix) Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".

x) Site storage and preservation manual has been placed under section -III. Bidder to note down all the requirement of storage and preservation required for several items given under this manual. Bidder shall necessarily follow all the practices given in the manual as applicable for its items/ equipment's under scope of supply.

11.0 OTHER TECHNICAL REQUIREMENTS

- 1) 15 days' time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.
- 2) Bidder to depute competent designer (s) at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL.
- 3) Bidder to assess the capability of their 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. No deviations shall be entertained.
- 4) Commercial implication includes price implication as well as delivery implication.
- 5) Handrail minimum 1000 mm high (from floor/ roof level) hand railing shall be provided around all floor/roof openings, projections/balconies, walkways, platforms, steel stairs, etc. All handrails and ladder pipes shall be 50 mm nominal bore MS pipes (medium class) Conforming to IS: 1161. Spacing of handrail post shall be limited to 1200 mm as far as possible but can be adjusted to suit the length of railing.
- 6) Type of roof for vertical cylindrical storage tanks shall be either supported cone roof or self-supporting cone roof as per latest edition of relevant design code.
- 7) Commissioning of tanks will consist of installation of all accessories of tanks as per approved drawing/specification, charging of tank, water-fill test (for minimum 24 hours after complete filling of tank), satisfactory functioning of all accessories, emptying of tank, subsequent painting of complete tanks and changing of gaskets as per specification requirement.
- 8) Bidder to furnish prices and unit price of each item of proposed tanks as per BHEL's price format only along with the final price bid.
- 9) Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL.

**TITLE****2x800 MW UPPUR STPP****TECHNICAL SPECIFICATION FOR
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- 10) All tools and plants including welding machines, crane, hydra, fork lift, batching plant etc. and instruments as required for construction, erection and commissioning, trial run and functional demonstration test at site shall be arranged by the bidder.
- 11) Bidder to furnish list of sub-vendors based on sub-vendor list enclosed with the specification during detail engineering stage for BHEL's / Customer review and approval and items shall be procured from these suppliers only.
- 12) Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges, counter flanges etc. from BHEL approved sub vendor only. No argument on this account shall be entertained.

C**1.0****SCOPE OF SUPPLY FOR AIR RECEIVER**

- 1) Accessories for air receiver like safety relief valves, fusible plugs, pressure gauges, pressure transmitter, temperature gauges, automatic drain traps shall be provided by successful bidder.
- 2) Drain piping for auto drain trap of each air receiver to the nearest drain.
- 3) Qty. are as below:
Safety relief valves = 4
Fusible plugs & Pressure gauges = 4 each
Pressure transmitter = 4
Temperature gauges = 4
Automatic drain traps = 4

2.0**SCOPE OF SERVICES FOR AIR RECEIVER**

- 1) Mounting of accessories on air receiver like safety relief valves, fusible plugs, pressure gauges, pressure transmitter, temperature gauges, automatic drain traps is in successful bidder scope of work.
- 2) E&C of drain pipe to the nearest drain.

3.0**EXCLUSION**

- 1) Air receivers are excluded from bidder's scope.
- 2) Civil work for air receivers is excluded from bidder's scope.

**TITLE****2x800 MW UPPUR STPP****TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM**

SPECIFICATION NO.: PE-TS-425-166-A001

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SECTION – I**SPECIFIC TECHNICAL REQUIREMENTS****SECTION IB – System write up (Fuel Oil Handling system)**

	2x800 MW UPPUR TPP TECHNICAL SPECIFICATION FOR FUEL OIL HANDLING SYSTEM		SPECIFICATION NO.: PE-TS-425-166-A001	
			REVISION 00	DATE: 25/10/2017
			SECTION: IB	

07.07.17	02	Resubmission for approval. Editable copy of compliance sheet attached as required	AKG	HK	PK
19.04.17	01	Resubmission for approval. Revised as per customer comments vide letter ref. no. Lr. No. SE/E/T&H(P)/E9/A1/F.Uppur-BTG/D.162/16, dt. 05.12.2016	AKG	HK	PK
Date	Rev	Description of Revision	ALT	CHD	APPD
PROJECT		2X800MW UPPUR STPP (STAGE-I,UNIT#1&2) IN RAMANATHAPURAM DISTRICT, TAMILNADU			
		CUSTOMER: TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED			
		CONSULTANT: TRACTEBEL ENGINEERING PVT. LTD.			
		MAIN CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD			
JOB No.	423	CUSTOMER DOC. No.:			
STATUS	CONTRACT	BHEL Doc. No. : PE-DC-425-166-A001			Rev: 02
PACKAGE		FUEL OIL HANDLING SYSTEM FOR AUXILIARY BOILER			
TITLE		DESIGN MEMORANDUM FOR FUEL OIL HANDLING SYSTEM FOR AUXILIARY BOILER INCLUDING • P&ID , PE-DG-425-166-A001 • CIVIL ASSIGNMENT DRAWING FOR TANK FARM DYKE AREA , PE-DG-425-166-A002			
PREPARED BY		SAURABH SINGH	-SD-	06/08/2016	
CHECKED BY		HARISH KUMAR	-SD-	06/08/2016	
APPROVED BY		PRAVEEN KISHORE	-SD-	06/08/2016	



2x800 MW UPPUR TPP
TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM

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SECTION: IB

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2	Scope of Supply & Services	3
3	Demonstration test	3
4	Painting Schedule	3
5	Layout requirement	3
6	Data Sheet of Tanks	4
6.1	Float and Board type Level Indicator	5
6.2	Pipes, Fittings, Flanges & Accessories	5
6.3	Valves	6
7	Mandatory Spares	6
8	Terminal Point	6
9	Exclusion	6
10	Drawings Enclosed	6
a	PE-DG-425-166-A001, P&ID	7
b	PE-DG-425-166-A002, Tank farm area layout	8
c	Annexure-I for Painting of Tanks	9



2x800 MW UPPUR TPP
TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM

SPECIFICATION NO.: PE-TS-425-166-A001

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SECTION: IB

1.0 Intent

- 1) The purpose of this document is to bring out clarity with regard to the following:
 - a) Scope of Design, engineering, supply and exclusions for Fuel oil handling system for auxiliary boiler.
 - b) Major technical requirements of various items covered under this package

2.0 Scope of supply & services

1) Scope of Supply

Scope of supply shall comprises of following:

- a) One (1) nos. of fixed roof type Mild Steel HSD Day tank of effective capacity 80 cum each along with accessories as indicated in tank Sketch.
- b) Valves and Instrumentation as indicated in Sketch.

2) Scope of Services

- a) Erection & Commissioning of HSD day tank along with accessories

3) CCOE approval for HSD day tank.

3.0 Demonstration Test

Water fill test shall be carried out for at least 24 hrs. at site during commissioning of the tanks as demonstration test.

4.0 Painting Schedule

Painting of tanks (inside, underneath & outside), structural steel, piping, stairways & the Color coding for the same shall be as per **ANNEXURE-I** given at the end of this document.

5.0 Layout Requirements

- 1) System layout shall conform to the requirements of the Indian Petroleum Act 1934 & Petroleum Rules 2002 / OISD-118. FOHS layout is shown in drawing titled Layout of Fuel Oil Area enclosed with this Design Memorandum. Based on this final layout during detail engineering will be prepared.
- 2) As per OISD-118, Table-1, HSD storage tank shall be maintained at a distance of 90m from boiler area. Hence HSD day tank shall be located near main dyke area / pressuring pump house. Customer to provide space of 18M x 18M neat to main dyke area (however at least 30M apart).

BHEL PEM	DATA SHEET FOR LDO DAY TANK FOR AUXILIARY BOILER		
	PROJECT TITLE: 2X800MW UPPUR TPP		REV NO: 02
1	SERVICE IDENTIFICATION	LDO DAY TANK FOR AUXILIARY BOILER	
2	CAPACITY (EFFECTIVE) (m ³)	80	
3	NUMBER REQUIRED	1 No .	
4	STORAGE MEDIUM	LDO/HSD	
5	TYPE	VERTICAL, CYLINDRICAL	
6	TENTATIVE SIZE	DIA. 6.0 MX Ht. 4.5M	
7	PRESSURE CLASS	DESIGN FOR FILLED WATER HEAD / ATOMSPHERIC	
8	MATERIAL OF CONSTRUCTION	MILD STEEL TO IS:2062	
9	DESIGN TEMPERATURE	60 ⁰ C	
10	LOCATION OF INSTALLATION	OUTDOOR	
11	DESIGN & CONSTRUCTION CODE	IS803 / API650	
12	CORROSION ALLOWANCE (CA)	1.8 MM (AS PER IS 803 CLAUSE NO. B-4)	
13	MIN. PLATE THICKNESS INCLUDING CA (IN MM)	BOTTOM – 8, SHELL - 6, ROOF- 6	
14	JOINT EFFICIENCY	0.85	
15	MATERIAL OF CONSTRUCTION FOR PLATES	IS2062 GR. B	
16	MATERIAL OF CONSTRUCTION FOR STRUCTURES (ANGLE, CHANNEL, BEAM, BAR AND FLAT)	IS2062 GR. A	
17	HANDRAIL		
17.1	SIZE OF PIPE	50 NB	
17.2	MATERIAL	ERW PIPE AS PER IS:1239 (MEDIUM GR.),PART-I, GALVANIZED	
18	NOZZLE CONNECTIONS REQD /	AS PER ENCLOSED SKETCH	
19	NOZZLE MATERIAL	API 5L GR. B ERW/ASTM A 106 GR.B	
20	VALVES MATERIAL	AS PER VALVE DATASHEET	
21	MATERIAL FOR PIPES & FITTINGS	AS PER DATASHEET OF PIPES AND FITTINGS	
22	STAIRCASE FOR TANKS:	WE ARE PROVIDING SPIRAL STAIRCASE ALONG THE SHELL OF TANKS .	
23	WIDTH OF PLATE	WIDTH OF THE PLATE CAN BE CONSIDERED OUT OF THESE 1500/1800/2000. AS PER IS: 803	
24	SURFACE PREPARATION		
			AS PER ANNEXURE-I ,PAINTING SCHEDULE FOR TANK
25	INSIDE PROTECTION	➔	
26	EXTERNAL PAINTING		
27	MANHOLE	TWO (2) NOS. ONE ON SHELL & OTHER ON ROOF	
	NOTE : ALL OTHER GENERAL TECHNICAL REQUIREMENTS / ACCESSORIES & SPARES AS PER CUSTOMER TENDER SPECIFICATION		



2x800 MW UPPUR TPP
TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM

SPECIFICATION NO.: PE-TS-425-166-A001

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6.1 Datasheet of Float and Board type Level Indicator

- As per Tender Specification, Volume V clause no. 3.03.14 of C & I System.

6.2 Pipes, Fittings, Flanges & Accessories

S. No.	Items	Material Standard/ Other details	Dimension Standard
1.	Pipe		
A.	FUEL OIL		
	Type of end connection (Pipe to pipe & Pipe to equipment)	65 NB & above: API-5L Gr.B or A106 Gr.B Butt Welded for pipe; near equipment, this shall be of flanged type 50Nb and Below: Socket welding; near equipment this may be either socket welded or flanged.	Butt Welding - ANSI B 16.25 Socket Welding - ANSI B 16.11 Flanged- ANSI B 16.5 /BS 4504 / IS 6392
2.	FITTINGS & FLANGES		
A.	FUEL OIL		
a)	Fittings (Elbow, Tees and Reducers) 65mm NB & larger A 234 or WPB BW ENDS ANSI –B-16.25 50mm NB & below A105 socket weld ends ANSI-B16.11		
b)	Flanges		
	All sizes	Fabricated from IS 2062 plate/ASTM A 105	ANSI B16.5 Class- 150 lb.
3.	GASKETS		
a.	Fuel Oil	Teflon	
b.	Water Service	Teflon	
4.	Bolts / Studs	ASTM A 193 Gr. B7	
5.	Nuts	ASTM A 194 Gr 2H	

6.3 Datasheet of valve

Gate Valves	
	50 mm NB & large
Code	API-600
Body & bonnet	A-216 Gr. WCB
Seat/trim	11 to 13% chrome steel
Bolts for bonnet	A 193 Gr. B7
Nuts for bonnet	A 194 Gr. 2H
Globe valve	
Code	BS-1873
Body & bonnet	A216 Gr. WCB
Trim	Chrome steel (Brinell hardness B-250 min) as per AISI-431
Bolts for bonnet	A 193 Gr. B7
Nuts for bonnet	A 194 Gr. 2H
Check valves:	
Code	BS-1868
Body & bonnet; Trim	Same as per globe valves above
Seating surfaces	Same as per globe valves above



2x800 MW UPPUR TPP
TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM

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Ball valves:	
Code	BS-5351Teflon sealed full bore fire safe design
Body	A216 Gr. WCB
Ball	Stainless Steel AISI-316
Plug valves (oil service only)	
Code	API-599 self-lubricated wrench operated with an easy visible port position indicator
Body	A216 Gr. WCB
Plug	Hardened carbon steel

7.0 Mandatory Spares

Mandatory spares shall be provided as indicated below:-

S.no	DESCRIPTION OF ITEMS	QUANTITY
1	Level indicator for HSD day oil tank	1 No.
2	Level transmitter for HSD day oil tank	1 No.
3	Motorized valve actuator	1 No.

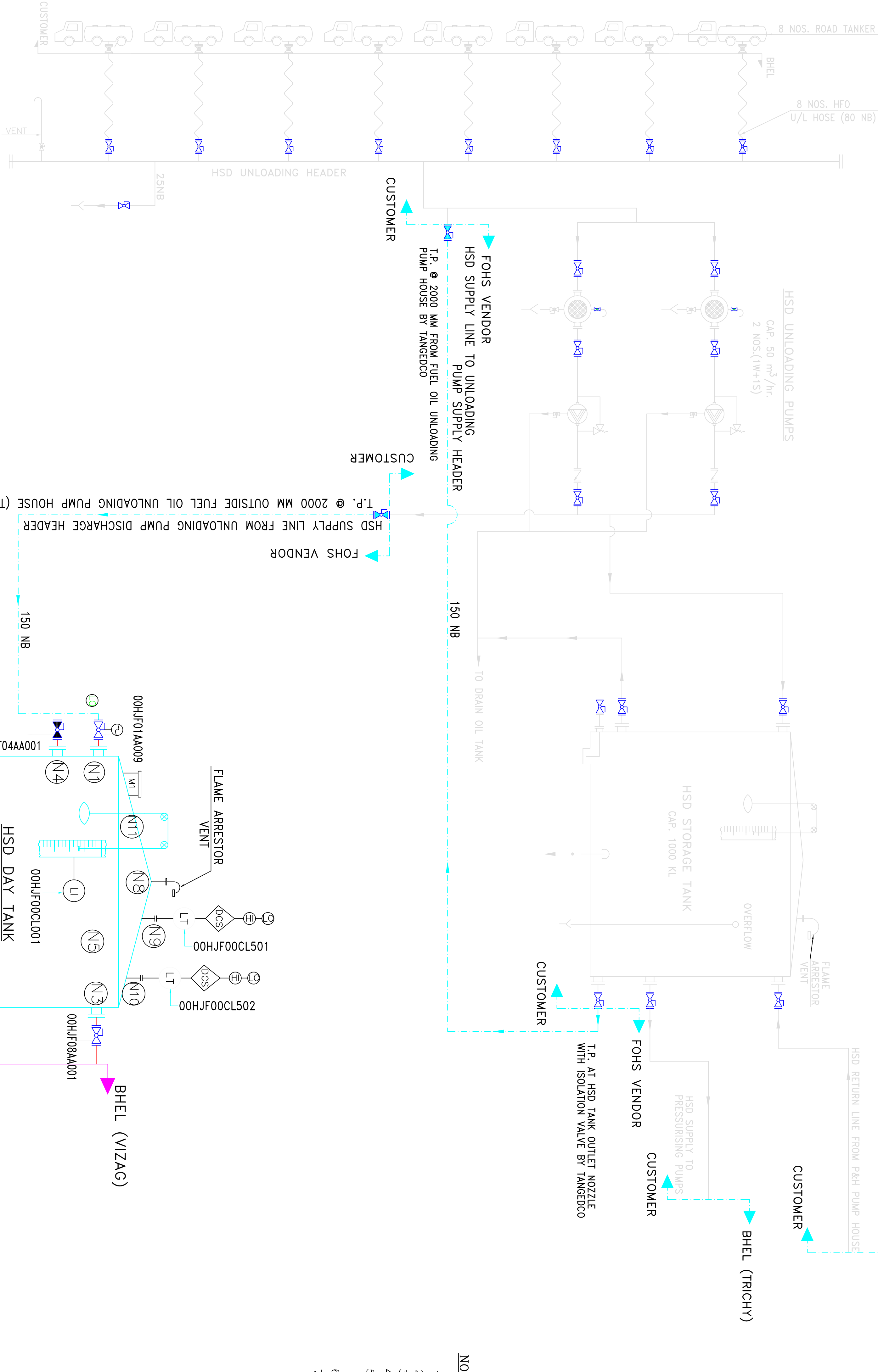
8.0 Drawings Enclosed

Following drawings / Sketches are enclosed:-

- a) PE-DC-423-166-A001,P&ID (R00)
- b) PE-DC-423-166-A002,Tank farm area layout (R00)
- c) Annexure-I for Painting of Tanks (R01)
- d) Annexure-A ((plate shell thickness calculation)
- e) Annexure-B (Tank sizing calculation and capacity calculation)
- f) Annexure-C (Dyke size calculation)

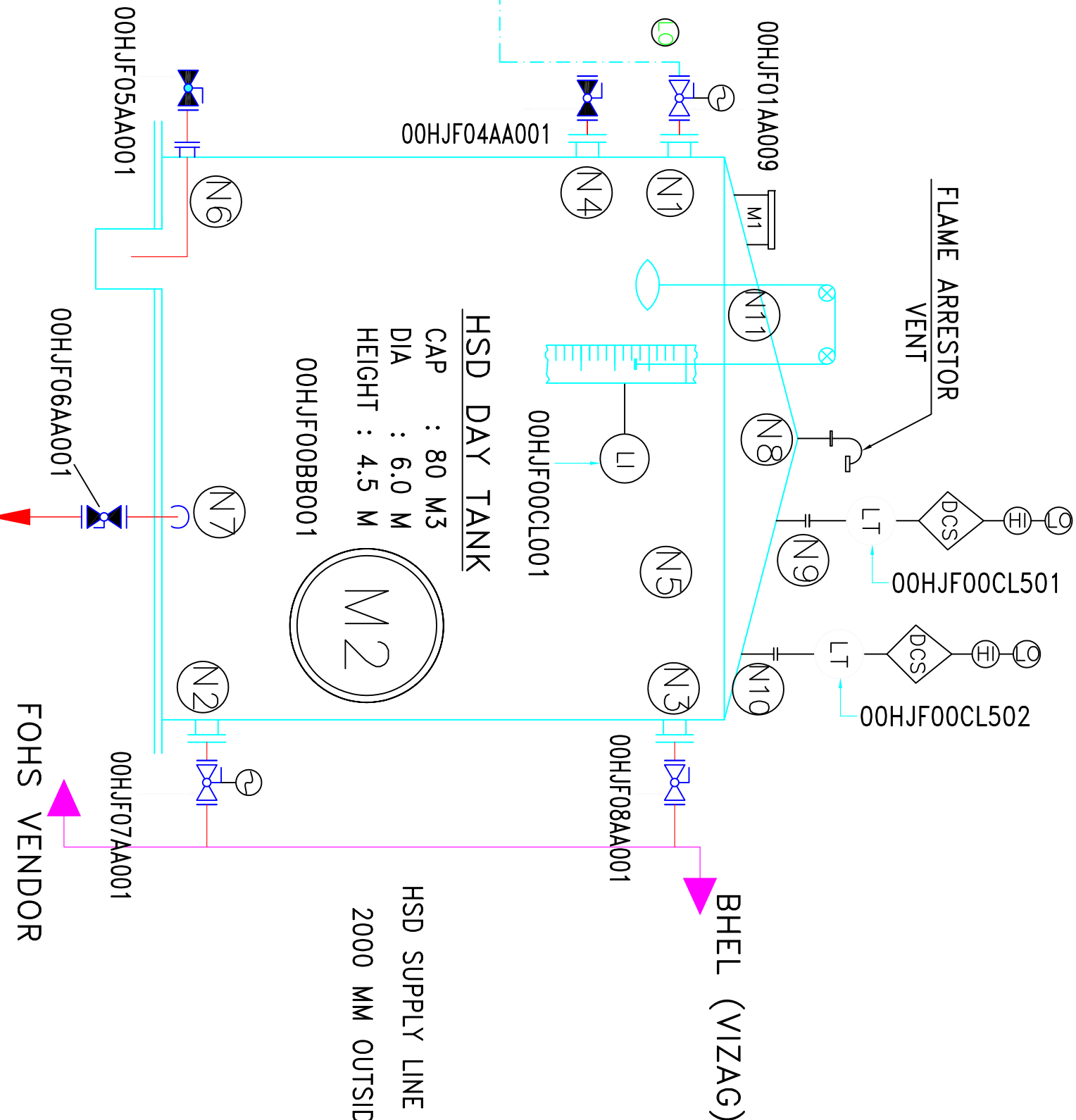
LEGEND	
SYMBOL	DESCRIPTION
Ⓢ	LEVEL TRANSMITTER
Ⓢ	LEVEL INDICATOR (FLOAT & BOARD TYPE)
Ⓢ	BALL VALVE
Ⓢ	BALL VALVE (N/C)
Ⓢ	LOCAL DRAIN
Ⓢ	SIGNAL TO DCS/ LO OR HI)
Ⓢ	ON/OFF LIMIT SWITCH
Ⓢ	MOTORIZED VALVE

- NOTES:
- VENTS AND DRAINS SHALL BE PROVIDED AT THE HIGHEST AND LOWEST POINTS RESPECTIVELY.
 - TANK DRAIN VALVES ARE IN NORMALLY CLOSE CONDITION.
 - HSD DAY TANK DYKE AREA IS LOCATED NEAR TO MAIN TANK DYKE AREA, HOWEVER 30M APART.
 - LEVEL INDICATOR FLOAT & BOARD TYPE SHALL BE PROVIDED ON TANK.
 - CONTROL OF MOTORIZED VALVE SHALL BE IN CUSTOMER SCOPE.
 - HOWEVER CABLING BY FOHS VENDOR.
 - LT SHALL BE TERMINATED TO CUSTOMER SCOPE PLC / DCS PANEL.
 - FUEL OIL PIPE OUTSIDE HSD DAY TANK SHALL BE FREE ISSUED TO FOHS VENDOR BY BHEL. HOWEVER E&C OF FUEL OIL PIPING IS IN FOHS VENDOR SCOPE.



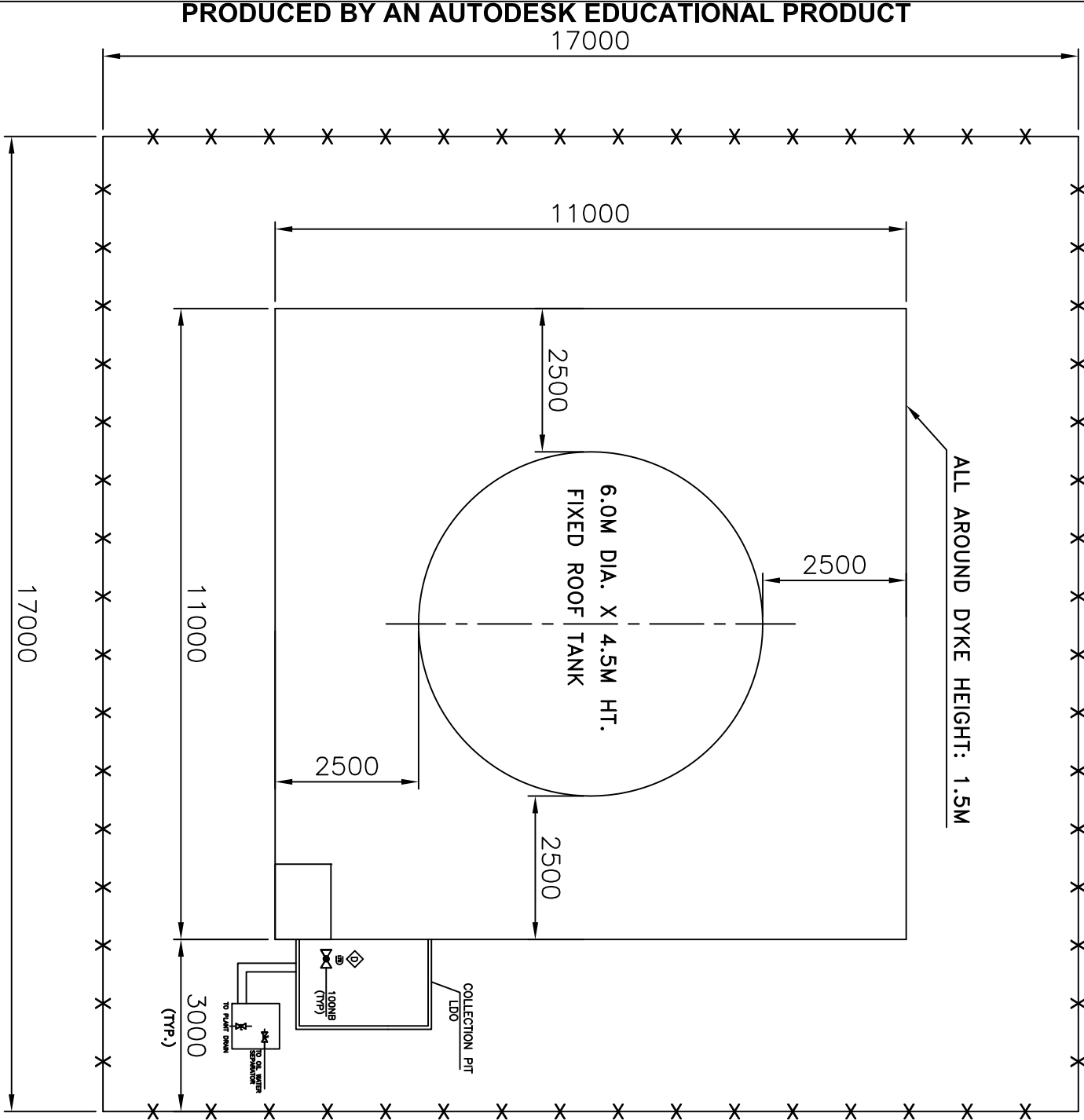
NOZZLE DETAILS:

NOZZLE No.	SIZE	QTY.	SERVICE
N1	150 NB	1	INLET
N2	100 NB	1	OUTLET
N3	50 NB	1	RETURN LINE
N4	80 NB	1	OVERFLOW
N5	-	1	FOR FIRE PROTECTION (AS PER CUST. REQUIREMENT)
N6	50 NB	1	DRAIN WITH ISOLATION VALVE
N7	80 NB	1	SPARE OUTLET WITH BLIND
N8	100 NB	1	FLAME ARRESTOR
N9	80 NB	1	LEVEL TRANSMITTER
N10	80 NB	1	LEVEL TRANSMITTER
N11	40 NB	1	LEVEL INDICATOR
M1	600 NB	1	ROOF MANHOLE WITH COVER
M2	600 NB	1	SHELL MANHOLE WITH COVER



PROJECT	2X800MW UPPUR STPP (STAGE-1,UNIT#1&2) IN RAMANATHAPURAM DISTRICT, TAMILNADU		
CUSTOMER	TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED		
CONSULTANT	M/s LAHMEYER INTERNATIONAL (INDIA) PVT LTD		
CONTRACT	425		
CONTRACTOR	BHARAT HEAVY ELECTRICALS LTD		
PROJECT ENGINEERING MANAGEMENT	PROJECT ENGINEERING MANAGEMENT		
DRN.BY	CHD.BY	APP.DY	

TITLE	P&ID FOR HSD DAY TANK FOR AUXILIARY BOILER		
DEPT.	SCALE NTS.	DRAWING NO.	
DATE	DATE	DATE	
DATE	DATE	DATE	



BHARAT HEAVY ELECTRICALS LTD.

POWER SECTOR

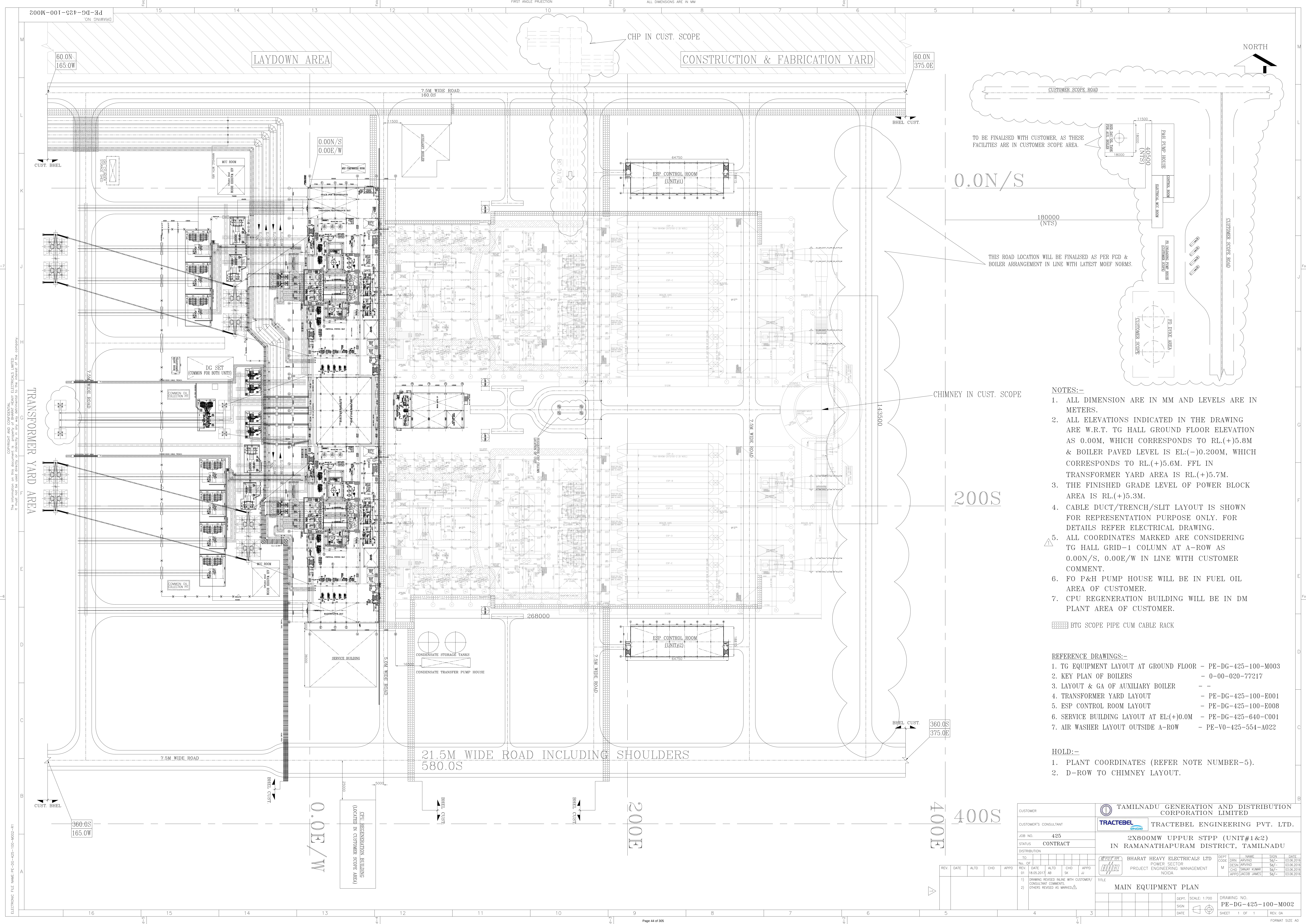
PROJECT ENGINEERING MANAGEMENT

Noida-201301

PACKAGE : FUEL OIL HANDLING SYSTEM

2X800 MW UPPUR TPP

DRN.	ARG.	02.11.17	DATE	TITLE
CHKD.	HK.	02.11.17	DATE	
APPD.	SKB	02.11.17	DATE	
DEPT.	NAME	DATE		
A	SCALE :			LAYOUT FOR DAY OIL TANK FARM AREA
				BHFL DRG. NO. : PE-DG-425-166-A002
				SHEET NOS REV.
				1 OF 1



- NOTES:-
1. ALL DIMENSION ARE IN MM AND LEVELS ARE IN METERS.
 2. ALL ELEVATIONS INDICATED IN THE DRAWING ARE W.R.T. TG HALL GROUND FLOOR ELEVATION AS 0.00M, WHICH CORRESPONDS TO RL.(+).5.8M & BOILER PAVED LEVEL IS EL.(-).0.200M, WHICH CORRESPONDS TO RL.(+).5.6M. FFL IN TRANSFORMER YARD AREA IS RL.(+).5.7M.
 3. THE FINISHED GRADE LEVEL OF POWER BLOCK AREA IS RL.(+).5.3M.
 4. CABLE DUCT/TRENCH/SPLIT LAYOUT IS SHOWN FOR REPRESENTATION PURPOSE ONLY. FOR DETAILS REFER ELECTRICAL DRAWING.
 5. ALL COORDINATES MARKED ARE CONSIDERING TG HALL GRID-1 COLUMN AT A-ROW AS 0.00N/S, 0.00E/W IN LINE WITH CUSTOMER COMMENT.
 6. FO P&H PUMP HOUSE WILL BE IN FUEL OIL AREA OF CUSTOMER.
 7. CPU REGENERATION BUILDING WILL BE IN DM PLANT AREA OF CUSTOMER.
- BTG SCOPE PIPE CUM CABLE RACK

- REFERENCE DRAWINGS:-
1. TG EQUIPMENT LAYOUT AT GROUND FLOOR - PE-DG-425-100-M003
 2. KEY PLAN OF BOILERS - 0-00-020-77217
 3. LAYOUT & GA OF AUXILIARY BOILER -
 4. TRANSFORMER YARD LAYOUT - PE-DG-425-100-E001
 5. ESP CONTROL ROOM LAYOUT - PE-DG-425-100-E008
 6. SERVICE BUILDING LAYOUT AT EL.(+).0.0M - PE-DG-425-640-C001
 7. AIR WASHER LAYOUT OUTSIDE A-ROW - PE-V0-425-554-A022

- HOLD:-
1. PLANT COORDINATES (REFER NOTE NUMBER-5).
 2. D-ROW TO CHIMNEY LAYOUT.

CUSTOMER		TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED									
CUSTOMER'S CONSULTANT		TRACTEBEL ENGINEERING PVT. LTD.									
JOB NO.		425									
STATUS		CONTRACT									
DISTRIBUTION		2X800MW UPPUR STPP (UNIT#1&2) IN RAMANATHAPURAM DISTRICT, TAMILNADU									
TO		Bharat Heavy Electricals Ltd									
REV		DATE	AB	SK	APPD	DATE	AB	SK	APPD	DATE	AB
1)		18.05.2017	AB	SK	APPD	18.05.2017	AB	SK	APPD	18.05.2017	AB
2)		DRAWING REVISED IN LINE WITH CUSTOMER/CONSULTANT COMMENTS/OTHERS REVISED AS MARKED									
TITLE		MAIN EQUIPMENT PLAN									
DEPT		POWER SECTOR									
SIGN		PROJECT ENGINEERING MANAGEMENT									
DATE		Noida									
SCALE		1:700									
DRAWING NO.		PE-DG-425-100-M002									
SHEET		1 OF 1									
REV		0A									

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ELECTRONIC FILE NAME: PE-DG-425-100-M002-R1



FUEL OIL HANDLING SYSTEM

DM. NO. PE-TS-425-166-A001

REVISION 00

DATE: 25/10/2017

2x800 MW UPPUR TPP

ANNEXURE-I

Painting specification for **HSD** Day Oil Tank

	Tank inside surface	Tank outside surface	Tank underneath surface	Structural steel work, piping, steel floors, & stairways
Surface preparation	Blast clean to SA 2.5	Blasting cleaning to SA 2.5	Wire Brushing/ hand tool cleaning to ST-2.	Abrasive blasted to Sa 2½.
Primer	Two (2) layers of zinc phosphate epoxy primer, total DFT >75 micron	Two (2) layers of zinc phosphate epoxy, total dry film thickness 75 micron each.	2 coats of high build Coal tar epoxy suitably pigmented (2 pack), DFT: 80-100 microns each coat.	2 coat of Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each Primer shall be 60 microns.
Intermediate coat	2 pack high build epoxy, DFT 80 micron	One (1) layer 2 pack high build epoxy polyamide MIO, DFT 100µm." one layer, 2 packs of zinc phosphate epoxy, Total FT 100 microns.	N. A.	Two intermediate MIO Epoxy paint, and one top polyurethane coating shall be applied. Dry film thickness of each intermediate coat shall be 90 microns
Finish	Two pack silicon acrylic DFT 150 micron	Two (2) finishing coats of chlorinated rubber paint in approved shades at 50 microns DFT each coat in approved shades.	N. A.	Polyurethane coating shall be 30 microns. The under coat and finish coat shall be of different tint to distinguish the same from finish paint.
Total DFT	305 microns	275 microns	160 – 200 microns	330

Note: - Handrail shall be hot dip galvanizing as per IS 4736.**SUGGESTED COLOUR CODES FOR PAINTING** (Ref: Vol II, Ch-6 Painting clause No.6.8)

NO. ITEM /SERVICE	COLOUR	IS-5	COLOUR(BAND)	IS -5
Light oil (HSD)	Light brown	410	Brilliant green	221

Annexure-A (plate shell thickness calculation)

Tank design			
DATE: 07.07.2017			
VERTICAL, CYLINDRICAL & CENTER COLUMN SUPPORTED FIXED CONE ROOF TANK AS PER IS 803/API650.			
Sl. No.	SPECIFICATIONS	UNITS	VALUES
A.1.0.	Input Design Data		
1	Quantity of Tank	Nos.	1
2	Diameter, D	m	6
3	Total Tank Height of Shell, H _t	m	4.5
4	Maximum Design Liquid Level, H _l	m	3.28
6	Nominal Capacity, Q _t	m ³	127.24
9	Design Specific Gravity, G	-	1
10	Design Density of liquid, ρ	kg/m ³	1000
11	Design Pressure, P	mLC	Hydrostatic Head
12	Vacuum Pressure, V _p	kg/m ²	50
13	Design Temperature, T	°C	60
14	Corrosion Allowance, C	mm	1.8
15	Joint Efficiency Factor, E	-	0.85
16	Radiography Examination		Spot Radiography
17	Material of Construction		IS 2062 Gr. B
18	Maximum Allowable working Stress, σ _s	kg/cm ²	1680
19	Width of Shell Plates, W _s	m	1.5
20	Width of Bottom Plates, W _b	m	1.5
21	Width of Roof Plates, W _r	m	1.5
22	Yield Stress Minimum, σ _y	MPa	240
Table 2, Page no.4 IS 2062:2006			
B.0.	DETAILED CALCULATIONS.		
B.1.0.	Calculation of Shell Plate Thickness.		
	Minimum thickness as per specification		6
	Number of Shell Courses	Nos.	3
B.1.1	Thickness of 1 st Course, $t = (50 \times G \times D \times (H-0.3)/\sigma_s \times E) + C.A$		
	Course Under consideration from bottom of tank, n		1
	Height from the Bottom of course under consideration to the top of curb angle, $H = H_t - ((n-1) \times W_s)$	m	4.5
	Thickness of 1 st Course, t	mm	2.39
	Thickness for the first course is	mm	6
	However provided thickness for the first course is		6
B.1.2	Thickness of 2 nd Course, $t = (50 \times G \times D \times (H-0.3)/\sigma_s \times E) + C.A$		
	Course Under consideration from bottom of tank, n		2
	Height from the Bottom of course under consideration to the top of curb angle, $H = H_t - ((n-1) \times W_s)$	m	3
	Thickness of 2 nd Course, t	mm	2.07
	Thickness for the second course is.	mm	6
	However, provided thickness for the second course is.		6
B.1.3	Thickness of 3 rd Course, $t = (50 \times G \times D \times (H-0.3)/\sigma_s \times E) + C.A$		
	Course Under consideration from bottom of tank, n		3
	Height from the Bottom of course under consideration to the top of curb angle, $H = H_t - ((n-1) \times W_s)$	m	1.5
	Thickness of 3 rd Course, t	mm	1.76
	However provided thickness for the third course is.	mm	6
	However provided thickness for the third course is.		6
B.2.0			
	As per Clause No. 6.2.1(a), Page 17 of IS 803; All Bottom Plate of tank, uniformly resting on the ground, shall have a minimum nominal thickness of 6 mm, But 8mm thickness shall be provided for bottom plate		8
B.3.0	Roof Plate Thickness.		
	As per Clause No. 6.4.2.2, Page 36 of IS 803; Minimum nominal thickness of roof plate shall be 5 mm, But 6 mm thickness shall be provided for roof plate		6

ANNEXURE-B

TANK SIZING CALCULATION FOR AUXILIARY BOILER

Sl.No.	Tank parameter	DAY OIL TANK	
1	No of tanks	1	
2	Gross Capacity (m ³)	127.2	Gross Vol= $3.14*d*d*h/4$
4	Internal Dia (d) (m)	6	
5	Height of the tank(h) (m)	4.5	
6	Height of Curb angle (mm)	65	
7	Diameter of overflow nozzle (mm) (D)	168	Considering inlet nozzle of size 100NB.Customer to inform the inlet size.
8	Height of reinforcement above nozzle(mm) (D/2)	84	
9	Distance maintained from the bottom of Overflow nozzle to HIGH Level (h ₁)	150	
10	Additional Margin considered (10% of (D+D/2+h ₁)) (M)	40.2	
11	Size of the Lowest Nozzle (NB)	114	100NB
12	Distance from Bottom of Tank to lowest tank nozzle centre (h ₂) (As per IS:803, Table 10, Regular Type) (mm)	230	
13	Height from the centre of the Nozzle to the top of nozzle (h ₃) (mm)	57	
14	Height of "LOW WATER LEVEL" above the lowest Nozzle (h ₄)(mm)	150	
15	Height to be deducted from the over height for effective height (h ₁ +h ₂ +h ₃ +h ₄ +D+D/2+M)	944	
16	Effective Height (H)	3.6	
17	Effective Capacity (m ³)	100.49	Effective vol. = $3.14*d*d*(H)/4$

Annexure-C			
Dyke area calculation for One No. HSD DAY TANK 80 CUM			
No. of HSD tanks	1		
dia of tank	6		
ht of tank	4.5		
height upto tank overflow	3.6		
Volume to be captured	101.74	103.7707	considering 2% margin
dia of HSD foundation	7		
height of HSD foundation	1		
length of dyke	11		
width of dyke	11		
height of dyke	1.3		
dead volume of HSD foundation	38.47		
dead vol of HSD tanks upto dyke wall height	8.53		
Dyke area volume	157.3		
deleted vol.	47.00		
Effective volume of tanks	110.30		
Height of dyke is with 200mm free board as per OISD	1.5		

**TITLE****2x800 MW UPPUR STPP****TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM**

SPECIFICATION NO.: PE-TS-425-166-A001

REV.: 00

Section: IC

Date: 25/10/2017

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SECTION – I**SPECIFIC TECHNICAL REQUIREMENTS****SECTION IC – System write up (Condensate storage tank)**



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13/10/2017	03	Revised as per comment dt. 09.10.2017	AKG	HK	HK
04/07/2017	02	Revised as per comment vide Lr. No. SE/E/T&H(P)/E9/A1/F.Uppur -BTG/D. 164/17, dt. 18.06.2017	AKG	HK	HK
09/03/2017	01	Document revised as per the customer comment. Marked as	SS	HK	HK
Date	Rev	Description of Revision	ALT	CHD	APPD
PROJECT		2X800 MW UPPUR TPP			
		CUSTOMER TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED			
		CONSULTANT TRACTEBEL ENGINEERING PVT. LTD.			
		BHARAT HEAVY ELECTRICALS LTD PS-PEM, PPEI-BUILDING, SECTOR-16A, PLOT NO. 25, NOIDA-201301			
JOB No.	425				
STATUS	CONTRACT	BHEL Doc. No: : PE-DC-425-167-A001			Rev: 03
PACKAGE		MISC TANKS- SITE FABRICATED			
TITLE		DATA SHEET FOR MISC TANKS (SITE FABRICATED)- CONDENSATE STORAGE TANK			
PREPARED BY		SAURABH SINGH	-SD-	10/08/2016	
CHECKED BY		HARISH KUMAR	-SD-	10/08/2016	
APPROVED BY		PRAVEEN KISHORE	-SD-	10/08/2016	



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5	Painting Schedule	3
6	Data Sheet of Tanks and other BOI's	4
6.1	Datasheet of Miscellaneous Tank	4
6.2	Float and Board type Level Indicator	5
6.3	Pipes, Fittings, Flanges & Accessories	6
6.4	Valves	6
7	Sub-Vendor Items / Inspection Categorization List	7
8	Mandatory Spares	7
9	Drawings Enclosed	7
11	PE-DC-425-167-S001, Condensate Storage Tank Sketch	8
12	Annexure-I for Painting of Tanks	9
13	Annexure-II for Inspection Categorization List for Bought Out Items	10
14	Annexure-III for Tank design calculation for plate thickness.	11



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1.0 Intent

- 1) The purpose of this document is to bring out clarity with regard to the following:
 - a) Scope of Design, engineering, supply and exclusions for Miscellaneous Tanks – Site Fabricated
 - b) Major technical requirements of various items covered under this package

2.0 Interfacing Drawings:**1) BHEL PEM- Mechanical System Engineering:**

- a) PE-DG-425-100-N106, P&ID for condensate Transfer System

3.0 Scope of supply & services**1) Scope of Supply**

Scope of supply shall comprises of following:

- a) Two(2.0)nos. of fixed roof type Mild Steel Condensate storage tank of capacity 1200 cum along with accessories as indicated in tank Sketch.
- b) Valves and Instrumentation as indicated in Sketch.

2) Scope of Services

- a) Erection & Commissioning of Condensate storage tank along with accessories

4.0 Demonstration Test

3

Water fill test shall be carried out for at least 24 hrs at site during commissioning of the tanks as demonstration test.

5.0 Painting Schedule

Painting of tanks (inside, underneath & outside), structural steel, piping, stairways & the Color coding for the same shall be as per **ANNEXURE-I** given at the end of this document.



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6.0 Data Sheet of Tanks and other BOI's**6.1 Datasheet of Miscellaneous Tank (Condensate Storage Tanks)**

S. No	CHARACTERISTICS	TANKS
1.	No. of tanks & capacity	Two (2) Nos. 1200 cum
2.	Type of construction	Vertical cylindrical storage tank
3.	Tank Dimensions	13.0 m dia x 10.5m ht
4.	Design & construction code	IS803 / API650
5.	Corrosion allowance (CA)	1.8 mm
3	6. Min. Plate thickness including CA (in mm)	Refer Annexure-III
	7. Joint efficiency	0.85
	8. Material of construction for Plates	IS2062 Gr. B
	9. Material of construction for Structures (Angle, Channel, Beam, Bar and Flat)	IS2062 Gr. A / B
	10. Handrail	
	10.1. Size of pipe	50 NB
	10.2. Material	ERW pipe as per IS:1239 (Medium Gr.), Part-I, Galvanized
	10.3. Dimension standard	ANSI 36.10, plain ends
	11. Material for Valves, Pipes & fittings	As per DS of valves, Pipes and fittings given below
	12. Other accessories to be provided with tank	Seal pot & NaOH breather pots
3	13. Dip Hatch	Not applicable (to avoid atmospheric air to come in contact with DM water)
	14. Width of Plate	Width of the plate can be considered out of these 1500/1800/2000. As per IS803, minimum course width is 1500mm unless agreed otherwise mutually.
	15. Internal Ladder for Tanks:	Spiral staircase shall be provided along the external surface of tank shell and monkey ladder on internal surface shall be provided. Two nos. Manhole i.e. one on the tank roof & other one on tank shell shall be provided.
	16. Operating/Design Pressure	Atmospheric/ Hydrostatic head (Full of water)
	17. Operating/Design Temperature	40°C / 50°C
	18. Test Pressure	Water fill test (Full of water)

NOTE:



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1. All the tanks shall be designed with **IS803/API 650/IS10987**.
2. Top landing platforms shall be covered with steel grating with handrail and toe plate and shall not be less than 800 mm wide.
3. Tank vents shall be sized in accordance with API 2000.
4. Tank inlet pipes shall run up to the bottom to avoid agitation.
5. For DM water services, complete erection Hardware material shall be SS316 only.
6. A circumferential Drain shall be provided around CS Tank and the same may be connected to plant drain.
7. Tank bottom to paved level pedestal height shall be min. 1000 mm.
8. Level transmitter shall be non-contact ultrasonic type.

3

6.2 Float and Board type Level Indicator (Ass per Cl. no. 3.03.22, Vol.-V)

2

S.NO.	COMPONENT	DESCRIPTION
1	Type	Mechanical Type (Float Operated)
2	Float Material	SS316 having 2 nos. Guide wires
3	Float Wire Pulley	Shall comprise of 2 nos. Cast Aluminium Pulley hosing Assembly with SS 304 pulley and pulley shaft. Steel ball bearings shall be provided in pulley housing for easier float movement. Float wire material shall be SS316L. Between 2 pulleys, 1" NB G.I. short pipe with tentative Length.
4	Guide wire Assembly	CS chamber with spring and adjuster having 1" Class 150 ANSI RF MS flange. Guide wire rope shall be SS316L.
5	Counter Weight	MS counter – weight with Aluminium Pointer and Brass assembly Pull Chain.
6	Scale	SS 316/Aluminium material in mm with 1 % accuracy.
7	Nozzle Details	For float wire pulley assembly, one tapping and for guide. wire assembly two tapping at the top of the tank; Size 1" NB (Top Mounting Type)
8	Process Connection	Flanged as per ANSI B 16.5 to suit 1" NB nozzle (Nozzle length - 150 mm for float wire, 100 mm for guide wire)
9	Accessories (to be supplied with the instrument	
10	Counter flange	All mating Flanges, Nozzle
11	Mounting Accessories	All mounting accessories
12	Tag Plate	To be provided (material SS316)
13	Quantity	Two (2) No., One for each tank



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6.3 Pipes, Fittings, Flanges & Accessories

S.No.	Description	Material Standard	Dimensional Standard
1.0	SS Pipes		
1.1	50 NB and below	Stainless steel pipe as per ASTM A-312, Gr. 304 , Seamless, Sch. 40S	As per ANSI B-36.19, socket welded
1.2	65 NB and above	Stainless steel pipe as per ASTM A-312, Gr. TP-304, Seamless, Sch.10S	As per ANSI B-36.19, BW ends as per ANSI B16.25
2.0	SS Fittings(Elbow, Tees & Reducers)		
2.1	50 NB and below	Forged Stainless steel as per ASTM A-182, F-304	ANSI B 16.11, S/W ends
2.2	65 NB and above	Stainless Steel as per ASTM A-351, CF8	ANSI B 16.9, B/W ends
3.0	SS Flanges		
3.1	For SS Pipes up to 50 NB	ASTM A182 F304	ANSI B16.5, RF
3.2	For SS Pipes above 50 NB	ASTM A403 Gr. 304	ANSI B16.5, FF
4.0	Gasket for SS fittings		
4.1	Up to 50NB	SS jacketed CAF with superior oil / resistance	ANSI B 16.21
4.2	Above 50NB	PTFE (TEFLON)	ANSI B 16.21
5.0	Bolts & Nuts		
5.1	Wherever applicable in all the tanks.	ASTM A-193, Gr. B7 for Bolts ASTM A-194, Gr. 2H for Nuts	ASTM A-193 / A-194

6.4 Valves

S.NO.	COMPONENT	DESCRIPTION
1.	Body & Bonnet	ASTM A182 Gr.F304 (50NB & below) ASTM A351 Gr.CF8M (50NB above)
2.	Wedge & Seat ring	ASTM A182 Gr.F304 (50NB & below) ASTM A351 Gr.CF8M (50NB above)
3.	Trim	ASTM A182 Gr F304
4.	Rating	Class 800 (50NB & below) Class 150 (50NB above)
5.	Ends	SW to B16.11 (50NB &below) Flanged to B16.5 (50NB above)
6.	Design Standards	B16.34 / API600 for Gate valve B16.34 / BS1873 for Globe valve
7.	Testing standards	API 598 for all valve (All sizes)
8.	Bolts & Nuts	A193 Grb7 & A194 Gr.2H



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7.0 Mandatory Spares

2

Mandatory spares shall be provided as indicated below:

S.NO.	DESCRIPTION OF ITEMS	QUANTITY
1.	Level indicator for Condensate Storage tank	1 Nos.

The instrument shall be supplied with three sets of blank scales.

8.0 Drawings Enclosed

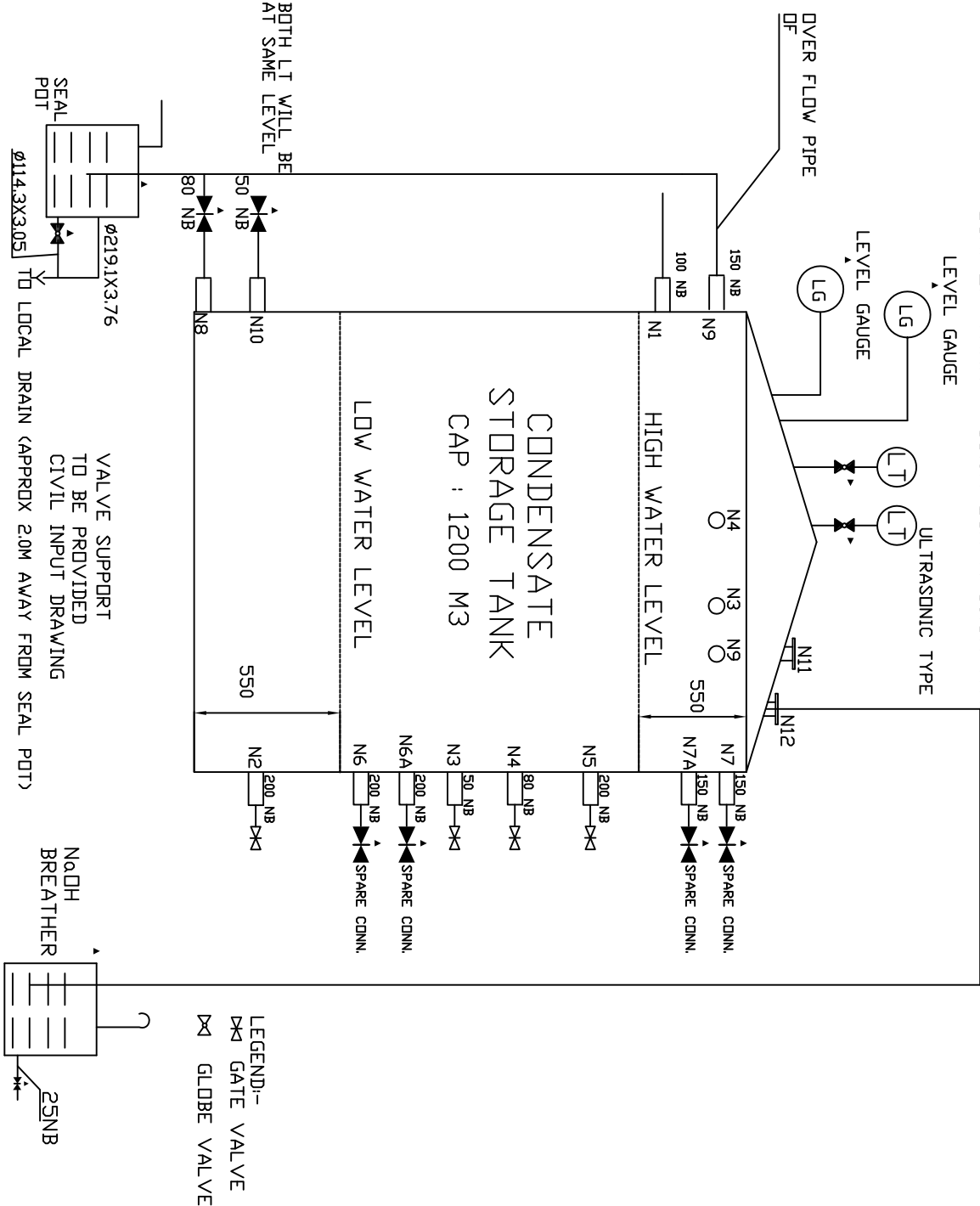
Following drawings / Sketches are enclosed with DS of Miscellaneous Tanks:

3

- a) PE-DC-425-167-S001, Condensate Storage Tank Sketch
- b) Annexure-I for Painting of Tanks
- c) Annexure-II for Inspection Categorization List for Bought Out Items
- d) Annexure-III for Tank design calculation for plate thickness.

SKETCH FOR CONDENSATE STORAGE TANK
TWO(2.0) NOS OF CAPACITY 1200M3

DIM. OF TANK - 13.0M DIA x 10.5M HT.



NOTES:

- 1.0 - HIGH WATER LEVEL SHALL BE MIN.150 MM BELOW BOTTOM OF OVERFLOW NOZZLE.
- 2.0 - NOZZLE ORIENTATION SHALL BE AS PER FINAL LAYOUT.
- 3.0 - ALL NOZZLES (ALONG WITH FLANGES & COUNTER FLANGES), OVERFLOW PIPE, NOZZLE FOR MOUNTING LEVEL INDICATOR AND PIPING FOR NOZZLE N5 UP TO THE VALVE AT BOTTOM SHALL BE SUPPLIED BY TANK VENDOR. TRANSMITTER SHOWN ARE EXCLUDED FROM TANK VENDOR SCOPE. THESE SHOULD BE SUPPLIED SEPARATELY AS A PART OF INSTRUMENTATION. HOWEVER, 25NB TAPINGS SHALL BE PROVIDED IN TANK BY TANK VENDOR FOR MOUNTING OF THESE LTs..
- 5.0 - ALL ITEMS THUS MARKED ARE TO BE SUPPLIED ALONG WITH TANK.
- 6.0 - LOCATION OF THE TANK IS OUTDOOR.
- 7.0 - ALL INLET PIPING INSIDE THE TANK SHALL BE EXTENDED DOWN TO 500MM FROM BOTTOM OF TANK AND SHALL BE PROPERLY SUPPORTED WITH TANK SHELL. WEIR PLATES SHALL BE PROVIDED JUST BELOW ALL THE INLET PIPES INSIDE THE TANK.
- 9.0 - THE NET CAPACITY OF EACH TANK I.E 1200 CUM IS CAPACITY BETWEEN LOW AND HIGH LEVEL SHOWN IN THIS SKETCH.
- 10.0 - NOZZLE/VALVES END CONNECTION SOCKET WELDED =< 50NB FLANGED JOINT > 65NB 11.0 - 600MM LONG 16SQ BAR AT PITCHING OF 300MM OR CATWALK TO BE PROVIDED ON TANK ROOF FOR APPROACHING THE NOZZLES
- ** MIN 200NB, EXACT SIZE SHALL BE DECIDED DURING DETAILED ENGINEERING

NOZZLE NO	DESCRIPTION	SIZE(NB)
N1	DMV INLET	100
N2	OUTLET FOR PUMP SUCTION	200
N3	RECIRCULATION	50
N4	BOILER FILL RECIRCULATION	80
N5	EXCESS DUMP	200
N6	SPARE CONNECTION (OUTLET)	200
N7	SPARE (INLET)	150
N8	DRAIN	80
N9	OVER FLOW	150
N10	SAMPLING COLLECTION WITH VALVE	50
N11	MANHOLE TWO(2) NOS, ONE ON ROOF OTHER ON SHELL	MIN 600MM
N12	TANK VENT	**
N6A	SPARE CONNECTION (OUTLET)	200
N7A	SPARE (INLET)	150



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ANNEXURE-I

	Tank inside surface	Tank outside surface	Tank underneath surface	Structural steel work, piping, steel floors, & stairways
Surface preparation	Blasting according to Sa 2½ and ISO 8501-1:1988.	Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.	Wire Brushing/ hand tool cleaning to ST-2.	Wire Brushing/ hand tool cleaning to ST-2.
Pre-Treatment	Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501-1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75µm.	Not Applicable		
Primer	Two layers of Zinc phosphate epoxy primer, total dry film thickness >75µm.	Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75µm.	2 coats of high build coal tar epoxy suitably pigmented (2 pack), DFT:80-100 microns each coat.	Two (2) coats of epoxy based zinc rich primer of 35 microns.
Intermediate coat	2 pack high build epoxy, dry film thickness 80 µm.	One (1) layer 2 pack high build epoxy polyamide MIO, DFT 100µm.	N. A.	N. A.
Finish	2 pack silicon acrylic, dry film thickness of 150µm per coat.	Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 50 microns DFT each coat in approved shades.	N. A.	Two (2) coat of Acrylic polyurethane of 50 microns per coat.

Note: -



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- 1.) Handrail shall be hot dip galvanizing as per IS 4736.
- 2.) PAINTING AS PER VOL.-II, CHAPTER – 6 “General & Schedules Painting”.

ANNEXURE-II

INSPECTION CATEGORIZATION LIST FOR BOUGHT OUT ITEMS - MISCELLANEOUS TANKS		
S.No	Category of Inspection	Item
1	III	CS Pipes ERW
2	III	CS Pipes Seamless
3	III	SS Pipes
4	III	Structural Steel
5	III	M.S. Plates
6	II	Gate & Globe (Cast Steel / Forged Steel)
7	III	Level Indicator - Float and Board Type
8	III	Paint
9	III	Pipe Fittings
Notes		
1	Cat-I: TENGEDCO/Nominated Agency will directly participate in inspection and MDCC shall be issued to BHEL	
2	Cat-II: Inspection will be carried out by BHEL third party inspection agency / BHEL and BHEL MDCC shall be issued to the vendor for physical dispatch.	
3	Cat-III: For COC items, BHEL will be fully responsible for meeting the contractual requirements including drawings / Documents. BHEL shall duly certify and approve the COC and BHEL MDCC shall be issued to the vendor for physical dispatch.	

DATA SHEET FOR MISC. TANKS: SITE FABRICATED (CONDENSATE STORAGE TANK)				Annexure-III
2x800MW UPPUR TPP				
Tank design calculation for plate thickness				DATE: 25.10.2017
VERTICAL, CYLINDRICAL & CENTER COLUMN SUPPORTED FIXED CONE ROOF TANK AS PER IS 803/API650.				
Sl. No.	SPECIFICATIONS	UNITS	VALUES	REFERENCES
A.1.0.	Input Design Data			
1	Quantity of Tank	Nos.	2	(As per Tender Specification)
2	Diameter, D	m	13	
3	Total Tank Height of Shell, H _t	m	10.5	
4	Maximum Design Liquid Level, H _l	m	9.28	
6	Nominal Capacity, Q _t	m ³	1393.68	
8	Effective Capacity, Q _e	m ³	1231.74	
9	Design Specific Gravity, G	-	1	Considered As per IS: 803 , Cl. 6.3.1.1, Page -22.
10	Design Density of liquid, ρ	kg/m ³	1000	
11	Design Pressure, P	mLC	Hydrostatic Head	As per IS: 803 , Cl. 6.3.1.3, Page -22.
12	Vacuum Pressure, V _b	kg/m ²	50	
13	Design Temperature, T	°C	60	(AS PER IS 803 CLAUSE NO. B-4)
14	Corrosion Allowance, C	mm	1.8	
15	Joint Efficiency Factor, E	-	0.85	As per Tech. Specification
16	Radiography Examination		Spot Radiography	
17	Material of Construction		IS 2062 Gr. B	Cl. 5.1.1, Page 16 of IS 803
18	Maximum Allowable working Stress, σ _s	kg/cm ²	1680	
19	Width of Shell Plates, W _s	m	2	Table 2, Page no.4 IS 2062:2006
20	Width of Bottom Plates, W _b	m	2	
21	Width of Roof Plates, W _r	m	2	
22	Yield Stress Minimum, σ _y	MPa	240	
B.0.	DETAILED CALCULATIONS.			
B.1.0.	Calculation of Shell Plate Thickness.			
	Minimum thickness as per specification		6	Page 22 of IS:803
	Number of Shell Courses	Nos.	6	
B.1.1	Thickness of 1 st Course, t = (50 x G x D x (H-0.3)/σ _s x E) + C.A			
	Course Under consideration from bottom of tank, n		1	
	Height from the Bottom of course under consideration to the top of curb angle, H = H _t - ((n-1) x W _s)	m	10.5	
	Thickness of 1 st Course, t	mm	6.45	
	Thickness for the first course is	mm	6.45	
	However provided thickness for the first course is		8	
B.1.2	Thickness of 2 nd Course, t = (50 x G x D x (H-0.3)/σ _s x E) + C.A			
	Course Under consideration from bottom of tank, n		2	
	Height from the Bottom of course under consideration to the top of curb angle, H = H _t - ((n-1) x W _s)	m	8.5	
	Thickness of 2 nd Course, t	mm	5.54	
	Thickness for the second course is.	mm	6	
	However, provided thickness for the second course is.		6	
B.1.3	Thickness of 3 rd Course, t = (50 x G x D x (H-0.3)/σ _s x E) + C.A			
	Course Under consideration from bottom of tank, n		3	
	Height from the Bottom of course under consideration to the top of curb angle, H = H _t - ((n-1) x W _s)	m	6.5	
	Thickness of 3 rd Course, t	mm	4.63	
	However provided thickness for the third course is.	mm	6	
	However provided thickness for the third course is.		6	
B.1.4	Thickness of 4 th Course, t = (50 x G x D x (H-0.3)/σ _s x E) + C.A			
	Course Under consideration from bottom of tank, n		4	
	Height from the Bottom of course under consideration to the top of curb angle, H = H _t - ((n-1) x W _s)	m	4.5	
	Thickness of 4 th Course, t	mm	3.72	
	Thickness for the fourth course is.	mm	6	
	However provided thickness for the fourth course is.	mm	6	
B.1.5	Thickness of 5 th Course, t = (50 x G x D x (H-0.3)/σ _s x E) + C.A			
	Course Under consideration from bottom of tank, n		5	
	Height from the Bottom of course under consideration to the top of curb angle, H = H _t - ((n-1) x W _s)	m	2.5	
	Thickness of 5 th Course, t	mm	2.81	
	Thickness for the fifth course is.	mm	6	
	However provided thickness for the fifth course is.		6	
B.1.6	Thickness of 6 th Course, t = (50 x G x D x (H-0.3)/σ _s x E) + C.A			
	Course Under consideration from bottom of tank, n		6	
	Height from the Bottom of course under consideration to the top of curb angle, H = H _t - ((n-1) x W _s)	m	0.5	
	Thickness of 6 th Course, t	mm	1.9	
	Thickness for the sixth course is.	mm	6	
	However provided thickness for the sixth course is.		6	
B.2.0				
	As per Clause No. 6.2.1(a), Page 17 of IS 803; All Bottom Plate of tank, uniformly resting on the ground, shall have a minimum nominal thickness of 6 mm, But 8mm thickness shall be provided for bottom plate		8	
B.3.0	Roof Plate Thickness.			
	As per Clause No. 6.4.2.2, Page 36 of IS 803; Minimum nominal thickness of roof plate shall be 5 mm, But 6 mm thickness shall be provided for roof plate		6	

**TITLE****2x800 MW UPPUR STPP****TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM**

SPECIFICATION NO.: PE-TS-425-166-A001

REV.: 00

Section: IB/1

Date: 25/10/2017

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SECTION – I**SPECIFIC TECHNICAL REQUIREMENTS****SECTION IB/1 – System write up (Accessories for Air Receiver)**



2x800 MW UPPUR TPP
TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM

SPECIFICATION NO.: PE-TS-425-166-A001

REVISION 00

DATE: 25/10/2017

SECTION: IB/1

1.0 Intent

- 1) The purpose of this document is to bring out clarity with regard to the following:
 - a) Scope of Design, engineering, supply and exclusions for Accessories for air receiver.
 - b) Major technical requirements of various items covered under this package

2.0 SCOPE OF SUPPLY FOR AIR RECEIVER

- 1) Accessories for air receiver like safety relief valves, fusible plugs, pressure gauges, pressure transmitter, temperature gauges, automatic drain traps shall be provided by successful bidder.
- 2) Drain piping for auto drain trap of each air receiver to the nearest drain.
- 3) Qty. are as below:
 Safety relief valves = 4
 Fusible plugs & pressure gauges = 4 each
 Pressure transmitter = 4
 Temperature gauges = 4
 Automatic drain traps = 4

3.0 SCOPE OF SERVICES FOR AIR RECEIVER

- 1) Mounting of accessories on air receiver like safety relief valves, fusible plugs, pressure gauges, pressure transmitter, temperature gauges, automatic drain traps is in successful bidder scope of work.
- 2) E&C of drain pipe to the nearest drain.

4.0 EXCLUSION

- 1) Air receivers are excluded from bidder's scope.
- 2) Civil work for air receivers is excluded from bidder's scope.

5.0 Mandatory Spares

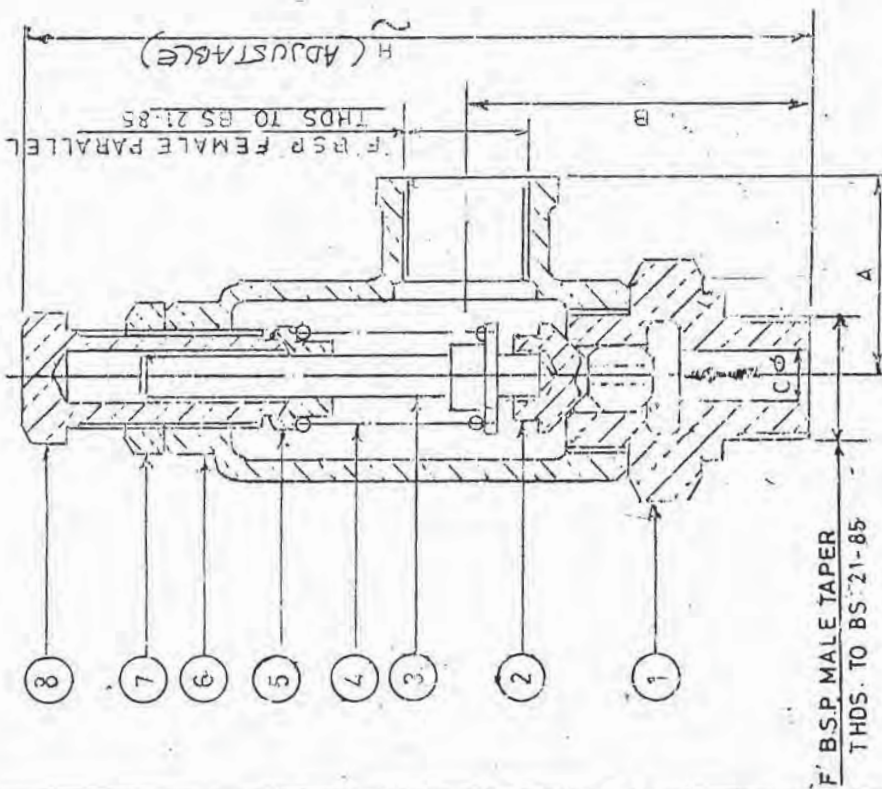
Mandatory spares shall be provided as indicated below:-

S.no	DESCRIPTION OF ITEMS	QUANTITY
1	Pressure Gauge for Air receiver	1 No.
2	Pressure Transmitter for Air receiver	1 No.
3	Temperature Gauge for Air receiver	1 No.

AUTOMATIC DRAIN VALVE (ADT)

TECHNICAL SPECIFICATION

MODEL	:	
SUPPLY	:	230 V AC $\pm$ 10%, 50Hz
POWER CONSUMPTION	:	10 WATTS
MAX. OPERATING TEMP. (AMBIENT)	:	70 DEG. C.
OPERATING HUMIDITY (AMBIENT)	:	0-95% RH.
MAX. WORKING PRESSURE	:	12.5 Kg/Sq. cm.
MAX. FLUID TEMPERATURE	:	80°C.
PILOT PRESSURE REQUIRED	:	2.5 Kg./Sq. cm. (1:1 with inlet air) Min.
PILOT AIR CONNECTION	:	yes
VALVE END CONNECTION (INLET, OUTLET)	:	1" BSP (F).
CYCLE TIME	:	1-128 min. VARIABLE.
VALVE OPEN DURING CYCLE TIME	:	4 Sec. CONSTANT.
VALVE ORIFICE	:	50mm.
WEIGHT	:	2.41kg(approx)
APPLICATION	:	Air Receiver



DIMENSIONAL DATA						
MAIN DIMENSIONS						
NOMINAL SIZE	H	C	F	A	B	
1/2 15 mm	140	9.5	1 1/2	35	56	
3/4 20 mm	153	16	3/4	41	68	
1 25 mm	178	22.2	1"	45	70	
1 1/4 32 mm	195	27	1 1/4	51	79	
1 1/2 40 mm	222	34	1 1/2	57	94	
2 50 mm	246	44.5	2	70	100	
2 1/2 65 mm	375	57	2 1/2	81	116	
3 80 mm	464	68	3	95	123	

Valve type-Safety valve.

PART NO	REVISION MADE	REVISION No	DATE	AUTHORISED SIGNATORY	REMARKS
01	INLET THDS CHANGED FROM PARALLEL TO TAPER	01	03 16 2001	<i>[Signature]</i>	

BRONZE (IBR CLAUSE 282 (a) (IV) GR.B)
 SPRING LOADED ENCLOSED DISCHARGE.
 RENEWABLE SEAT.
 RENEWABLE DISC.

INLET END:BSP TAPPER TO BS:21 OUTLET:SCREWED FEMALE

Cu-ALLOY TRIM

BSP PARALLEL THREAD TO BS:21

MAX 150 PSIG (10.34 BAR) WATER OR
 AIR.MAX 150 PSIG (10.34 BAR) WATER OR AIR

SHELL TEST PRESSURE-300 PSIG (20.7 BAR) HYD.

DESIGN PRESSURE - 13.5 Kg/cm2
 DESIGN TEMPERATURE - 100 DEG C

Hydrotest pressure Duration: 3 Min.

STANDARD MATERIAL COMBINATION				
P. No.	Name of Parts	No. Off	Material	Specification / Standard
8	ADJUSTING SCREW	1	BRONZE	BS 1400 - 85 LG 2C
7	LOCKING NUT	1	BRONZE	BS 1400 - 85 LG 2C
6	SPRING CHAMBER	1	BRONZE	BS 1400 - 85 LG 2C
5	SPRING DISC	1	BRONZE	BS 1400 - 85 LG 2C
4	SPRING (Cadmium PLATED)	1	CARBON STEEL	IBR-94 CLAUSE 307
3	STEM	1	BRASS ROD	BS 2872-89 or 2874-86 CZ112
2	DISC	1	BRONZE	BS 1400 - 85 LG 2C
1	BODY	1	BRONZE	BS 1400 - 85 LG 2C

PART No.	REVISION MADE	REVISION No.	DATE	AUTHORISED SIGNATORY	REMARKS

connection. Cabling need not terminated inside the switch. Cable ends are to be soldered in connector and to be inserted for easy maintenance.

- Over range protection	:	One Fifty (150) percent of full scale
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1/2, Division 1 area)/Flame Proof (IEC – 79.1, Part I) as applicable.
IBR Requirement	:	For high pressure service, Process tapping and root valves are as per IBR rules and regulations.

Accessories

- 3 / 5 valve manifold	:	As applicable depending on type of switches
- Self cleaning type pulsation dampners/Snubber (Material SS316)	:	Pump and compressor discharge lines
- Syphon	:	For all steam lines
- Protective separating diaphragm	:	For fuel oil & corrosive liquid lines.
- Mounting	:	Local (in LIE/LIR for BTG package only).

3.03.03 PRESSURE & DIFFERENTIAL PRESSURE GAUGES (PG & DPG)

Applicable standard	:	IS:3602-1966, IS/3624, ASME B 40.1
Type/Construction	:	

-760 mm to 1.0Kg/cm ²	:	Bellows/Diaphragm
-Above1.0Kg/cm ²	:	Bourdon Tube
- Suction side of pumps	:	Compound gauge

Materials

- Bourdon tube	:	316 SS
- Bellows	:	316 SS
- Movement	:	316 SS
- Case	:	SS 316/ Die-cast aluminum with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere.
- Protective Diaphragm	:	Teflon
Dial size	:	150mm with toughened shatter proof glass. 300 mm with toughened shatter proof glass for frame mounted gauges.
Scale Details	:	Graduations in black lines on white dial, on white dial, 270 Deg. pointer deflection scale provided with



glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges.

Accuracy	:	$\pm$ One (1) percent or better
Connection - Instrument Process	:	1/2 inch NPT Male Bottom
Mounting	:	Local / Frame mounted.
	:	1/2 inch NPT Male (Back entry) mounted on local gauge board.
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
IBR Requirement	:	For high pressure service, Process tapping and root valves are as per IBR rules and regulations.

Accessories

- 3 way needle valve/manifolds	:	For all gauges depending upon service.
- Self cleaning type	:	Pump and compressor discharge lines
Pulsation dampener/snubber (S316)	:	
- Syphon	:	For all steam lines
- Protective separating seal	:	For fuel oil and corrosive liquid lines

Other particulars

- External Zero adjustment	:	For all gauges
- Safety device	:	
Ranges 5 to 20 Kg/cm ²	:	Rubber blow out disc with open front construction.
Ranges above 20 Kg/cm ²	:	Neoprene safety diaphragm at the back with solid front construction.
- Over range protection	:	One Fifty (150) percent of full scale

Other Requirments

:	Movement mechanism shall be glycerin filled for oil services & vibration prone area.
:	For Fuel oil & corrosive liquid lines diaphragm type sensors required. Armored capillary of 10 M for Fuel oil & Corrosive liquid service.
:	Contact type pressure gauges are not acceptable for interlock & protection.
:	For condensate storage tank and DM water storage tanks, the pressure



gauge in terms of 0-10000 mm wc or suitable range having **dial size of 300mm or bigger size** shall be provided.

3.03.04

Temperature Transmitters (TT)/Differential Temperature Transmitters (DTT)

Type	:	Dual Input, SMART type configurable from control room through HART protocol (HMS System).
Display type	:	Indicating type (5 digit LCD Display).
Accuracy	:	$\pm 0.10\%$.
Ambient temperature error	:	0.1% per 10°C change
Output	:	4-20 mA DC (2 wire system) HART compatible signals for analogue monitoring inputs to the distributed control system (DDCMIS), DCS & PLC.
Protection class	:	NEMA 4/IP66 or equivalent degree of protection for enclosure)/(Explosion/Flame proof for NEC Class-1, Division 1/2 area)/ flame proof (IEC-79.1, Part I). As applicable).
Material of accessories	:	SS316
Stability	:	$\pm 0.1\%$ or ± 0.1 deg C of reading (whichever is great) for 2 years in case of RTD inputs and for 1 year in case of Thermocouples inputs.
Operating Voltage	:	16 – 48 V DC
Calibration	:	as per NIST monograph 125 for T/C & European Curve Alpha = 0.00385 for RTD .
Ref. Junction compensation	:	Provided
Span/zero adjustment	:	Locally adjustable, Non interacting
Auto calibration	:	Provided
Burn out protection upscale	:	Provided
Input - output isolation	:	Provided
Circuit ungrounded	:	Provided
EMC compatibility	:	As per EN 61326
Operating Ambient Temperature	:	0 to 70 deg C.
Mounting	:	Head Mounted/locally mounted as per application finalized by owner.

Temperature Transmitters shall not be used for CLCS, OLCS, interlock & protection services anywhere in the plant with RTD & Thermocouples. However RTD & Thermocouples are used for control, interlock & protection application, same shall be



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Instrument Connection	:	1/2 " NPT (F).
Thermowell	:	To suit Temp. switch with same design criteria as specified for RTDs.
Electrical	:	Suitable for Plug in type. All the switches are internally connected and brought to the surface with Amphenol male/female connection. Cabling need not terminated inside the switch. Cable ends are to be soldered in connector and to be inserted for easy maintenance.
Enclosure Class	:	IP-65 or better/ (Explosion/Flame proof for NEC Class-1/2, Division 1 area)/ flame proof (IEC-79.1, Part I). As applicable).
Other Particulars		
- Capillary length	:	As per requirement (min 10 meters)
- Immersion Length	:	Within $\pm$ ten (10) mm of center line of pipe with adjustable nuts.
- Extension neck length	:	Minimum 50 mm above insulation of pipe /As per approved hookup drawings.
- Packing glands	:	Yes
IBR Certification	:	For high pressure service, Steam Temp, Fuel oil temp. measurement as per IBR rules and regulations
N.B	:	Switches designed for cross ambient operation shall be used in applications where the ambient temperature will approximate or exceed the switch set point.

3.03.09 TEMPERATURE GAUGES (TG)

Applicable standard : IS : 3602,BS:5235 ISA:RP:8.1
except as modified in this specification

Type/Construction

- Thermometer : Industrial type, Gas in Filled type with separable thermowell
- Thermowell : Bar stock3d

Material

- Bulb : 316 SS
- Capillary : Armoured SS (Applicable for capillary Type)



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- Casing	:	SS 316/ Die-cast aluminum with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere
Dial Size	:	150mm with shatter proof glass
Scale Details	:	270 degree dial rotation/deflection. Graduations in black lines on white dial provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller .Pointer stop for all gauges
Accuracy	:	$\pm$ One (1) percent or better
Response time	:	Maximum 15 seconds without thermowell and 30 seconds with thermowell
Connection		
- Pipe	:	M33 x 2
- Thermowell	:	To suit instrument with same design criteria specified for RTDs.
- Process Connection	:	(i) M 33 x 2 / Rc 1-1/2" (ii) SS316 Flanged, for Air & Gas systems, with mating flanges, fasteners, gaskets etc.
- Extension	:	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends
Other Particulars		
- Capillary length	:	5Meters/10 Meters as required
- Immersion Length	:	Within + ten (10) mm of center line of pipe with adjustable nuts.
- Extension neck length	:	Minimum 50 mm above insulation of pipe /As per approved hookup drawings.
- Stop at Maximum value	:	For all gauges of scale
- Pointer	:	Externally adjustable
	:	In general, Contact type Temp. gauges are not acceptable for interlock & protection.
		Contact type Temp. gauges are acceptable for interlock & protection in case of bearing temp. only.
- Over range protection	:	150 percent (%) of full scale
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)



IBR Certification : For high pressure service, Steam Temp., Fuel oil temp. measurement as per IBR rules and regulations

3.03.10 TEST THERMOWELLS (TW)

Applicable Standard : ASME PTC 19.3 TW - 2010
 Type/Construction : Machined from Bar Stock
 Material : 316 SS/F11/F22/F91
 Connection :
 - Pipe : M33 x 2
 - Test Instrument : To suit test instruments
 Accessories : Plug with SS chain
 IBR Certification : For high pressure service, Steam Temp., Fuel oil temp. measurement as per IBR rules and regulations
 Bidder shall provide calculation for thermowell as per ASME – PTC-19.3 TW - 2010.

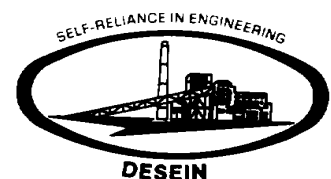
Test wells shall be provided on main steam, reheat steam, extraction steam, feed water, condensate, spray water lines and other piping as required to meet ASME test requirements.

3.03.11 DIRECT MOUNTED LEVEL TRANSMITTERS (LT)

Displacer type level transmitter shall not be used in the process anywhere in the plant.

3.03.12 Ultrasonic Level Transmitter (for Water sump/Tank level, Raw water reservoir level, Cooling water fore bay level measurements)

Principle of Operation : Detection of reflected ultrasonic pulse
 Measuring Ranges : Up to 30 meters (typical)
 Signal Processing : Microprocessor Controlled Signal Processing
 Operating Freq. : 10 KHz to 50 KHz (typical)
 Display : Head mounted alpha-numeric back lit LCD/LED
 Calibration & Configuration : Accessible from front of panel & HART calibrator.
 Diagnosis : On-line
 Status : For power, Hi / Lo / V. Hi / V. Lo-level indication, fault etc.
 Construction : Plug-on board
 Power supply : 240 V AC 50 Hz from UPS / 24V DC
 Signal Output : 4-20 mA DC with HART (isolated) - 600 Ohm load.
 Hysteresis : Fully adjustable preferred
 Output contacts : 2SPDT Potential free changeover contacts @ 8A 230V AC.
 Accuracy & Repeatability : $\pm 0.25\%$ of span or better



- xxiv. Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application. For HFO, LFO Applications, SS capillary with thin wafer element with ANSI RF flanged ends are to be provided. For hazardous area, explosions proof enclosure as described in NEC article 500 shall be provided.
- xxv. Gauges (all type) for local monitoring in field.
- xxvi. Each switching element including the limit and torque switches of valve actuators shall be provided with minimum two contacts i.e. 2SPDT OR DPDT.
- xxvii. All instruments should be supplied with valid calibration and test certificates provided by OEM.
- xxviii. Canopy/Enclosure shall be provided for field instruments like transmitters, switches & flow meters, etc and any other equipment to protect from direct sun light, lightning & rain.

3.03.00 **FIELD INSTRUMENTS AND PANEL MOUNTED INSTRUMENTS SHALL BE SUPPLIED & OFFERED AS PER DATA SHEETS SPECIFIED BELOW:-**

3.03.01 **Pressure, Differential Pressure, DP type Level and Flow Transmitters (PT, DPT, LT & FT)**

Smart Transmitters of the electronic type shall be furnished.

All Transmitter shall be installed in closed LIE in the boiler area. Similarly transmitter for TG shall also be in LIE except the transmitters located in covered area on TG floor and these shall be mounted in LIR.

Transmitters shall be equipped with mounting brackets suitable for a mounting in transmitter enclosures.

In general, Transmitters are envisaged to be grouped at several places as to be decided during detailed engg. stage. For this purpose, suitable enclosures complete with all tubing, fittings, purge meters, loop cable trays etc. shall be provided.

Type/Construction	:	Sealed capacitance/ Inductance/ Silicon resonance type
Material		
- Body	:	Die cast Aluminum with epoxy coating for air & flue gas SS316 for other services
- Diaphragm	:	316 SS



- Measurement element	:	Teflon seal
		For Hydrogen gas pressure/differential pressure transmitters, the suitable material and coating shall be chosen as per the suggestion of transmitter manufacturer.
- Valves	:	Carbon steel for non-corrosive Applications SS316 for corrosive applications.
Output signal	:	4 to 20 mA Amp. DC (Two wires) HART Compatible
Local Indicator	:	LCD indicator (5 digit) with scale of Engg. unit
Overall Accuracy	:	$\pm 0.04\%$ or better of Span $\pm 0.2\%$ or better of span for remote seal type transmitter.
Turn down ratio	:	100:1 in general 30:1 or better of Span for very high pressure & very low pressure services.
Stability	:	$\pm 0.15\%$ of URL for 10 years.
Response time	:	150 msec.
Power supply	:	24V DC nominal
Drive capability	:	600 Ohms nominal
Enclosure Class	:	IP-65 /(Explosion proof for NEC Class-1, Division 1 area)/Flame proof (IEC – 79.1, Part I).
Span and Zero	:	Locally adjustable, non-interacting
Zero suppression / elevation	:	At least 100% of Span

Connection

- Process		Quarter (1/4) inch NPT with/without oval flanges
- Electrical	:	Suitable for Plug in type connection (Both side of transmitter), unused entry with blind plug.
IBR Requirement	:	For high pressure & high temperature service, Process tapping and root valves shall be as per IBR rules and regulations.

Accessories

:



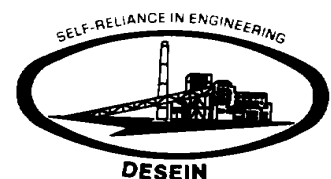
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- For Absolute Pressure Transmitters: Two (2) valve SS316 manifold
- For Gauge & Vacuum : Three (3) valve SS316 manifold pressure transmitter
- For DP, level & flow : Five (5) valve SS316 manifold transmitter
- For oil and corrosive : Separator diaphragm seals liquids
- For all transmitters : Mounting bracket

Requirments for flanged remote seal diaphragm:

Maximum pressure rating : To meet 200 percent of process pressure

Availability of seals : for both high and low pressure sides with capillary connection in case of differential pressure transmitters and

Single Capillary connection for pressure transmitters.

Capillary length : 6.0 m

Fill fluid : Suitable oil

Process connection size : 1 inch

Flange size and Accessories : As per process requirement.

Flange pressure rating : Required Class (ANSI)

Process liquid : Sea water, Ash water, chemical, hydrogen gas, sealoil etc.,

Process fluid temperature : 25°C to 60°C

Diaphragm and wetted part material : Suitable for sea water, ash water and chemical applications.(offered material to be specified)

Flushing option : To be made available with 1/4 inch (necessary drain and gasket suitable for sea water application to be provided)

Transmitter should not be mounted directly on the manifold, Manifold shall be non integral and standalone type. Snubbers/Pulsation dampners shall be used where the process media is unstable for measurement such as the discharge of a pump. Over range protection shall be used where necessary. The coil syphons & condensate pots shall be used for steam services. Transmitters shall be provided with suitable drain & vent points.

- ~~3.03.01.01 Transmitters, smart positioner & other HART based instruments shall be supplied along with 4 Nos. of universal type hand held/portable calibrators per unit. Temperature transmitters shall be supplied along with 4 Nos. of hand held/portable mV source generators per unit. If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided.~~





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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

SECTION ID – Customer specification

CHAPTER 13

13.0 LP PIPING, VALVES & SPECIALITIES**13.1 Equipment sizing Criteria**

13.1.1 All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period.

13.1.2 For all LP piping system covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated elsewhere. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration.

13.1.3 Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following.

a) Water Application

		Water Velocity in m/sec		
	Pipe Size	Below 50 mm	50-150 mm	200 mm & above
a)	Pump suction	-----	1.2-1.5	1.2-1.8
b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5
c)	Header	----	1.5-2.4	2.1-2.4

The pipes in CW, ACW & DMCW system shall be designed to maintain a maximum velocity of 2 m/s inside the pipelines at pump discharge.

Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.

WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value.

i)	Carbon steel pipe	100
ii)	CI Pipe/Ductile Iron	100
iii)	Rubber lined steel pipe	120
iv)	Stainless steel pipe	100

For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/sump/reservoir from which the pumps draw water.

Pumps for desalination service shall be designed considering 10% margin on flow and friction head over the actual requirement.



b) Compressed Air Application

Compressed air – 15.0 m/sec. (under Average Pressure & Temp. conditions)

- 13.1.4 The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.
- 13.1.5 Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.
- 13.1.6 Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered.
- 13.1.7 Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.
- 13.1.8 High points in piping system shall be provided with vents alongwith valves as per the system requirement. Low points shall be provided with drains alongwith drain valves as per the system requirement. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.
- 13.1.9 Material of construction for pipes carrying various fluids shall be as specified elsewhere.
- 13.1.10 Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.
- 13.1.11 Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.
- 13.1.12 Threaded joints shall be provided with Teflon sealant tapes.
- 13.1.13 Following types of valves shall be used for the system/service indicated.

System	Type of Valves					
	Butterfly	Gate	Globe	Check	Ball	Plug
Water	x	x	x	x	x	
Air		x	x	x	x	
Drains & Vents		x	x	x		
Fuel oil		x	x	x	x	x

In water service, valves above 200 NB size shall be butterfly valves.

- 13.1.14 Recirculation pipes alongwith valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation



diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30% design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.

13.1.15 All Piping 450 NB & Above shall be designated as Large dia Piping.

13.2.00 TECHNICAL SPECIFICATION

13.1.00 GENERAL

Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers/supports, tanks etc.

13.2.00 Pipes and fittings

13.2.1 All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as adhered to. The bidder shall furnish the pipe sizing / thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.

13.2.2 Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.

13.2.3 Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.

13.2.4 Bends, loops, offsets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).

13.2.5 Wherever Bidder's piping coming under this specification, terminates at an equipment or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.

13.2.6 The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/expansion joint etc. shall be provided as may be necessary depending on layout.



- 13.2.7 Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.
- 13.2.8 For rubber lined ERW pipes, beads shall be removed.
- 13.2.9 Inspection holes shall be provided at suitable locations for pipes 800 NB and above as required for periodic observations and inspection purposes.
- 13.2.10 At all intersection joints, it is Contractor's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.
- 13.2.11 For large size pipes/duct, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy & tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code.

Transient analysis / surge analysis wherever specified and required shall be conducted in order to determine the location, number and size of the Air-Release valve on certain long distance/high volume piping systems such as CW/ ACW/ Raw Water etc.

13.3.00 Material

- 13.3.1 Alternate materials offered by Bidder against those specified shall either be equal to or superior to those specified, the responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.
- 13.3.2 No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.
- 13.3.4 All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockiest are not acceptable.
- 13.3.5 All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable reference to enable identification of the certificate that certifies the material.
- 13.3.6 Material of construction for pipes carrying various fluids shall be as follows:

	Service	Pipes	Fittings
1.	Circulating Water (CW) - condenser risers including header near condenser upto terminal point	IS 3589 FABRICATED FROM IS 2062 PLATES - INTERNALLY LINED WITH CORROCOAT OR POLYUREA COATING OF 1500 MICRONS DFT	
2.	ACW	300 NB & BELOW - SS 316L ABOVE 300 NB -	



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	Service	Pipes	Fittings
		ERW IS 1978 (OR) API5L (OR) IS 3589 FABRICATED FROM IS 2062- INTERNALLY LINED WITH CORROCOAT OR POLYUREA COATING OF 1500 MICRONS DFT	
3.	RO Stage II Reject, Guard pond inlet & discharge, Piping from Reject sump,. Ash water piping using sea water and all other sea water applications.	UPTO 150 NB - ASTM A 312 TP 316 L (ERW)/ DUPLEX SS 200 NB & ABOVE - ERW IS 1978 (OR) API5L (OR) IS 3589 FABRICATED FROM IS 2062- Internally lined with Corrocoat or polyureA Coating inside of 1500 microns DFT/ GRP/ FRP	
4.	Filtered Water, service water, AHP Seal Water, HVAC Make up, Air Pre-Heater Wash water, Passivated DM Water and clarifier sludge.	IS-2062 Gr. B/ASTM-A- 36/ASTM A-53 type 'E' Gr. B/IS-3589 Gr. 410/IS-1239 Heavy. 150 NB & above pipes shall be spiral welded.	
5.	RO Stage II Permeate, Dematerialized water, (condenser Make up water, Boiler fill and Deaerator Fill water) & DMCW overhead tank make-up water	Stainless steel to ASTM A-312, Gr. 304 seamless/ welded	
6.	Drinking water	ASTM A-53 type E Gr. B galvanized /IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to SI-4736 or equivalent.	
7.	Instrument air & plant air.	ASTM A-53 type E Gr. B galvanized /IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to SI-4736 or equivalent.	
8.	Fuel Oil piping	API5L	



	Service	Pipes	Fittings
9.	HOSES FOR HFO TANKER HEATING (STEAM/ CONDENSATE)	CARBON STEEL – ELECTRO ZINC PLATED	
10.	FUEL OIL UNLOADING LINES	IS1239 / IS1978 / API5L Gr.B (ERW) / IS3589 FABRICATED FROM IS 2062 PLATES	Screwed fittings of GI as per IS 1239 Heavy. Galvanization shall be as per IS 4736.
11.	FUEL OIL PUMP DISCHARGE LINES	ASTM A 106 GR B	
12.	PSF/ UF Feed/ Permeate/ Backwash/ Chemical Backwash/ Chemical Cleaning/ Effluent water (Upto 150 NB) (Pipes & Fittings)	CPVC ON 10 Sch 40	CPVC PN 10
13.	PSF/ UF Feed// Chemical Backwash/ Chemical Cleaning/ Effluent water (> 150 NB)	GRP	GRP PN 10
14.	Sodium Hypochlorite/ All Chemical Dosinf lines (pipes & Fittings)	CPVC Sch 80 ASTM	CPVC Sch 80 ASTM

- 13.3.7 In water lines, pipes upto 150 mm NB shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr. B/IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS: 1239 Grade heavy except for dematerialized water and condensate spill lines.
- 13.3.9 Pipes of above 150 mm NB shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr. 410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr. B/ASTM-A-36. However, larger pipes, i.e. 1000 mm NB and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr. B and shall meet the requirements of AWWA-M-11(for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/ surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).
- 13.3.10 In dematerialized water service, the pipes upto 50 NB shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65 mm NB upto and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness.
- 13.3.11 Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.
- 13.3.12 Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410/IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally



reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B/IS: 3589, Gr. 410/IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).

13.3.13 Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.

13.3.14 Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.

13.3.15 If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.

13.4.0 Piping Wall Thickness

13.4.1 The calculation of wall thickness required for pipelines subject to internal and/or external pressure shall be based on the formulae and recommendations as given in the applicable codes. Adequate allowances shall be made towards thinning due to bending, weakening at branch connections, threading, commercial tolerances on pipe wall thickness, corrosion and erosion, etc., and the same shall be subject to approval by Purchaser. In any case a minimum corrosion allowance of 1.0 mm shall be considered while selecting the thickness.

13.4.2 In case of carbon steel materials, the nominal wall thickness of pipeline shall not be less than the minimum acceptable values given below:

NB mm (inch)	15 (1/2)	30 (3/4)	25 (1)	32 (1¼)	40 (1.5)	50 (2)	65 (2.5)	80 (3)	100 (4)	125 (5)
Min. thickness, mm	3.2	3.2	3.6	3.6	3.6	3.6	3.6	4.0	4.5	5.4
NB mm (inch)	150 (6)	200 (8)	250 (10)	300 (12)	350 (14)	400 (16)	450 (18)	500 (20)	600 (24)	
Min. thickness, mm	5.4	6.35	6.35	6.35	7.1	7.1	7.1	8.0	8.0	

> NB 600 mm to NB 900 mm	-	8.0 mm
> NB 900 mm to NB 1200 mm	-	10.0 mm
> NB 1200 mm to 1400 mm	-	12.0 mm
> NB 1400 mm to 1600 mm	-	14.0 mm
> NB 1600 mm to NB 2200 mm	-	16.0 mm
> NB 2200 mm	-	18.0 mm

13.5.0 Piping Layout

13.5.1 Piping shall be grouped together where practicable and routed to present a neat appearance.

13.5.2 Piping routing shall be such as to provide sufficient clearance for removal and maintenance of equipment, easy access to valves, instruments and other accessories. The piping shall not encroach on the withdrawal space of various equipments.



- 13.5.3 Over head piping shall have a normal minimum vertical clearance of 2.5 meters above walkways and working areas and 8 m above roadways/railways. When several pipelines are laid parallel, flanged joints must be staggered. Welded and flanged joints should as far as possible be located at one third span from supports. If the support is situated right under the welded joints this joint must be reinforced with a strap. Flanged and welded joints must be avoided in the middle of the span. Valves should be located in such a manner so as to ensure their convenient operation from the floor or the nearest platform.
- 13.5.4 Pipelines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipe and submit to Employer for approval.
- 13.5.5 All piping shall be routed so as to avoid interference with other pipes and their hangers and supports, electrical cable trays, ventilation ducting, structural members, equipment etc.
- 13.5.6 Adequate clearance shall be ensured with respect to the above to accommodate insulation and pipe movements, if any.
- 13.5.7 Piping shall generally be routed above ground but where specifically indicated / approved by the project Manager the pipes may be arranged in trenches or buried. Pipes at working temperature above the ambient shall however not be buried.
- 13.5.8 Sufficient up stream and down stream lengths shall be provided for flow measuring devices, control valves and other specialties.
- 13.5.9 All local instruments shall be located on pipelines as to render them observable from the nearest available platforms.
- 13.5.10 Openings provided in the wall for pipelines must be closed with bricks and mortar with 10-12 mm clearance between brick work and pipe after taking care of insulation and thermal movement, if any. The clear space must be filled with felt or approved filling compound.
- 13.6.00 Slope/Drains and Vents**
- 13.6.1 Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent shall not be less than 15 mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15 mm for line size up to 150 mm, not less than 20 mm up to 300 mm and not less than 25 mm for 350 mm to 600 mm pipes and not less than 50 mm for 600 mm and above pipes.
- 13.6.2 Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.
- 13.7.0 Pipe Joints**



In general all water lines 65 mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50 mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.

13.7.1**Screwed**

- (a) Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/IS: 554 unless specified otherwise.
- (b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be joined by welding. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & out side) after welding with zinc rich electrode, alongwith the nascent threaded metal portion at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test.
- (c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately.
- (d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate pasts. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing.
- (e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to



inaccessibility of the inside welded surface and where galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.

13.7.2 Welded

- (a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.

13.7.3 Flanged

- (a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only.
- (b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.
- (c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.

13.8.00 Bends/elbows/mitre bends/Tees/Reducers & other fittings

13.8.1 Unless otherwise specified elbows shall be of long radius type.

13.8.2 For pipe sizes up to 65 Nb, long radius forged elbows or seamless pipe bends shall be used. Pipe bends, if used, shall be cold bent to a radius measured to the centre line of pipe of 3 to 5 times the pipe diameter.

13.8.3 For steel pipes 80 Nb and above, seamless long radius forged elbows shall be used. For pipe size 250 Nb and above mitre bends may be used for all pipes except rubber lined pipes. The bend radius shall be $1\frac{1}{2}$ times the nominal pipe diameter. 90 deg. Bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces $22\frac{1}{2}$ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.

13.8.4 Mitre bends are not acceptable in case of rubber lined mild steel pipes.

13.8.5 For pipe fittings such as reducers and tees, the material shall be to ASTM A-234 gr. WPB up to 300 NB. For pipe reducers and tees above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fittings shall conform to the dimensional standard of ANSI B-16.9.

However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.

For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.



- 13.8.6 Stainless steel fittings shall conform to either ASTM-A-182, Gr. 304 (316 for Sea water application, if any) or ASTM-A-403, Gr. WP 304 (316 for Sea Water application, if any) Class-S, for sizes upto and including 50 mm NB, i.e. the fitting shall be of seamless construction.

However, for stainless steel fittings above 50mm NB, the same shall conform to ASTM-A-403, Gr. WP 304 (316 for Sea water application, if any), Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.

- 13.8.7 In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.

13.9.00 Flanges

- 13.9.1 Flanges shall be slip on type. Welding of flanges in tension is not permitted.

- 13.9.2 All flanges and-flanged drilling shall be to ANSI B 16.5/BS EN-1092 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 (316 for Sea water application, if any) or equivalent. For all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water (Sea water) etc flanges & bolts & nuts shall be SS 316 L construction.

13.10.00 Specific technical requirement of laying buried pipe with anti corrosive treatment

The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.

13.10.1 Trenching

- (a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822.
- (b) Free access shall be provided for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joint is obtained.
- (c) The free working space shall conform to IS: 5822. The trench shall be excavated so as to provide minimum cover of 1000 mm between the top of the pipe and finished grade.
- (d) Prior to lowering and laying pipe in any trench, the bidder shall backfill and compact the bottom of the trench or excavation in accordance with IS: 5822 to provide an acceptable bed for placing the pipe.
- (e) Coating and Wrapping shall be done as under.

13.10.2 Preparation and cleaning of piping

- (a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power



cleaning method such as sand blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Kerosene will not be permitted for cleaning. This cleaning operation shall be immediately followed by priming with the mechanical priming machine.

- (b) Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.
- (c) The cleaning and priming operation shall be carried out at site. The entire pipe length shall be cleaned but the ends of the pipes shall be left without coating for a distance of 230 mm for joints, which shall be coating manually at site after laying, welding and testing the pipe.

13.10.4 Trench bed preparation and back filling

Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.

13.10.5 Laying of galvanized steel (GI) pipes

All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. Threaded portion on either side of the socket joints shall be applied with Zinc silicate paste.

All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and "anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.

13.11.00 Cleaning and Flushing

13.11.1 All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.

13.11.2 Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done in such a manner that the coating on MS pipe is not affected.

13.11.3 After erection, all water lines shall be 1.2-1.5 times the operating velocities in the pipelines.

13.11.4 All compressed air pipe work shall be cleaned by blowing compressed air.

13.12.00 Painting of Pipes

13.12.1 Buried Piping



Internal surfaces

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

Tests to be carried out after application: Bond/ Adhesion test, Holiday test

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Coal tar primer compatible with coal tar enamel grade. The number of coats shall be two with a DFT of 35 microns each.
- (iii) Coal tar enamel shall be applied. A single spiral inner wrap of glass fibre tissues shall be applied overlapping at least 25 mm ensuring impregnation of glass fibre tissues in the first coat. The second coat of enamel and second outer wrap of glass fibre felt, Type – I to IS: 7193-1974 will be applied in the same way confirming to Table – 10 of IS – 10221 – 1982.

The total thickness of the coating will not be less than 4.0 mm

- (iv) Alternatively Wrapping with coal tar based anticorrosion tape conforming to IS 15337: 2003 is also acceptable in lieu of s.no. (iii) above. Wrapping thickness shall be 4.0 mm.

Tests to be carried out after application: Bond/ Adhesion test, Holiday test

13.12.2**Overground Piping****Internal surfaces**

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.



- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

13.12.3 Other requirements

- (a) Paint manufacturers instructions shall be followed in method of application, handling, drying time etc.
- (b) The color of the finish paint shall be as per approved color-coding.
- (c) If finish paint was applied in shop, one coat of finish paint shall be applied at site.
- (d) The dry film thickness of paint shall not be less than 0.15 mm.

13.12.4 Color code for identification

The pipes shall be color painted/banded for identification as per the approved color-coding scheme and shall be generally as per IS-9404.

13.13.00 Specification for hangers and supports

- 13.13.1 All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.
- 13.13.2 While designing supports for rubber lined pipes special consideration should be given. Any kind of welding on these pipes is not allowed after rubber lining.
- 13.13.3 Hanger for piping 65 mm Nb and larger and all spring support assemblies regardless of size shall be completely engineered in conformance with the provisions of power piping code ANSI B 31.1.
- 13.13.4 Hangers, saddles, supports etc. shall be fabricated from plates/pipes sections conforming to ASTM A 53/IS: 2062/IS: 226/ or equivalent. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. The structural steel work shall be as per IS: 800/BS: 4360. Insulation protection saddles shall be used at support point of all insulated piping.
- 13.13.5 The support shall be so interspaced as to minimize sagging of the pipes and to keep them within permissible limits where pipes are full with the conveying media.
- 13.13.6 The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.
- 13.13.7 All pipe supports shall be designed to provide an absolute minimum head room of 2.5 m from floor in passages/walkways.
- 13.13.8 At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.
- 13.13.9 All components of hangers/support shall be provided with two coats of primer (red oxide paint) at shop before dispatch to site. After erection they shall be given finish coat of Long Oil Synthetic enamel to IS: 2932 of total DFT 100 to 140 microns. CLH & VLH will be primed with Epoxy Zinc rich primer of 50 micron followed by finish painting of Aliphatic Acrylic Polyurethane or equivalent of DFT 65 microns.



13.14.00 Design/Construction/Material Particulars of Gate/Globe/Check Valves/Globe Stop Valve/Butterfly Valve**13.14.1 GENERAL**

- (a) All valves shall be suitable for the service conditions i.e. flow, temperature and pressure, at which they are required to operate.
- (b) The valves as well as all accessories shall be designed for easy disassembly and maintenance.
- (c) Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.
- (d) All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be of outside screw and yoke type.
- (e) All valves shall be closed by rotating the hand wheel in the clockwise direction when looking at the face of the hand wheel. In case where the hand wheel is not directly attached to the valve spindle suitable gearing shall be introduced.
- (f) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined.
- (g) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required. For valves of size 350 mm and above either bevel or spur gearing shall be provided to facilitate manual operation.
- (h) The valves coming in vacuum lines shall be of extended gland type and / or water sealed.
- (i) The actuator-operated valves shall be designed on the basis of the following:
 - (1) The internal parts shall be suitable to support the pressure caused by the actuators.
 - (2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.
 - (3) All actuator-operated valves shall be provided with hand operated gearing mechanism also.
 - (4) All actuators operated valves shall open/close fully within time required by the process.
- (j) Valves coming under the purview of IBR shall meet IBR requirements.
- (k) Gate/slucice valves shall be used for isolation of flow. Gate valves shall be provided with the following accessories in addition to other standard items:
 - (1) Hand wheel
 - (2) Position indicator (for 65 NB & above valve size)



- (l) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction.
- (m) Check valves shall be used for non-return service. They shall be swing check type or double door (Dual plate) check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening/closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600 mm NB.
- (n) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing.
- (o) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable.
- (p) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.
- (q) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer.
- (r) All valves except those with rising stems shall be provided with continuous mechanical position indicator; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.
- (s) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS-1538 for fitting shall be applicable.

13.14.2**VALVE BODY MATERIAL**

Valve body material for various services shall be as follows:

Valve body material for water application like DM Cooling Water (Passivated DM Water) (DMCW), RO Stage I Permeate, AHP Seal Water, APH/ ESP Wash, Service Water, Potable Water, HVAC Make UP shall be cast iron for sizes 65 NB and above; gun-metal/ Forged Carbon Steel for sizes 50 Nb and below.

Valve body material for sea water application like Circulating Water. Auxiliary Coling water, Blowdown, CT make up, sea water Intake, Guard pond inlet & Discharge, Ash Water using sea water, RO Stage II reject, RO Stgae I reject, Reject Sump discharge and all other sea water applications shal be Duplex Stainless Steel for all sizes.



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For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below.

DM water: SS body and disc alongwith SS internals.

Condensate: Cast Carbon Steel/Forged Carbon Steel.

- 13.14.2.1 The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.

Standards and Codes

AWWA-C-504	Rubber seated butterfly valves
BS-5155/EN-593	Cast iron and steel body butterfly valves for general purpose.
IS-778	Gun-metal gate, globe and check valves for general purpose.
BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.
IS-780	Sluice valves for water works purpose (50-300 mm size)
IS-2906	Sluice valves for water works purpose (350-1200 mm size)
IS-5150	Cast iron wedge and double disc gate for general purpose.
BS-5152	Specification for cast iron globe valves
BS-5153	Cast iron check valves for general purpose.
IS-5312	Swing check type reflux (non-return) valves
ANSI B 16.34	Standard for valves
API-594	Standard for Dual-check valves
API-600	Steel gate valves
ANSI-B-16.10	Valves face to face and other relevant dimension
API-598	Valves inspection test



13.14.2.2 End Connections

The end connections, shall comply with the following:

Socket welding (SW) – ANSI B 16.11

Butt Welding (BW) – ANSI B 16.25

Threaded (SC) – ANSI B 2.1

Flanged (FL) – ANSI B 16.5 & AWWA-C-207 (steel flanges), ANSI B 16.1 (Cast Iron flanges)

13.14.2.3 All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).

13.14.2.4 All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints.

13.14.2.5 All gun metal body valves shall have screwed ends.

13.14.2.6 All flanged end valves/specialties shall be furnished alongwith matching counter flanges, fasteners, gaskets etc. as required to complete the joints

13.15.00 Check Valves

13.15.1 Check valves shall comply with the following characteristics:

- (a) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal);
- (b) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position.
- (c) In the case of swing check valves, the body seat shall be inclined at such an angle from the vertical as will facilitate closing and prevent chatter.

13.15.2 Drilling on flanges of flanged valves must correspond to the drilling on flanges of the piping system on which the valves are to be installed.

13.15.3 All flanged valves intended for installation in steel piping systems shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class.

13.15.4 Counter flanges to be installed on air pipes shall be screwed-on type irrespective of size.

13.16.00 Globe Valves

13.16.1 The globe valves shall have the following characteristics;

Straight conveyed flow

Right angle

Preferably, the valves shall be of the vertical stem type.



13.16.2 Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle.

13.16.3 The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.

13.16.4 For the regulating valves, valves with regulating plug & parabolic outline disc type is preferred.

13.16.5 All motorized globe valves with regulating plug for which indication of percentage (%) opening are required in the control room shall be provided with necessary position transmitter.

13.17.00 Gate valves

All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate.

Gate valves shall be of the solid/elastic or articulated wedge disc and rising stem type.

13.18.00 Air Release Valve

- (a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.
- (b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.
- (c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260 and spindle shall conform to high tensile brass.
- (d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/butterfly valve.

13.19.00 Butterfly Valves

13.19.1 Design/Construction

- (a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm nb diameter. In such a case, however, the bidder will have to necessarily submit thickness calculations,



in order to establish the integrity of the fabricated valve body under the system operating pressure condition.

- (1) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable.
- (2) The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable.
- (3) For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.
- (4) The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.
- (5) The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration.
- (6) The operating mechanism shall be mounted directly on or supported from the valve body.
- (7) All valves shall be complete with:
 - Position indicator (located in a visible place)
 - Arrow indicating the flow direction;
 - Adjustable mechanical stop limiting devices to prevent over Travel of valve disc in open/close position.
 - All valves shall be "tight shut off"
- (8) Hand operated valves shall have the following
 - Local hand controls
 - The hand controls shall close the valve with clockwise rotation.



The hand controls shall be dimensioned to guarantee an easy maneuver under most severe conditions.

The hand controls shall be provided with locking systems suitable to avoid the disc assuming a non-desirable position during the operation.

Hand wheel shall be made of malleable iron with arms and rims of adequate strength. The hand wheel of diameters 300 mm or less shall be provided with handles for ease of operation. The pulling force required on the hand wheel rim shall not exceed 25 Kgf when operating the valve under full flow and operating pressure.

Valves-350 Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.

Valves-350 Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque. It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.

Limit and torque switches (if applicable) shall be enclosed in water tight enclosures alongwith suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.

13.19.2 Material of Construction (Butterfly Valves)

Materials and other design details shall be as indicated below:

(a) Cast Iron Butterfly valves

Body & Disc	ASTM A48, Gr. 40 with 2% Ni/ IS: 210. Gr. FG-260, with 2% Ni and epoxy coated
Shaft	BS 970 431 S: 291/EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.
Seat ring	18-8 Stainless steel
Seal	Nitrile Rubber
Companion Flanges	IS 2062
External hardware	SS 316



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- | | | |
|--|-------------------|--------|
| | Internal hardware | SS 316 |
|--|-------------------|--------|
- (b) Duplex Stainless Steel Butterfly valves (All Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water (Sea water) etc.)
- | | | |
|--|-------------------|-------------------------|
| | Body & Disc | Duplex Stainless Steel |
| | Shaft | Duplex Stainless Steel. |
| | Seat ring | Duplex Stainless Steel |
| | Seal | Nitrile Rubber |
| | Companion Flanges | Duplex Stainless Steel |
| | External hardware | Duplex Stainless Steel |
| | Internal hardware | Duplex Stainless Steel |
- (c) Stainless Steel Butterfly Valves
- | | | |
|--|-------------------|---|
| | Body & Disc | ASTM A 351, Gr. CF8M/ASTM-A-182-Gr. 304 |
| | Shaft | ASTM A 182, Gr. 316/ASTM-A-479 Gr. 316/Equivalent |
| | Disc & Seat Rings | EPT/BUNA-N/Neoprene |
| | Companion Flanges | SS 304 |
| | External hardware | SS 316 |
| | Internal hardware | SS 316 |
- (d) Carbon Steel Butterfly Valves
- | | | |
|--|-------------------|---|
| | Body & Disc | ASTM A 216, Gr. WCB |
| | Shaft | ASTM A 182, Gr. 304/ASTM-A-479 Gr. 304/Equivalent |
| | Disc & Seat Rings | EPT/BUNA-N/Neoprene |
| | Companion Flanges | IS 2062 |
| | External hardware | SS 316 |
| | Internal hardware | SS 316 |

13.19.3 Proof of Design Test (Type Test) for Butterfly Valves

Proof of Design (POD) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual POD test shall be conducted by the bidder in the presence of Employer's representative.



All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of POD test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the POD test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of POD test of AWWA-C-504.

13.20.00**MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)**

(a) The materials shall generally comply with the following:

(1) Cast Steel Valves

Body & bonnet	ASTM A 216 Gr. WCB/ ASTM A 105
Disc for non-return Valves	ASTM A 216 Gr. WCB/ ASTM A 105
Trim.	ASTM A 182 Gr. F6 or Equivalent
Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316

(2) Stainless Steel Valves

Body & Bonnet	ASTM A 351 Gr. CF 8M/ ASTM A 182 Gr. 304
Disc	-do-
Trim.	ASTM 182 Gr. F. 316 /ASTM-A-479 Gr. 316 or Integral with body
Companion Flanges	SS 304
External hardware	SS 316
Internal hardware	SS 316

(3) Cast Iron Valves

Body & bonnet 260	BS 1452 Gr. 14/IS-210 Gr. FG
Seating surfaces and rings	13% chromium steel/13% Chrome overlay
Disc for non-return valves	BS 1452 Gr. 14/IS-210 Gr FG 260
Hinge pin for non-return valves	AISI 316
Stem for gate globe valves	13% chromium steel or Equivalent



	Back Seat	13% chromium steel / 13% Chrome overlay
	Companion Flanges	IS 2062
	External hardware	SS 316
	Internal hardware	SS 316
(4)	Gun Metal Valves	
	Body and bonnet	IS 318 Gr. 2/Equivalent Standard
	Trim	-do-
	Companion Flanges	IS 2062
	External hardware	SS 316
	Internal hardware	SS 316
(5)	Duplex Stainless Steel (All Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)	
	Body & bonnet	Duplex Stainless Steel
	Disc for non-return	Duplex Stainless Steel
	Stem	Duplex Stainless Steel
	Trim.	Duplex Stainless Steel
	Companion Flanges	Duplex Stainless Steel L
	External hardware	Duplex Stainless Steel
	Internal hardware	Duplex Stainless Steel L

- (b) Cast iron body valves shall have high alloy steel stem and seat.
- (c) Material for counter flanges shall be the same as for the piping except for sea water application.

13.21.00 Float Operated Valves

- (a) Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.
- (b) DESIGN AND CONSTRUCTION FEATURES**
- The following design and construction feature of the valve shall be the minimum acceptable.
- (c) Valves shall be right-angled or globe pattern.



- (d) Valves shall be balance piston type with float ball.
- (e) Leather liner shall not be provided.
- (f) The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or IS: 210 Grade 200 or equivalent, and float shall be of copper with epoxy painting of two (2) coats. For all sea water applications the complete valve shall be SS 316 L construction.
- (g) Valves shall be suitable for flow velocities of 2 to 2.5m/sec.
- (h) The valves shall have flanged connections.

13.22.00 PAINTING OF VALVES:

Two (2) coats of primer followed by three (3) coats of epoxy of approved color code/shade (usually same as that of connected piping) shall be applied to all exposed surfaces except stainless steel surface, Galvanized steel surface and gun metal surface at shop as required to prevent corrosion, before dispatch. The use of grease/oil other than light grade mineral oil, for corrosion protection is prohibited. The total DFT of painting shall be 150 micron (minimum). If during transport, unloading/unpacking or erection at site any part of the painted surface gets damaged, the same shall be made good by the contractor by repainting with compatible painting primer and enamel to the satisfaction of the project manager.

13.23.00 RUBBER EXPANSION JOINTS

- 13.23.1 All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.
- 13.23.2 The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.
- 13.23.3 The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.
- 13.23.4 The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.
- 13.23.5 Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.
- 13.23.6 Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipelines.
- 13.23.7 The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the 'duck' shall be either a superior quality braided cotton or synthetic fibre having maximum flexibility and non-set characteristic.
- 13.23.8 The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.



- 13.23.9 All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr. B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.
- 13.23.10 The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges.
- 13.23.11 All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.
- 13.23.12 Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.
- 13.23.13 Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.
- 13.23.14 Bidder to note that any metallic part which comes in contact with DM / Corrosive water shall be of stainless steel material.
- 13.23.15 For all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc the bolts & nuts, stretcher plates and companion flanges shall be SS 316 L.**

13.24.00 STRAINERS

13.24.1 Simplex type

The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition fitted with a removable plug. The material of construction of various parts shall be as follows:

- | | | |
|-----|------------------|---|
| (a) | Body | IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent)
Duplex Stainless Steel (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc) |
| (b) | Strainer Element | Stainless steel (AISI 316)

Duplex Stainless Steel (all Sea Water applications including guard pond, reject sump, CW, ACW, CT |



make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)

- (c) End connection Screwed upto 50 mm Nb, and flanged above 50 mm Nb

13.24.2**Duplex type**

- (a) The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow. 2 x 100% automatic self cleaning filters shall be provided for each unit in the ACW discharge header.

- (b) Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows.

Body IS: 318, Gr. 2
Up to 50 mm Nb, and IS:210,
Gr. FG 260 of ASTM-A-515 Gr. 75/IS-2062
Gr. B and internally epoxy-painted above 50 NB.

SS 316 L (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)

Strainer element Stainless steel (AISI 316) for normal water/ Duplex Stainless Steel (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)

End connection Screwed up to 50 mm NB, and Flanged above 50 NB. Gasket shall be of full face type

- (c) The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data.
- (d) The size of the strainer and the flow direction will be indicated on the strainer body casting.
- (e) Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.

13.24.3

Three shop coats of paint preceded by two coats of primer shall be applied to all exposed surfaces as required to prevent corrosion. All parts shall be adequately protected for rust prevention. The use of grease or oil other than light grade mineral oils for corrosion protection is prohibited.



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CHAPTER - 6

PAINTING

1.0 SCOPE

This section defines the technical requirements for surface preparation, selection and application of paints on equipment, vessels, machinery, piping, ducts etc. However, manufacturers shall follow their standard procedures for painting their equipment. The bidder shall submit a detailed painting procedure for approval of owner/ owner's representative after the award of contract.

The following surface and material shall require painting:

- a. All un-insulated carbon steel and alloy steel equipment like columns, vessels, storage tanks, pumps, heat exchangers etc.
- b. All un-insulated carbon steel and low alloy piping, fitting and valves (including painting of identification marks).
- c. All pipe structural steel supports, walkways, platforms, handrails, ladders etc.

The following surfaces and materials shall not require painting :

- a. Non-ferrous materials
- b. Austentic stainless steel
- c. Plastic and / or plastic coated materials
- d. Insulated surface of equipment and pipes except color coating wherever required.
- e. Painted equipment like blowers, pumps, valves etc. with finishing coats in good condition and with matching color code.

2.0 CODES AND STANDARDS

Painting of equipment shall be carried out as per the specifications indicated below and shall conform to the relevant IS specification for the material and workmanship.

The following Indian Standards may be referred to for carrying out the painting job :

IS:5	:	Colours for ready mixed paints and enamels
IS:1303	:	Glossary of terms relating to paints
IS:2379	:	Colour code for identification of pipelines
IS:1477	:	Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS:2524	:	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS:2395	:	Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)



IS:2338	:	Code of practice for finishing of wood and wood based materials (Parts I & II)
IS:158	:	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting.
IS:2074	:	Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
IS:104	:	Ready mixed paint, brushing, Zinc Chrome, priming
IS:2932	:	Enamel Synthetic exterior (a) Undercoating (b) finishing
IS:4682	:	Code of practice for lining of vessels & equipment
SIS 559000	:	Swedish standard for blasting
ISO 8504-2	:	Preparation of steel substrates before application of paints and related products. Surface preparation methods Part 2 Abrasive blast cleaning
ISO 8501-1	:	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Part 1 : Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.
SIS 05 5800	:	Surface preparation by acid pickling
SSPC SP08	:	Surface preparation by acid pickling
IS 2629	:	Recommended practice for hot dip galvanizing of iron and steel
ASTM A780	:	Standard practice for repair of damaged galvanized coatings
SSPC	:	Steel structures painting council
NACE	:	National association of Corrosion Engineers
DIN	:	Deutsehes Institute for Normung
BS	:	British Standard
ASTM	:	American Society for Testing material
AWWA	:	American Water works association

3.0 SURFACE PREPARATION

The surface shall be prepared in a manner suitable for coatings. Chemical derusters or rust converters shall not be applied. Acid cleaning is subject to approval of Purchaser/ Purchaser's representative.

3.1 BLASTING

The surface of the part/ component shall be blasted before the coating material is applied.

Compressed air supply for blast cleaning shall be free of water and oil. Air compressors shall not be allowed to deliver air above 1100C. Blasting activity shall be performed at temperatures 30C above dew point and substrata temperature between 50C & 500C and relative humidity not exceeding 85% shall be maintained during painting. Necessary safety precautions for equipment and operator shall be adhered to and shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work.



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Abrasive used for blast cleaning carbon steel and alloy steel shall be as per ISO 8504-2 and SSPC painting manual. Suggested abrasives are chilled iron grit, shot steel, malleable iron grit and shots of non metallic abrasive (aluminum oxide, copper slag, garnet etc.).

The grade of blasting shall be performed in line with the approved painting scheme.

The nature, quality and grain size of abrasives and the parameter of their use are to be chosen to obtain the required surface profile depth and cleanliness.

Surfaces prepared for coating shall be coated the same day and before any visible rusting occurs (the time elapsed between blast cleaning and commencement of painting shall under no circumstances exceed 4 hours, but in any case must commence before signs of degradation occur).

The grades of surface finish

	ISO 8501-1	SIS 055900	SSPC	NACE
White metal	Sa3	Sa3	SP5	1
Near White metal	Sa 2½	Sa 2½	SP10	2
Commercial Blast	Sa2	Sa2	SP6	3
Brush off blast	Sa1	Sa1	SP7	4

Unless otherwise specified in the documents, the surface shall satisfy the following requirements after blasting

(a) Blasting according to SIS 055900, Grade Sa 2½

Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each primer coat shall be 15-25 µm.

3.2 Manual Rust Removal

Manual rust removal shall be allowed for welded zones and for touching up installed components.

3.3 Cleaning

Removal of impurity

	Impurity	Removal
a)	Dust, Loose deposits	Vacuum cleaning, brushing
b)	Adhesive deposits	Power brushing
c)	Oils, greasy impurities	Wet Blasting, Use of Detergent Additives by agreement
d)	Salt deposits	Rinsing
e)	Markings (eg felt up pen)	Organic solvents to manufacturer's specifications eg Trichloro trifluoro ethane and solvents containing acetone (renew solvent and rag frequently)

3.4 Acid Pickling

Prior to galvanizing the surface preparation shall be done by acid pickling as per SSPC-SP-08.



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4.0 PROCESSING

4.1 General Application Conditions

The primer shall be applied to properly prepared surfaces only. The specifications of the coating material manufacturers shall be observed. The minimum temperature shall be + 5°C and the relative humidity shall not exceed 80%. The temperature of the work piece shall be at least 3°C above dew point.

4.2 Application Procedure

The primer shall be applied by means of brush or by spary. The top coats shall be applied by means of brush, roller or spray.

At points where coating application is interrupted, the individual layers shall be adequately stepped to ensure proper layer sequence when coating operations are resumed.

4.3 Touching Up

Before each layer is applied, previous coating shall be touched up where necessary by way of rust removal and cleaning according coating manufacturers specification. The final top shall be reapplies completely.

4.4 Uncoated Surfaces

Moving parts of machines (e.g stems, shafts, sliding and locating bearings), nameplates, instruments and sealing surface shall not be coated. Welds shall be left free of coating upto a distance of 30 mm on each side of the weld edge until erection and weld examinations, if any, have been completed.

4.5 Bond Strength

The pill off stress determined using the pull off test method for adhesion shall not be less than 1.5 N/mm², according to ISO 4624.

5.0 SURFACE CONDITIONS OF COATING SURFACES

The coating surface shall have a uniform film thickness, shade and gloss and shall be free from inclusions, sags and wrinkles.

6.0 COATING SYSTEMS

6.1 General Requirements for Coating Systems

Coating materials according to SSPC, BS 5493 or DIN 55 928 shall be used. Intermediate coats are to be pigmented with micaceous iron oxide. The materials shall be matched with each other so that they are compatible. Coatings deviating this



specification shall be subject to approval. Standards of surface preparation and painting shall give a time to first maintenance of 10 years.

The colour and gloss of top coats shall be in accordance with sub clause suggested colour codes for painting (Sub Clause 6.8)

6.2 Standard Coating System (External Coatings)

(a) Steel Surfaces

- (i) All steel structures shall receive two primer coats and two sandwich coat of MIO Epoxy paint and one finish coat of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied after erection and final alignment of the erected structures. Two intermediate coats and one finished coat shall also be applied after erection.
- (ii) Steel surface which is to be painted shall be cleaned of dust and grease and the heavier layers of rust shall be removed by chipping prior to actual surface preparation. The surface shall be abrasive blasted as explained in clause 3.1 to Sa 2½ finish as per SIS05-5900. Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each primer shall be 60 microns.
- (iii) Two intermediate MIO Epoxy paint, and one top polyurethane coating of approved brand shall be applied. Dry film thickness of each intermediate coat shall be 90 microns and top polyurethane coating shall be 30 microns. The under coat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness shall be 330 microns. All paints shall be of approved brand and shade as per owner's requirement.
- (iv) Joints to be site welded shall have weldable primer applied within 100 mm of welding zone. Similarly where friction grip fasteners are to be used removable anti corrosive coating shall be provided. On completion of the joint the surfaces shall receive the paint as specified.
- (v) Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams, supporting gratings or chequered plate shall receive one additional coat of finish paint over the above number of coats specified before erection. Portion of steel member embedded/ to be encased in concrete shall not be painted.

(b) Gratings and Step Threads

(i) Surface Preparation

Gratings and step threads shall be cleared by acid pickling as per SSPC-SP-08

(ii) Hot Dip galvanizing

The hot dip galvanizing shall be done as per IS 2629. The average mass of coating shall be 610 gm/m².



(iii) Post Treatment

Immediately after galvanizing post treatment such as chromating shall be applied to retard white rust attack.

(iv) Touch up mechanical damages

The repair of damages coatings shall be done as per the recommended practice ASTM A780.

6.3 Painting of Indoor components such as valves, pumps, motors, electrical parts, tanks etc.**At Works****Surface Preparation**

Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 25 µm may be used.

Prime Coat

Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75µm.

At Site

Thorough cleaning to remove oil, grease, dirt and any other contaminants. Derusting of all mechanical damages according to SIS 055900 Grade ST3. Touch up with dry film thickness 50 µm.

Finish Coat

Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 30-40 microns DFT each coat in approved shades.

Remarks

Equipment coated with a standard application system can be accepted if the quality of this application system is corresponding with the quality of the above mentioned system.

6.4 Painting of Outdoor equipment (external surfaces) such as piping, valves, pumps, motors, electrical parts, tanks etc.

Weather exposure, weather resistance, temperature upto 120°C as per clause 6.1 & 6.3. However

Surface Preparation

Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75µm.

Intermediate Coat

One (1) layer 2 pack high build epoxy polyamide MIO, DFT 100µm.

Finish Coat

Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 50 microns DFT each coat in approved shades.

6.5 Special Coating

(a) Parts exposed to temperatures above 120°C, upto 200°C, not insulated

(i) At Works

Surface Preparation

Blasting according to SIS 055900 grade Sa 2½ and ISO 8501-1:1958. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm.

(ii) At Site

Pretreatment

Dersuting of all mechanical damages, according to ISO 8501-1:1989, grade St 3 touch up with 1 pack inorganic ethyl zinc silicate, dry film thickness 50µm.

Intermediate Coat

1 pack silicon acrylic dry film thickness 35 µm.

Final Coat

1 pack silicon acrylic, dry film thickness as 35µm.
Total system dry film thickness 145µm.
Final coat according to colour code.



(b) Parts exposed to temperatures above 200°C, upto 400°C, not insulated**(i) At Works****Surface Preparation**

Blasting according to ISO 8501-1:1958 grade Sa-2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm.

(ii) At Site**Pretreatment**

Derusting of all mechanical damages, according to standard Sa 2½ to ISO 8501-1:1988. Touch up with coating system according to manufacturer's recommendations.

(c) Insulated parts continuously exposed to condensing water or parts exposed to temperatures

For parts that are provided with insulation on site.

(i) Insulated parts exposed to condensing water**At Works****Surface Preparation**

Blasting according to Sa 2½ to ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm shall be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm

(ii) Insulated parts exposed to temperatures

Parts exposed to temperatures upto < 400°C

Surface Preparation

Blasting according to Sa 2½ to ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm shall be used.



Parts exposed to temperature above 400°C at works (Steam pipes, pressure tubes and parts for the HRSG, such as heating surfaces, heaters and superheaters, reheaters etc)

Temporary Primer

Varnish

(d) Intermittent exposure due to condensing water/ chemicals (Indoors)

(i) At Works

Surface Preparation

Blasting according to Sa 2½ and ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Two layers of Zinc phosphate primer, total dry film thickness 75µm.

(ii) At Site

Pretreatment

Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501-1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75µm.

Intermediate Coat

2 pack high build epoxy, dry film thickness 80 µm.

Finish Coat

2 pack silicon acrylic, dry film thickness of 50µm.

Total system dry film thickness 205µm.

When exposed o weathering, weather resistance finish coat shall be applied.

(e) Water Exposure

(i) At Site/ Works

Pretreatment

Removal of all welding pearls.



Blasting according to Sa 3 to ISO 8501-1:1988

Coat

4 coats 2 pack coal tar epoxy, dry film thickness 125 µm each.

Total system dry film thickness 500µm

Touch up after erection as required.

6.6 Painting of Pipes

6.6.1 Buried Piping

Internal surfaces

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

Note : All steel pipes carrying sea water shall be internally coated with corrocoat/ polyurea coating having thickness 1500 DFT.

Tests to be carried out after application : Bond/ Adhesion test, Holiday test

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Coal tar primer compatible with coal tar enamel grade. The number of coats shall be two with a DFT of 35 microns each.
- (iii) Coal tar enamel shall be applied. A single spiral inner wrap of glass fibre tissues shall be applied overlapping at least 25 mm ensuring impregnation of glass fibre tissues in the first coat. The second coat of enamel and second outer wrap of glass fibre felt, Type – I to IS: 7193-1974 will be applied in the same way confirming to Table – 10 of IS – 10221 – 1982.

The total thickness of the coating will not be less than 4.0 mm

- (iv) Alternatively Wrapping with coal tar based anticorrosion tape conforming to IS 15337: 2003 is also acceptable in lieu of s.no. (iii) above. Wrapping thickness shall be 4.0 mm.



Tests to be carried out after application : Bond/ Adhesion test, Holiday test

6.6.2 Overground Piping

Internal surfaces

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

Note : All steel pipes carrying sea water shall be internally coated with corrocoat/ polyurea coating having thickness 1500 DFT.

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

6.7 Internal Coatings

6.7.1 Tanks (Internal surfaces) as specified in relevant sections of specification

Industrial deionised, demineralised and potable water upto 60°C pH range 4.5-9.5

Blasting according to Sa 2½ and ISO 8501-1:1988.

Prime Coat

Two layers of Zinc phosphate epoxy primer, total dry film thickness >75µm.

Pretreatment

Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501-1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75µm.

Intermediate Coat

2 pack high build epoxy, dry film thickness 80 µm.



Finish Coat

2 pack silicon acrylic, dry film thickness of 150µm per coat.

In case of service or potable water tanks, the coating material selected shall not taint the water. The paint system shall conform to regulations issued by Food & drug administration/ National Public Health service/ AWWA/ OSHA and comply with applicable laws, regulations, ordinances etc. of the local authority, state or the nation pertains to work.

QA/ QC Procedure including pinhole inspection, shall be submitted for approval by Owner/ Owner's representative.

6.6.2 Rubber Lining of Pipes, Valves and Tanks for DM Water**Pretreatment**

Blasting according to Sa 2½ and ISO 8501-1:1988

Rubber Lining

Hard rubber 5 mm for DM water applications as IS – 4682

6.7 Painting for Electrical items

6.7.1 All the steel work shall be thoroughly cleaned of rust, scale, oil, grease, dirt and swarf by pickling, emulsion cleaning etc. The sheet steel shall be phosphate/ oven dried and then painted with two coats of zinc rich primer paint. After application of the primer, two coats of finishing epoxy paint shall be applied. The colour of the finishing coats inside shall be glossy white and exterior of the treated sheet steel shall be shade 631 of IS-5/ RAL 7032 for all switchboard/ MCC/ Distribution boards, control panels etc.

6.7.2 All electrical equipment shall be given tropical and fungicidal treatment and outdoor equipment shall be provided with rain hood to prevent entry of rain water into the equipment.

6.7.3 Painting of I & C equipment : Epoxy coating required for all I & C equipment.

6.8 SUGGESTED COLOUR CODES FOR PAINTING

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
1.	Structures, platforms, galleries, ladders and handrails	Dark Admiralty Grey	632	-	-
2.	Boiler casing, ducting	Nut Brown	413	-	-



SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
3.	Crane				
3.1	Crane structure	Golden Yellow	356	Black	-
3.2	Trolley & hook	Crimson	540	-	-
4.	Fans, pumps, motors, compressors	Light Grey	631	-	-
5.	Tanks (without insulation and cladding)				
5.1	Outdoor	Aluminium	-	-	-
5.2	Indoor	Light grey	631	-	-
6.	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
7.	Switchgear	Light grey (Powder coated)		-	-
8.	Control & relay panels	Light grey (Powder coated)	631/70 78 of IS 1650	-	-
9.	Turbines	Light Grey	631	-	-
10.	Generators & Exciter	Light Grey	631	-	-
11.	Transformers	Aluminum	-	-	-
12.	Machinery guards	Signal red	537	-	-
13.	Piping (without insulation and cladding)				
13.1	Water System				
a	Boiler feed	Sea Green	217	-	-



SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
b	Condensate	Sea Green	217	Light Brown	410
c	DM Water	Sea Green	217	Light Orange	557
d	Soft Water	Sea Green	217	French Blue	166
e	Bearing Cooling Water	Sea Green	217	French Blue	166
f	Potable & filtered Water	Sea Green	217	French Blue	166
g	Service and clarified water	Sea Green	217	French Blue	166
h	Cooling water	Sea Green	217	French Blue	166
l	Sea Water	Sea Green	217	White	-
14.	Ash Transmitting Vessels and pipe lines	Aluminium	-	-	
15.	Air System				
15.1	Station air	Sky blue	101	-	-
15.2	Control air	Sky blue	101	White	-
16.	Oil system				
16.1	Fuel oil	Light brown	410	French	166
16.2	Light oil (HSD)	Light Brown	410	Brilliant green	221
16.3	Lubricating oil	Light brown	410	Light grey	631
16.4	Transformer oil	Light brown	410	Light orange	557
17.	Gas System				
17.1	Carbon dioxide	Canary yellow	309	Light grey	631
17.2	Hydrogen	Canary yellow	309	Signal red	537
18.	Fire services	Fire red	536	-	-
19.	Effluent pipes	Black	-	-	-
20.	Vacuum pipes	Sky blue	101	Black	-

Notes :

1. This colour code basically refers to IS:2379 for piping with necessary modifications



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2. Where band colour is specified, same shall be provided at 30 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.

Bidder shall furnish his painting specification to suit corrosive atmosphere of coastal area along with the bid. The specification shall in general be in line with the above requirements.



Tests	:	Tested at two hundred (200) percent of the maximum process pressure
Other details	:	For larger lengths, additional gauge glasses shall be provided with minimum of 50 mm overlap.

3.03.22 FLOAT & BOARD TYPE LEVEL GAUGE

Type of Instrument	:	Mechanical Type (Float Operated)
Service/ Application	:	As per service requirement
Measuring Range	:	as per requirement
Material Specification	:	
a) Float Material	:	SS316 having 2 nos. Guide wires
b) Float Wire Pulley	:	Shall comprise of 2 nos. Cast Aluminum Pulley housing Assembly with SS 304 pulley and pulley shaft. Steel ball bearings shall be provided in pulley housing for easier float movement. Float wire material shall be SS316L. Between 2 pulleys, 1" SS short pipe.
c) Guide wire Assembly	:	SS chamber with SS316 spring and adjuster having 1" Class 150 ANSI RF SS flange. Guide wire rope shall be SS316L.
d) Counter Weight	:	MS counter – weight with Aluminum Pointer and Brass assembly Pull Chain.
e) Scale	:	SS 316/Aluminum material in mm with 1 % accuracy.
Nozzle Details	:	For float wire pulley assembly, one tapping and for guide wire assembly two tapping at the top of the tank; Size 1" NB (Top Mounting Type)
Process Connection	:	Flanged as per ANSI B 16.5 to suit 1" NB nozzle (Nozzle length - 150 mm for float wire, 100 mm for guide wire)
Accessories (to be supplied with the instrument)	:	
a) Counter flange	:	All mating Flanges, Nozzle
b) Mounting Accessories	:	All mounting accessories
c) Tag Plate	:	To be provided (material SS316)

3.03.23 MASS FLOW METER**Sensor**

Measuring Principle	:	Coriolis Mass flow.
Primary Element	:	Flow Tube of 316SS or better
Heating Arrangement	:	Integral with Flow meter.
Temperature Control For Heating	:	To be provided.
Process Connection	:	ANSI RF Flanged and rating as per process requirement.



Gaskets, Fasteners, Counter and mating flange (SS316 material), nuts & bolts etc. shall also be included, wherever required with the field instruments.

- 3.02.00 Following minimum requirement of field instruments shall be fulfilled by Bidder (In addition, Redundancy criteria for field instruments shall be as specified else where in specification): -
- i. Level switches / pressure switches / flow switches/any other process switches etc. for OLCS / Alarms / Interlocks / Protection. Pressure switches at inlet, outlet of individual pumps and discharge header of pumps for protection and auto start / stop & alarms.
 - ii. Level switches (Type as per Owner Approval) for sump/tank/vessel/containers/heaters/hoppers/silo level very high/high/normal/low/very low interlocks.
 - iii. Level Transmitters (Type as per Owner approval) for open sump/tank/bunker/vessel/heaters/containers/silo etc. in addition to level switches.
 - iv. Stand pipes on both side of tank for all level instruments (LT, LS & LG).
 - v. Flow elements (Type as per Owner Approval) with flow transmitter & Flow meter for flow measurement of process medium like Steam, Water, Air, Flue Gas, Fuel oil, Lube oil, open channel liquid, solid fuel, ash flow, ash slurry, DM water, PT plant, ETP Plant, Raw water, Instrument and Service air etc. as decided by owner with in terminal points and scope.
 - vi. Pressure gauges, temp. Gauges and Temp. Element at inlet and outlet of each heat exchanger and cooler.
 - vii. DPG, DPT & DPS across the filters/strainers.
 - viii. Tapping points/test points shall be provided.
 - ix. All primary Instruments, hardwares & JB's etc used for measurement for HFO, LDO & Turbine Lube Oil system shall be flame proof (IEC-79.1, Part I). All primary Instruments, hardwares & JB's etc used for measurement for Hydrogen Gas & Oxygen Gas shall be intrinsically safe and explosion proof as per NEC article 500, class 1, Division 1 area I.
 - x. All Thermocouples & RTDs (Type as per Owner Approval) shall be Duplex. Thermocouples shall be provided for Mill outlet temperature and for Services with Temperature ≥ 200 deg C.
 - xi. All Field Instruments used in acid or alkaline atmosphere shall be with standard Anti corrosion coating i.e. the combination of Polyurethane and epoxy resin baked coating (ANSI/ISA-71.04).
 - xii. All primary instruments installed at "Minus level or Floor" shall be with protection class of IP 68.



- xiii. Transmitters (all type) for monitoring & controls purpose.
- xiv All field mounted push button, selector switch etc. shall be as per IEC or NEMA 4X protection.
- xv All limit switch shall be conform to IEC-60947-5-1 and shall have minimum 2SPDT/DPDT contacts.
- xvi At APH, **temperature measuring device of different lengths forming grid** shall be provided to have average temperature for variable flow of flue gas, secondary air and primary air. These temperatures may be connected to nearest remote I/O panel.
- xvii. On both left and right sides of furnace, separate lines shall be laid and provided with **furnace pressure transmitters having wide range** than the furnace pressure transmitter used for modulating Control.
- xviii. Temp. Transmitters are envisaged with RTD & Thermocouples for monitoring services/application only. However any RTD & Thermocouples are used for control, interlock & protection application, Metal Temperature, and bearing & winding temperature, same shall be directly wired to DDCMIS/DCS/PLC using instrumentation & Extension cables respectively.
- xix. As for the water flow/ steam flow measurements, **necessary flow elements/ transmitters are chosen in the process line and supplied such that their algebraic summation shall be mass balanced for calculating the system efficiency.**
- xx. Non Contact Type, electronic 2-wire position transmitters shall be provided for all inching type motorised valve and dampers.
- xxi. For Turbine oil tank, LDO/HFO tank, DM water tanks, CS tank, Chemical dosing tanks, Acid and alkali applications, lube oil tanks, and any other tank/sump etc., only non contact type level transmitters like Acoustic, Ultrasonic, Radar based (Type as per Owner Approval) shall be provided by bidders as specified in the specification and as approved by owner.
- xxii. Considering the type of application, wireless technology to bring signals to DDCMIS may be adopted by interfacing with OPC gateway to avoid cabling for smart level transmitters specified above at sr. no. xxi, in case used for monitoring only. However Wireless technology as adopted by Bidder shall be reliable and field proven in power plants and same shall be approved by Owner. Wirelss transmitters shall have the same minimum specification/parameters as mentioned for wired transmitters.
- xxiii. For Turbine oil, HFO/LDO applications & H2 Gas application, zener protection on power supplies shall be included.



glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges.

Accuracy	:	$\pm$ One (1) percent or better
Connection - Instrument Process	:	1/2 inch NPT Male Bottom
Mounting	:	Local / Frame mounted.
	:	1/2 inch NPT Male (Back entry) mounted on local gauge board.
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
IBR Requirement	:	For high pressure service, Process tapping and root valves are as per IBR rules and regulations.

Accessories

- 3 way needle valve/manifolds	:	For all gauges depending upon service.
- Self cleaning type	:	Pump and compressor discharge lines
Pulsation dampener/snubber (S316)	:	
- Syphon	:	For all steam lines
- Protective separating seal	:	For fuel oil and corrosive liquid lines

Other particulars

- External Zero adjustment	:	For all gauges
- Safety device	:	
Ranges 5 to 20 Kg/cm ²	:	Rubber blow out disc with open front construction.
Ranges above 20 Kg/cm ²	:	Neoprene safety diaphragm at the back with solid front construction.
- Over range protection	:	One Fifty (150) percent of full scale

Other Requirments

:	Movement mechanism shall be glycerin filled for oil services & vibration prone area.
:	For Fuel oil & corrosive liquid lines diaphragm type sensors required. Armored capillary of 10 M for Fuel oil & Corrosive liquid service.
:	Contact type pressure gauges are not acceptable for interlock & protection.
:	For condensate storage tank and DM water storage tanks, the pressure



gauge in terms of 0-10000 mm wc or suitable range having **dial size of 300mm or bigger size** shall be provided.

3.03.04 Temperature Transmitters (TT)/Differential Temperature Transmitters (DTT)

Type	:	Dual Input, SMART type configurable from control room through HART protocol (HMS System).
Display type	:	Indicating type (5 digit LCD Display).
Accuracy	:	$\pm 0.10\%$.
Ambient temperature error	:	0.1% per 10°C change
Output	:	4-20 mA DC (2 wire system) HART compatible signals for analogue monitoring inputs to the distributed control system (DDCMIS), DCS & PLC.
Protection class	:	NEMA 4/IP66 or equivalent degree of protection for enclosure)/(Explosion/Flame proof for NEC Class-1, Division 1/2 area)/ flame proof (IEC-79.1, Part I). As applicable).
Material of accessories	:	SS316
Stability	:	$\pm 0.1 \%$ or ± 0.1 deg C of reading (whichever is great) for 2 years in case of RTD inputs and for 1 year in case of Thermocouples inputs.
Operating Voltage	:	16 – 48 V DC
Calibration	:	as per NIST monograph 125 for T/C & European Curve Alpha = 0.00385 for RTD .
Ref. Junction compensation	:	Provided
Span/zero adjustment	:	Locally adjustable, Non interacting
Auto calibration	:	Provided
Burn out protection upscale	:	Provided
Input - output isolation	:	Provided
Circuit ungrounded	:	Provided
EMC compatibility	:	As per EN 61326
Operating Ambient Temperature	:	0 to 70 deg C.
Mounting	:	Head Mounted/locally mounted as per application finalized by owner.

Temperature Transmitters shall not be used for CLCS, OLCS, interlock & protection services anywhere in the plant with RTD & Thermocouples. However RTD & Thermocouples are used for control, interlock & protection application, same shall be



- d) Overall colour scheme and finish schedule of the plant and other buildings shall be designed judiciously and in a comprehensive manner taking into account the mass and void of buildings, its façade, equipments, exposed structural elements, piping, trestles, bus ducts and other service elements.
- e) Overall emphasis shall be on developing an eco-friendly architecture, merging with the nature with its own sustainable energy management systems.

The scheme shall be conceptually finalized in totality including that of equipments so that the proper coordination with other agencies can be taken up at appropriate time.

13.02.00 Architectural Design

- i) Natural light shall be used to the maximum extent specially in the form of north light / sky light. For adequate light & ventilation, National Building code recommendations shall be followed.
- ii) Entrance canopies, chajjas (projections, recesses) over openable windows and door openings on exterior facades shall be provided.
- iii) All the buildings shall be architecturally designed to meet the National Building Code (SP:7) norms and local building bye laws, wherever applicable.
- iv) Architectural design and detailing aspects of all the buildings shall be rendered through professional services of an Architect. Statutory requirements and any clearances from local authority may be required to be met with, wherever essential. The Architect Consultant shall be of National / International repute having experience in similar kind of works. The consultant shall evolve the design philosophy based on Employer's guidelines and shall present it in the form of presentation drawings, Prospective views, 3-D Models & detail drawings.
- v) Minimum 1000mm high (from floor / roof level) hand railing shall be provided around all floor / roof openings, projections / balconies, walkways, platforms, steel stairs, etc., All handrails and ladder pipes (except at operating floors) shall be 50mm nominal bore MS pipes (medium class) conforming to IS:1161 and shall be galvanized as per IS:4736 treated with etch primer and finished with suitable paint. All rungs and ladders shall also be galvanized. Minimum weight of galvanizing shall be 610 g/sqm.

All stairs and around all floor openings at operating floors, 1000mm high hand railing with 32 NB (polished) stainless steel pipe shall be provided.



- vi) All stairs shall have a maximum riser height of 180mm and a minimum tread width of 250mm. Minimum clear width of stair shall be 1200mm unless specified otherwise.
- vii) All buildings having metal cladding shall be provided with a 150mm high RCC toe curb at the edge of the floor along the metal cladding. 900mm high hand railing shall be provided on this RCC curb, wherever required from the safety point of view.
- viii) In all buildings, structures, suitable arrangement for draining out water collected from equipment blow downs, leakages, floor washings, fire fighting, etc., shall be provided for each floor. All the drains shall be suitably covered with grating or pre-cast RCC panels.
- ix) RCC staircase shall be provided for all RCC construction buildings and structural steel staircase for all structural steel buildings.
- x) Parapet, Chajjas over window and door heads, architectural facias, projections, etc., shall be provided with drip course in cement sand mortar 1:3. Cut lintels over windows/doors shall be avoided as far as possible.
- xi) All fire exits shall be painted with P.O red/signal red colour shade which shall not be used anywhere except to indicate emergency or safety measure. Fire safety norms shall be followed as per National Building Codes and fire safety requirements for providing fire exits, escape stairs and firefighting equipment. In detailing of all buildings, fire safety requirements conforming to IS:1641 and IS:1642 shall be followed.
- xii) All windows shall be provided with granite slab at sill level.
- xiii) All grills of window shall be of 12 mm square MS bars both ways.

13.03.00**Interior Design**

A comprehensive interior design scheme shall be conceived with the intention of projecting a definite theme and aesthetic appearance to inside working environment. It shall take into account the multidisciplinary engineering activities involving power plant technology, and architectural and civil engineering for a smooth control hierarchy and man machine inter face. All the design aspects such as flooring, false ceiling, furniture, colour scheme, equipment design, layout, illumination, fire fighting, acoustics and ergonomics requirements shall be detailed out so as to present an overall unified aesthetic spatial appearance. The areas to be undertaken for this interior design process shall be control room complex including common control room, computer room, conference rooms and office areas in the main plant building and the following aspects shall be reviewed and evaluated for design. Furniture to be supplied by Bidder for the control room complex shall be as specified under C&I specification.



Increase in permissible stresses shall be allowed in load combinations where dynamic piping loads are considered and shall be as permitted under seismic load conditions.

8.03.00 Equipment, Piping and Associated Loads

Equipment loads shall be considered over and above the imposed loads. Equipment loads shall be considered as given by equipment supplier.

8.04.00 Crane Loads

For crane loads, an impact factor of 25% and lateral crane surge of 10% (of lifted weight + trolley weight) shall be considered in the analysis of frame according to the provisions of IS:875. The longitudinal crane surge shall be 5% of the static wheel load. Longitudinal surge and lateral surge shall not be considered to act simultaneously.

8.05.00 Seismic Load

The project site is in Zone – III as per IS: 1893/Part I-2003 & IS:1893 – Part II – 2005.

Zone factor Z = 0.16
Importance factor = 1.75

Response reduction factor = 5.0 (for MRF) AND 3.0 (for OMRF)

8.06.00 Wind Load

Basic wind speed at project site is 50 m/sec. as per IS:875 -1987 Part-3

Probability factor, (k1 risk coefficient), terrain, height and structure size factor, k2 and topography factor, k3 shall be as per IS:875.

8.07.00 Damping in Structures

The damping factor to be adopted shall not be more than as indicated below:

Type of Structure	Wind Load	Seismic Load
a) Welded steel structure	1%	2%
b) Bolted steel structure	2%	2%
c) RCC structure	1.6%	5%

8.08.00 Temperature Load

For temperature loading, the total temperature variation shall be considered as 2/3 of the average maximum annual variation in temperature. The average



- j) ~~In cases where dead load provides the restoring forces, only 0.9 times characteristic dead load shall be considered. Imposed loads shall not be considered as restoring force.~~

10.04.00 Grouting

- i) Non-shrink flowable grout shall be used for under pinning work below base plate of columns. Non-shrink cum plasticiser admixture shall be added in the grout. For grouting of base of machine foundation high strength flowable ready mixed non-shrink grout shall be used.
- ii) Convextra GP-II, Sikka or equivalent grout shall be used for structural columns and equipment bases. Crushing strength of the grout shall generally be one grade higher than the base concrete. Minimum grade of grout shall be M30.
- iii) Nominal thickness of grouting shall be atleast 50 mm for building columns and pedestals of major equipment. For secondary posts, stair and ladder base, etc. grouting shall not be less than 25 mm thick.

10.05.00 Edge Distance For Bolts

Minimum distance from the center line of foundation / anchor bolt to edge of pedestal shall be the maximum of the following:

- i) Clear distance from the edge of base plate / base frames to the outer edge of the pedestal shall be minimum 50 mm.
- ii) Clear distance from the face of pocket to the outer edge of pedestal shall be 75 mm.
- iii) Clear distance from the face of pocket to the outer edge of pedestal shall be 75 mm.

10.06.00 Loading conditions for underground structures

Following loading conditions shall be considered in addition to the loading from super structure for the design of substructure of pump house, channels, sumps, tanks, trenches and other underground structures containing liquid.

- a. ~~Water pressure from inside and no outside pressure, like earth pressure, ground water & surcharge pressure (applicable only to structures which are liable to be filled up with water or any other liquid.)~~



59.1 The furnishing of engineering data by the Vendor/Contractor shall be in accordance with the schedule as per specification in the data sheet. The review of these data by the Engineer will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under 'Specification', external connections and of the dimensions which might affect plant layout. This review by the Engineer may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the Engineer shall not be construed by the Vendor/Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

59.2 All engineering data submitted by the Vendor/Contractor after final process including review and approval by the Engineer shall form part of the Contract and the entire 'Works' covered under these specifications shall be performed in strict conformity unless otherwise expressly requested by the engineer in writing.

60.0 DRAWINGS

60.1 In addition, the Vendor/Contractor shall furnish the 'Soft copy' of all essential drawings in addition to full size prints. Drawings shall be submitted in adequate number of copies as indicated in Volume II, Section -1, General Technical Specification.

61.0 INSTRUCTION MANUALS

61.1 The Vendor/Contractor shall furnish all required instruction manuals in adequate number of copies as indicated in Volume II, Section -1, General Technical Specification.

62.0 MISTAKES IN DRAWINGS

62.1 The Vendor/Contractor shall be responsible for any discrepancies, errors or omissions in the drawings and other particulars supplied by him, whether such drawings and particulars have been approved by Engineer or not provided that such discrepancies, errors, or omissions be not due to inaccurate information or particulars furnished in writing to the Vendor/Contractor by the Owner/Purchaser or the Engineer. The Owner/Purchaser shall be responsible for drawings and information supplied in writing by the Owner/Purchaser or the Engineer and for the details of special work specified by either of them. The Owner/Purchaser shall pay for any alterations of the supply necessitated by reason of inaccurate information so supplied by the Vendor/Contractor.

63.0 FIRST FILL OF OILS, LUBRICANTS, ETC.

63.1 Apart from the first fill of lubricants, additional 10% of first fill of oils, lubricants and essential chemicals, etc., which will be required to commission the equipment covered under the scope of Specification shall be furnished by the Vendor/Contractor unless specifically excluded under the exclusions in these specifications and



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- execution of the Contract will be submitted by the Contractor.
- 32.3 To ensure that the equipment and services under the scope of this "Contract" whether manufactured or performed within the contractor's works or at his sub-Contractor's premises or at the Purchaser's "Site" "Specification", the contractor shall adopt suitable quality assurance programme to control such activities at all points, necessary. Such programme shall be outlined by the contractor and shall be finally accepted by the Owner after discussions. A quality assurance programme of the contractor shall generally cover the following:
- His organization structure for the management and implementation of the proposed quality assurance programme,
 - Documentation control system,
 - The procedure for purchase of materials, parts, components and selection of Sub- Contractors service including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.,
 - System for shop manufacturing and site erection controls including process controls and fabrication and assembly controls,
 - Control of non-conforming items and system for corrective actions,
 - Inspection and test procedure both for manufacture and field activities,
 - Control of calibration and testing of measuring and testing equipment,
 - System for indication and appraisal of inspection status,
 - System for quality audits,
 - System for handling storage and delivery, and
 - System for maintenance of records.

33.0 MAINTENANCE TOOLS AND TACKLES ETC.

- 33.1 The proposal shall include all tools, wrenches, special tools, tackles, devices, instruments, equipments etc., required for the operation and maintenance, disassembly, checking, reassembling of the components, parts, subassemblies, erection, testing etc., of the equipment in each equipment package. The bidder shall indicate all the above items in the Bid proposal sheets in the form of a Schedule giving therein the description and the quantity of each item and price thereof. The lump sum price to be quoted by the bidder shall include prices of these tools and tackles. Unless otherwise specified in the Technical Specifications, these will be delivered along with the main equipment.
- 33.2 The bidder should furnish the items of maintenance tools and tackles etc., considered by them in their bid along with their unit price so as to compare the bids. If any of the maintenance tools and tackles which are essential for operation and maintenance of the plant are found to be missing from the list offered by a bidder, the highest price offered by the other bidders shall be considered for evaluation purpose.
- 33.3 These tools, tackles, special tools, devices etc., shall be meant basically for operation and maintenance of each equipment package and not to be used for site assembly and erection work for which the Contractor shall arrange the required tools, tackles, devices etc., separately at his own cost.

34.0 CONSTITUTION OF THE BIDDER

- 34.1 If the CONTRACTOR is a joint venture or consortium of two or more firms, all such firms shall be jointly and severally bound to the Owner for the fulfillment of the provisions of the contract and designate one of such firms to act as a leader with authority to bind the joint venture or consortium. The composition or constitution of the joint venture or consortium shall not be



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**TITLE****2x800 MW UPPUR STPP****TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM**

SPECIFICATION NO.: PE-TS-425-166-A001

REV.: 00

Section: IE

Date: 25/10/2017

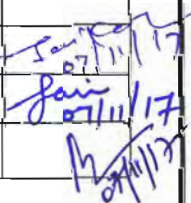
Page 1 of 1

SECTION – I**SPECIFIC TECHNICAL REQUIREMENTS****SECTION IE – Specific Technical Requirement (C&I)**

UPPUR 2x800MW STPP (UNIT-1&2)

TECHNICAL SPECIFICATION (C&I) FOR
FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST)

**TECHNICAL SPECIFICATION
(CONTROL & INSTRUMENTATION)
FOR
FUEL OIL HANDLING SYSTEM & MISC.
TANKS(CST)**

					
	UPPUR 2x800MW STPP (UNIT-1&2)		DESG	JKG	
	JOB NO: 425		CHKD	PJ	
REV. NO. 00		DATE: 07.11.2017	APPD	BS	

UPPUR 2x800MW STPP (UNIT-1&2)

**TECHNICAL SPECIFICATION (C&I) FOR
FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST)**

INDEX

S. No.	DESCRIPTION
1	TITLE SHEET
2	INDEX SHEET
3	SPECIFIC TECHNICAL REQUIREMENTS (C&I)
4	SPECIFICATION FOR MEASURING INSTRUMENTS (PRIMARY & SECONDARY), TRANSMITTERS, GAUGES etc.
5	LIST OF DOCUMENTS/DELIVERABLES
6	SIGNL EXCHANGE BETWEEN DRIVES & DCS (DCP)
7	DATA SHEETS FOR MOTORISED VALVE ACTUATOR
8	QUALITY ASSURANCE FOR INSTRUMENTS
9	TYPE TEST REQUIREMENT
10	SUB VENDOR LIST
11	INSTRUMENTATION CABLE, CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY
12	LIST OF MANDATORY SPARES
13	KKS TAG PHILOSOPHY

	UPPUR 2x800MW STPP (UNIT-1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST)	

**SPECIFIC TECHNICAL REQUIREMENTS
(C&I)**

Specific Technical Requirements

- 1.1 The make/model of various instruments/items/systems shall be as per the attached Vendor list. However the make/model of various instruments / items shall be subject to approval of owner / purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements, as per customer interpretation, among them are to be complied with.
- 1.2 Drawings/Documents and data to be furnished after award of the contract as per deliverables list.
- 1.3 All local gauges as well as transmitters, sensors for parameters like level etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. Th necessary root valves, impulse piping, drain cock, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting / erection of these local instruments shall be furnished even if not specifically asked for. The offer shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm2.
- 1.4 All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1, Division 1 area & flame proof) and an anticorrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange (SS316 material), nuts & bolts etc. shall also be included, wherever required with the field instruments.
- 1.5 Components of instruments, control devices, accessories, piping etc. Which contact with steam, condensate or boiler feed water shall be manufactured from copper free materials which do not react with media at operating parameters.
- 1.6 All wetted parts of instrument shall be suitable for sea water application (Duplex stainless steel or better) if applicable. Instruments, fittings, valves etc. shall be suitable for the hazardous area application.
- 1.7 All valve actuator shall be provided with conventional actuators with integral starter for ON/OFF valves. Non-contact type electronic 2-wire position transmitters shall be provided for all inching type motorized valves. The detailed specification of actuator is attached.
- 1.8 All Field Instruments used in acid or alkaline atmosphere shall be with standard anti corrosion coating i.e. the combination of Polyurethane and epoxy resin baked coating (ANSI/ISA-71.04). The junction boxes and instruments / electronics housing used shall be made of non – corrosive material.

- 1.9 All instruments should be supplied with valid calibration and test certificates provided by OEM. All transmitters shall be HART compatible.
- 1.10 Canopy/Enclosure shall be provided for field instruments like transmitters etc. and any other equipment to protect from direct sun light, lightning & rain.
- 1.11 These requirements are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of Customer shall prevail without any commercial/time implication.
- 1.12 All instruments shall be terminated on JB in field and both instrument and JB are in bidder scope. Bidder to provide JB/Rack & other erection hardware.
- 1.13 For cable scope, bidder to refer scope between BHEL and vendor defined in Electrical Specification.
- 1.14 Bidder to provide mandatory spares as per Mandatory Spares List.
- 1.15 Electrical Actuators with integral starter shall be provided for all on/off and inching type valves along with necessary interface units for linking to corresponding Control System as applicable, typical Hook-up diagram of drives is included for reference.
- 1.16 The specifications for instruments mentioned in the specification are minimum requirements. The detail specifications shall be finalized during detail engineering.
- 1.17 The bidders shall specifically mention any deviation they would like to take on the C&I specification. In absence of only deviation a "No deviation" certificate is to be furnished.
- 1.18 The quantity of instruments for the system shall be as per tender P &ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering, if any additional instruments are required for safe & reliable operation, bidder shall supply the same without any price / time implication.
- 1.19 Bidder to terminate all instrumentation and control elements in junction boxes. Bidder to provide input/output list, drives list, junction box schedule and termination details, write-up etc. List of documents to be submitted after award of contract is to be referred by bidder.
- 1.20 Bidder to perform tests of C&I items / instruments as per Quality plans/type test attached in the specification. However, if any test which is not specified in the quality plan but specified in specification tests for I&C equipment included elsewhere in specification, will have to perform by Bidder without any cost/time implication.

1.21 Instrument installation and accessories required for the same are in Bidder's scope and shall be submitted after award of contract. However any instrument installation not covered in the same shall be subject to customer and BHEL approval during detailed engineering.

1.22 Diaphragm seal shall be provided with Instruments having contact with corrosive media.

1.23 Painting Process/procedure & Painting material shall be suitable for sea water and saline conditions at site in line with national and international standards like ASTM, ISO etc.

1.24 Number of pairs to be selected for Screen Control cable (Size: 0.5 mm²)

- F-Type: 2P/4P/8P/12P/20P
- G-Type: 2P/4P/8P/12P
- Core Cable: 3CX2.5sqmm² / 12CX1.5sqmm²

1.25 The offered level transmitters shall be compatible with Universal type hand held calibrator.

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	UPPUR 2x800MW STPP (UNIT-1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST)	

**SPECIFICATION FOR MEASURING INSTRUMENTS
(PRIMARY & SECONDARY), TRANSMITTERS,
GAUGES ETC.**

CHAPTER-3**FIELD & MEASURING INSTRUMENTS AND FLOW ELEMENTS****3.00.00 FIELD & MEASURING INSTRUMENTS (PRIMARY & SECONDARY INSTRUMENTS) AND FLOW ELEMENTS****3.01.00 GENERAL REQUIREMENTS**

3.01.01 Field Instruments, control devices, remote instruments, Flow Elements and other equipment accessories covered under this specification shall be furnished in accordance with I&C specification sheets and drawings enclosed herewith and the requirements of all applicable clauses of this specification.

3.01.02 The instrumentation and control equipment shall conform to all applicable codes and standards including those referred in Cl. no. 1.08.00 in this Volume.

3.01.03 The instrumentation/control equipment and accessories shall be from the latest proven design for which the performance and high availability have been demonstrated by a considerable record of successful operation in power station service for similar applications. The bidder shall furnish sufficient evidence to fully satisfy the Owner in this regard.

3.01.04 In general, front draw out type instruments with plug-in facility at the rear for connecting cables for power supply and signal shall be provided unless otherwise specified like for Explosion proof area, Flame proof area and high vibration prone area. Separate plugs & socket connection shall be provided for connecting power supply cables and signal wires/cables.

The plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections.

Signal and Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands for Explosion proof area, Flame proof area and high vibration prone area.

3.01.05 Every instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuse of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.

3.01.06 All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1/2, Division 1 area & flame proof area) and an anti corrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland.



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Gaskets, Fasteners, Counter and mating flange (SS316 material), nuts & bolts etc. shall also be included, wherever required with the field instruments.

- 3.02.00 Following minimum requirement of field instruments shall be fulfilled by Bidder (In addition, Redundancy criteria for field instruments shall be as specified else where in specification): -
- i. Level switches / pressure switches / flow switches/any other process switches etc. for OLCS / Alarms / Interlocks / Protection. Pressure switches at inlet, outlet of individual pumps and discharge header of pumps for protection and auto start / stop & alarms.
 - ii. Level switches (Type as per Owner Approval) for sump/tank/vessel/containers/heaters/hoppers/silo level very high/high/normal/low/very low interlocks.
 - iii. Level Transmitters (Type as per Owner approval) for open sump/tank/bunker/vessel/heaters/containers/silo etc. in addition to level switches.
 - iv. Stand pipes on both side of tank for all level instruments (LT, LS & LG).
 - v. Flow elements (Type as per Owner Approval) with flow transmitter & Flow meter for flow measurement of process medium like Steam, Water, Air, Flue Gas, Fuel oil, Lube oil, open channel liquid, solid fuel, ash flow, ash slurry, DM water, PT plant, ETP Plant, Raw water, Instrument and Service air etc. as decided by owner with in terminal points and scope.
 - vi. Pressure gauges, temp. Gauges and Temp. Element at inlet and outlet of each heat exchanger and cooler.
 - vii. DPG, DPT & DPS across the filters/strainers.
 - viii. Tapping points/test points shall be provided.
 - ix. All primary Instruments, hardwares & JB's etc used for measurement for HFO, LDO & Turbine Lube Oil system shall be flame proof (IEC-79.1, Part I). All primary Instruments, hardwares & JB's etc used for measurement for Hydrogen Gas & Oxygen Gas shall be intrinsically safe and explosion proof as per NEC article 500, class 1, Division 1 area I.
 - x. All Thermocouples & RTDs (Type as per Owner Approval) shall be Duplex. Thermocouples shall be provided for Mill outlet temperature and for Services with Temperature ≥ 200 deg C.
 - xi. All Field Instruments used in acid or alkaline atmosphere shall be with standard Anti corrosion coating i.e. the combination of Polyurethane and epoxy resin baked coating (ANSI/ISA-71.04).
 - xii. All primary instruments installed at "Minus level or Floor" shall be with protection class of IP 68.



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- xiii. Transmitters (all type) for monitoring & controls purpose.
- xiv All field mounted push button, selector switch etc. shall be as per IEC or NEMA 4X protection.
- xv All limit switch shall be conform to IEC-60947-5-1 and shall have minimum 2SPDT/DPDT contacts.

- xviii. Temp. Transmitters are envisaged with RTD & Thermocouples for monitoring services/application only. However any RTD & Thermocouples are used for control, interlock & protection application, Metal Temperature, and bearing & winding temperature, same shall be directly wired to DDCMIS/DCS/PLC using instrumentation & Extension cables respectively.
- xix. As for the water flow/ steam flow measurements, **necessary flow elements/transmitters are chosen in the process line and supplied such that their algebraic summation shall be mass balanced for calculating the system efficiency.**
- xx. Non Contact Type, electronic 2-wire position transmitters shall be provided for all inching type motorised valve and dampers.
- xxi. For Turbine oil tank, LDO/HFO tank, DM water tanks, CS tank, Chemical dosing tanks, Acid and alkali applications, lube oil tanks, and any other tank/sump etc., only non contact type level transmitters like Acoustic, Ultrasonic, Radar based (Type as per Owner Approval) shall be provided by bidders as specified in the specification and as approved by owner.

- xxiii. For Turbine oil, HFO/LDO applications & H2 Gas application, zener protection on power supplies shall be included.



3.03.14 GUIDED WAVE RADAR/RADAR LEVEL TRANSMITTER

Type	:	Guided wave Radar (Contact type)/Radar (Non contact type) as finalized by owner.
Application	:	For HP Heaters, Deaerators, Turbine Lube oil tank, lube oil tanks, HFO & LDO tank level, Condenser Hotwell, LP heaters, CBD tank level, Stator water expansion level, and other Low pressure, Vacuum vessels.

Also Bulb type with Teflon coating & drop antenna shall be used acid /chemical tank applications.

For oil tank applications, four wire transmitter shall be supplied with zener barrier protection for power supply connected to level transmitters.

Environment Class	:	Highly abrasive with Gases and Fumes
Orientation	:	Vertical
Probe Type	:	Flexible Single lead with chuck
Probe Material	:	SS 316L
Connection Size & Type	:	2" Flanged ANSI 300 lb SS316L material
Connection material	:	SS 316L
Accuracy	:	+/- 5 mm
Resolution	:	± 1 mm
Type (Transmitter)	:	SMART, 2 Wire
Operating Principle	:	Time Domain Reflectometry
Output	:	4-20 mA, DC with HART protocol and 600 Ω output load.
Electrical Connection	:	1/2" NPT
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
Electrical Power	:	11-42 V DC
Housing material	:	Die Cast Aluminum
Vent & Drain Plug material	:	SS
Side Flange Material	:	SS
Local Display	:	Provided (LCD Digital)



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Units of Measurement : Length M

Electromagnetic compatibility: EN-61326

3.03.15 3 D TYPE ACOUSTIC WAVE LEVEL TRANSMITTER

Type	:	Acoustic Wave Level Transmitter (3 D type)
Application	:	One set of 3 D type Acoustic wave type level transmitter for each ESP Hopper (First field) measuring Level, Volume & Mass. 2 Nos. to be provided for Coal bunker level measurement for coal feeder in addition to 1 no. strain gauge type level measurement. Median from three values shall be chosen from triple redundancy.
Temperature compensation	:	Required for high temp applications
Operating Principle	:	Non - Intrusive acoustic wave transmission & Reflection
Frequency Range	:	3 – 10 KHz
Measurment Range	:	Empty to full
Accuracy	:	+/- 0.25 % for even surface & $\pm$ 0.5% for uneven surface.
Resolution	:	1 mm
Output	:	4-20mA DC with HART to corresponding control system.
Display Unit:		
Type	:	Head mounted LCD Display with Engg. Units
Location	:	Suitable location at bunker / Silo operating floor area
Protection Class	:	IP 65 or better// flame proof (IEC-79.1, Part I) As applicable).
Material Of construction:		
Housing	:	Polypropylene/Aluminum/SS
Flange	:	Polypropylene/Aluminum/SS
Sizes:		
Flange Size	:	2" ANSI 300 # RF SS minimum.
Electrical connection size	:	½" NPT (F)
Accessories	:	i. Double compression type Nickel Plated Cable glands.
		ii. Suitable Mating Flange, necessary gaskets, Canopy/Enclosure.



2 x 800 MW Supercritical Coal Based Uppur
Thermal Power Project
Spec. No. SE/E/T&H(P)/OT NO.01/2015-16
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3.03.22 FLOAT & BOARD TYPE LEVEL GAUGE

Type of Instrument	:	Mechanical Type (Float Operated)
Service/ Application	:	As per service requirement
Measuring Range	:	as per requirement
Material Specification	:	
a) Float Material	:	SS316 having 2 nos. Guide wires
b) Float Wire Pulley	:	Shall comprise of 2 nos. Cast Aluminum Pulley hosing Assembly with SS 304 pulley and pulley shaft. Steel ball bearings shall be provided in pulley housing for easier float movement. Float wire material shall be SS316L. Between 2 pulleys, 1" SS short pipe.
c) Guide wire Assembly	:	SS chamber with SS316 spring and adjuster having 1" Class 150 ANSI RF SS flange. Guide wire rope shall be SS316L.
d) Counter Weight	:	MS counter – weight with Aluminum Pointer and Brass assembly Pull Chain.
e) Scale	:	SS 316/Aluminum material in mm with 1 % accuracy.
Nozzle Details	:	For float wire pulley assembly, one tapping and for guide wire assembly two tapping at the top of the tank; Size 1" NB (Top Mounting Type)
Process Connection	:	Flanged as per ANSI B 16.5 to suit 1" NB nozzle (Nozzle length - 150 mm for float wire, 100 mm for guide wire)
Accessories (to be supplied with the instrument)		
a) Counter flange	:	All mating Flanges, Nozzle
b) Mounting Accessories	:	All mounting accessories
c) Tag Plate	:	To be provided (material SS316)



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3.03.41 **Junction Boxes**

Type of Enclosure	:	Flame proof/weather proof IP-65/Explosion Proof as per area classification. Design as per NEC-370 Article 18, 19 & 20.
Material	:	6 mm min. thick FRP with protective Coating 3 mm min. thickness Die cast aluminum for Flame proof/Explosion proof area.
Cable entry	:	Bottom or Side
Cable glands	:	Double compression type – Nickel plated brass with PVC hoods.
Mounting	:	Indoor/Outdoor
No. of terminals	:	As required with standardization with 20% spare of each size & type.
Terminals	:	Phoenix/Wago (screw less cage clamp type spring loaded)
Grounding	:	Two terminals for body and shield ground
Door	:	Hinged, lockable type.
Accessories	:	Suitable mounting clamps and other accessories shall be in scope of bidder. The brackets, bolts, nuts, screws, glands, lugs required for erection shall be of brass, included in bidder scope of supply. High voltage & insulation resistance test shall also be conducted.



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M6 Ni plated Brass earthing stud shall be provided (external 2 nos. internal 1 no.)
Gasket (Normal)- Neoprene/Polyurethane thickness 6.0 mm. Silicon for High Temperature area.
Colour : In General same as provided for control panels, and for special services, To be decided during detailed engineering & subject to owner's approval.

3.03.42 Cable Glands

Cables shall be terminated using double compression type cable glands. Cable glands shall conform to BS: 6121 & IP-67 and be of robust construction capable of clamping cable and cable Armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy-duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall be made of brass with nickel chrome plating Rubber components shall be of neoprene and of tested quality.

3.03.43 Interposing Relays (IPR)

Electromagnetic type IPRs with modular design, plug-in type connections, suitable for channel/DIN rail mounting in cabinets; coil rating 24V DC; 2 set of silver plated cadmium free with change over contacts rated for DC1 Breaking capacity of 0.5A 110 V DC/ 0.15 A 220 VDC and AC1 Capacity of 8/10 A 240 V AC. Capacity shall be as system requirements. Freewheeling diode across copper relay coil and self reset type status non-polarized LED indicator for the Coil (electronic) and a flag indicator for the Contacts (mechanical) shall be provided. Manual forcing/override facility is required. The insulation test voltage of 1.2/50 μ s between the coil & contacts for relay shall not be less than 4 KV between adjacent contacts. The operating temperature of the Relay & Sockets shall be from -20 deg. C to 60 deg. C. The operating/release time of the relay shall not be more than 10/5 ms respectively.

The relay and DIN Rail sockets shall have the necessary approvals like UL/VDE and V0/V2 inflammability class in accordance with UL94", IEC60664/IEC60664A/DINVDE0110.

Facility to stimulate IPR manually shall be provided. The VA burden of relays shall be suitable to match the capacity of output modules. Interposing relay & sockets for mounting the interposing relay shall be of same make only and sockets shall have the plug in RC circuits/Varistors, required for EMI suppression.

3.03.44 RECORDERS (CHARTLESS)

Type : Micro-processor based, Digital TFT display type
No. of Channels : Six (6) points and Forty Eight (48) point).
The parameters shall be decided during detailed Engineering. Quantities of recorders for BTG packages shall be decided during detailed Engineering.
(Simultaneous parameter display preferred)



	UPPUR 2x800MW STPP (UNIT-1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST)	

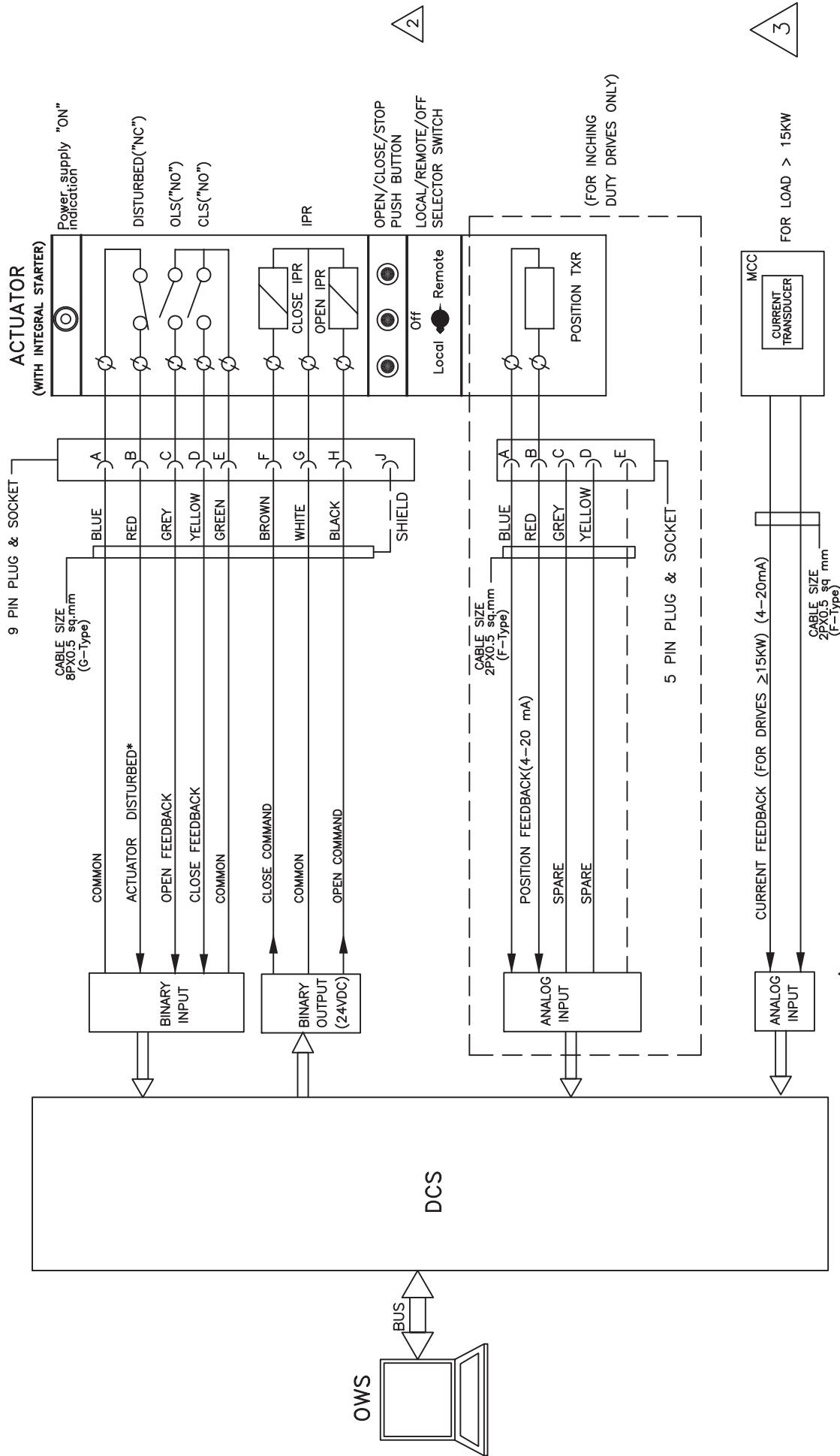
LIST OF DOCUMENTS/DELIVERABLES

2x800MW UPPUR STPP (UNIT#1&2) TECHNICAL SPECIFICATION (C&I) FOR FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST) LIST OF DELIVERABLES OF PEM - C&I DEPARTMENT							
DOCUMENT NUMBER PE-GL-999-145-I100				SHEET 1 of 1			
SI.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY	CUSTOMER	FROM	USER	REMARKS
INSTRUMENTATION							
1	PE-V0-425-155-I901	INSTRUMENT DATA SHEETS	A	-	VENDOR	C&I	
2	PE-V0-425-155-I902	INSTRUMENT SCHEDULE	I	-	VENDOR	C&I	
3	PE-V0-425-155-I903	INSTRUMENT HOOK UP	A	-	VENDOR	C&I	
4	PE-V0-425-155-I904	FIELD JB TERMINATIONS	I	-	VENDOR	C&I	
5	PE-V0-425-155-I905	QUALITY PLANS	A	-	VENDOR	C&I	
6	PE-V0-425-155-I906	TRANSMITTER JB GROUPINGS	I	-	VENDOR	C&I	
7	PE-V0-425-155-I907	ACTUATOR VALVE LIST	A	-	VENDOR	C&I	
OTHER DOCUMENTS							
1	PE-V0-425-155-I951	LIST OF I&C SPARE PARTS	A	-	VENDOR	C&I	
	Notes:						
		\$\$ - Approval by BHEL if Vendor BBU Item Approval by Customer if Customer BBU Item					

	UPPUR 2x800MW STPP (UNIT-1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST)	

SIGNAL EXCHANGE BETWEEN DRIVES &
DCS (DCP)

DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)



NOTE:

- 1) Redundancy of IO shall be as per specification requirement.
- 2) Position Feedback of Bidirectional Inching duty drives in vicinity may be grouped together in the field during cable engineering. Junction Boxes and Single Trunk cable of higher size may be used to connect.

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



PROJECT: 2X800 MW UPPUR STPP

TITLE DDCMIS INTERFACE FOR
 BIDIRECTIONAL DRIVE

DRG.NO. PE-DM-425-145-1002

DATE 21.07.2017

REV.NO. 03

SHT 7 OF 11

	UPPUR 2x800MW STPP (UNIT-1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST)	

DATA SHEETS FOR MOTORISED VALVE
ACTUATOR

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 05.10.16
			SHEET 1	OF 4
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL*	* PROJECT	2 x 800 MW Uppur Thermal Power Project		
	OFFER REFERENCE			
	* TAG NO. SERVICE			
	* DUTY	☐ ON / OFF	☐ INCHING	
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY		
	* OPENING / CLOSING TIME			
	* WORKING PRESSURE			
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF -20 to 70 DEG C AND RELATIVE HUMIDITY OF 0-95% IN HOT HUMID AND TROPICAL ATMOSPHERE AND HIGHLY POLLUTED AT PLACES OF COAL DUST AND FLY DUST		
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY		
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY		
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY		
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, DUST TIGHT SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, NEMA6/IP:68		
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL		
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.		
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.		
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING SERVICE - 150 STARTS/HR MINIMUM.		
HANDWHEEL	* REQUIRED	☒ YES ☐ NO		
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED		
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.			
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY		
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY		
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF I.S. TOLERANCE		
	ACTUATOR APPLICABLE WIRING DIAGRAM	☒ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☒ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram		
	COLOUR SHADE	☐ BLUE (RAL 5012) ☒ SIEMENS GRAY RAL 7030		
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☒ EPOXY ☐		
	SHAFT RPM	BIDDER TO SPECIFY		
	OLR SET VALUE	BIDDER TO SPECIFY		
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY		
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY		
	@ PWR SUPP TO MTR / STARTER	415V +/- 10%, 3 Phase, 3 Wire 50HZ +/-5%		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☒ 110 V		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 05.10.16
			SHEET 2	OF 4
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
	@ ENCLOSURE CLASS OF MOTOR	IP-68		
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B		
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos.,1 IN EACH PHASE) ☐		
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED		
INTEGRAL STARTER	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED		
	TYPE OF SWITCHING DEVICE	☒ CONTACTORS(Reversing type) ☐ THYRISTORS		
	TYPE	☒ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)		
	IF SMART			
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED		
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFI-BUS ☐ DEVICE NET ☐		
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC		
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED		
	e) TYPE OF HAND HELD PROGRAMMER	☐ BLUETOOTH ☐ INFRARED ☐		
	f) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED		
	g) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP		
	h) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED		
	STEP DOWN CONT. TRANSFORMER	☒ REQUIRED		
	OPEN-STOP-CLOSE PB(running open/close LED) THREE POSITION SELECTOR SWITCH	☒ REQUIRED ☐ NOT REQUIRED		
	INDICATING LAMPS	☒ REQUIRED ☐ NOT REQUIRED		
	LOCAL-OFF- REMOTE S/S(THREE POSITION SELECTOR SWITCH)	☒ REQUIRED ☐ NOT REQUIRED		
	STATUS CONTACTS FOR MONITORING	☒ REQUIRED ☐ NOT REQUIRED		
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (MOTOR THERMOSTAT TRIP/O/L RELAY OPERATED, CONT. /POWER SUPPLY FAILED, S/S IN LOCAL/OFF MODE, TORQUE SWITCH OPEN/CLOSE CUT OFF/STOP PB OPTD.)		
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☐ INTERPOSING RELAY ☒ OPTO COUPLER ☐ EITHER		
	QUANTITY	☒ 2 NOs. ☐ 3 NOs.		
	DRIVING VOLTAGE	☒ 20.5 – 24V DC ☐ _____ V DC		
	DRIVING CURRENT	☒ 125mA MAX ☐ _____ mA MAX		
	LOAD RESISTANCE	☒ > 192 ohms - <25 k ohms ☐ > _____ ohms - < _____ ohms		
TORQUE SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN / CLOSE	☒ 1 No. ☐ 2Nos. / ☒ 1 No. ☐ 2Nos		
	CONTACT TYPE	2 NO + 2 NC		
	RATING	5A 250V AC AND 0.5A 220V DC		
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE		
	ACCURACY	+3% OF SET VALUE		
LIMIT SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	☒ 2 Nos. 2 nos(adj) 1 No.	☒ 2Nos.	
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 250V AC AND 0.5A 220V DC		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 05.10.16
			SHEET 3	OF 4
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	REQUIRED for regulating/inching duty only.		
	MFR & MODEL NO.	BIDDER TO SPECIFY		
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) contactless inductive type		
	SUPPLY	☒ 24V DC ☐		
	OUTPUT	☒ 4-20mA		
	ACCURACY	± 1% FS		
SPACE HEATER	@SPACE HEATER	REQUIRED		
	@ POWER SUPPLY (NON INTEGRAL)	240V AC 1 ph 50Hz		
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY		
	@ RATING			
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED		
	ENCL CLASS ACTUATOR/MOTOR T.B.	☒ IP 68 @ ☐ NEMA6		
	@ EARTHING TERMINAL	REQUIRED		
	PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	☒ REQUIRED ☐ NOT REQUIRED ☐ ☒ 2 NOS. ☐		
CABLE GLANDS	@ POWER CABLE GLAND	During detailed engineering		
	@ SPACE HEATER CABLE GLAND	During detailed engineering		
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for BFV of CW PUMP(Cable size 2Px1.5mm2) 1 no suitable for 8P X 0.5 sq mm		
	OTHER CONTROL CABLE GLANDS-2	Additional 1 no suitable for 2P X 0.5 sq mm(inching duty only)		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 05.10.16
			SHEET 4	OF 4
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.	
NOTES: 1. SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY. 2. CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH: IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722 3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C. 4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED. 5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE. 6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%. 7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING. \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE. ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS. 8. IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR. 9. POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL 10. WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE 1.5 SQ. MM. 11. THE MOTOR SHALL BE CAPABLE OF STARTING AT 85 PERCENT OF RATED VOLTAGE AND RUNNING AT 80 PERCENT OF RATED VOLTAGE AT RATED TORQUE AND 85 PERCENT RATED VOLTAGE AT 33 PERCENT EXCESS RATED TORQUE FOR A PERIOD OF 5 MINUTES EACH. 12. THE ACTUATORS SHALL BE DESIGNED TO BE SELF-LOCKING UPON LOSS OF POWER. MOTOR SHALL BE DESIGNED TO CLOSE IN 30 SECS. FROM FULL OPEN POSITION AND SHALL HAVE ADEQUATE CAPACITY TO OPEN AND CLOSE UNDER FULL UNBALANCED DESIGN PRESSURE. 13. ALL SIX (6) LIMIT SWITCHES SHALL BE CHANGEOVER TYPE AND ADJUSTABLE BESIDES HAVING THE SNAP FACILITY. 14. THE INTEGRAL STARTER WHICH SHALL HAVE SOPHISTICATED ELECTRONIC CONTROLS WITH FIELD PROGRAMMING FEATURE. IT SHALL BE DESIGNED FOR REMOTE CONTROL FROM DCS/RESPECTIVE CONTROL SYSTEM. REQUIRED INTERPOSING RELAYS FOR RECEIVING OPEN/CLOSE/STOP COMMAND FROM DCS/RESPECTIVE CONTROL SYSTEM SHALL BE PROVIDED. POTENTIAL FREE CONTACTS AND TRANSDUCERS SHALL BE PROVIDED TO PROVIDE STATUS INDICATION AT REMOTE DCS/RESPECTIVE CONTROL SYSTEM. 15. THE REMOTE COMMAND SIGNAL (OPEN-STOP-CLOSE) FROM DCS/RESPECTIVE CONTROL SYSTEM/CONTROL PANEL SHALL BE ISOLATED FROM CONTROL ELECTRONICS THROUGH OPTO-ISOLATOR. 16. THE FOLLOWING INDIVIDUAL STATUS ANNUNCIATION LED'S (COLOUR-GREEN) SHALL BE PROVIDED LOCALLY (INTEGRAL TO ACTUATOR) TO ANNUNCIATE THE FOLLOWING FOR EASY LOCAL MONITORING. ACTUATOR IN LOCAL MODE ACTUATOR IN REMOTE MODE ACTUATOR RUNNING IN OPEN DIRECTION ACTUATOR RUNNING IN CLOSE DIRECTION ACTUATOR IN INCHING MODE. ACTUATOR IN SELF-RETAINING MODE LIMIT SWITCH OPEN TRIP LIMIT SWITCH CLOSE TRIP CONTROL VOLTAGE AVAILABILITY				
NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES				

FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP.

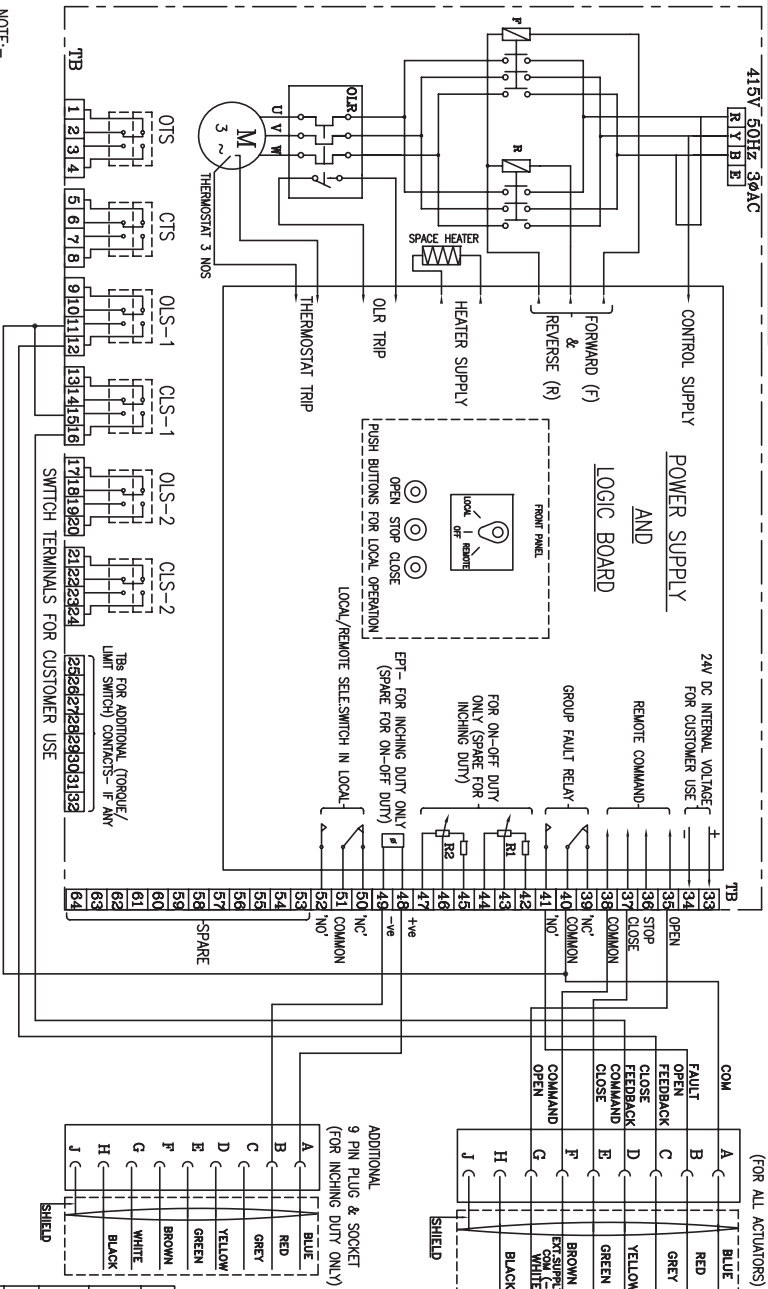
CONTACT DEVELOPMENT DIAGRAM

SWITCH	TERMINAL NO.	VALVE POSITION		
		FULL OPEN	INTERMEDIATE	FULL CLOSE
OTS	1-2		OPEN AT OVER TORQUE DURING OPENING TRAVEL	
	3-4		CLOSE AT OVER TORQUE DURING OPENING TRAVEL	
	5-6		OPEN AT OVER TORQUE DURING CLOSING TRAVEL	
CTS	7-8		CLOSE AT OVER TORQUE DURING CLOSING TRAVEL	
OLS-1	9-10			
	11-12			
OLS-1	13-14			
	15-16			
OLS-2	17-18			
	19-20			
OLS-2	21-22			
	23-24			

INDICATES CONTACT CLOSED

INDICALES CONIACI OPEN

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC



NOTE:-

1. ALL TORQUE AND LIMIT SWITCHES (OTS,CIS,OLS1&2, CLS1&2) ARE WITH 2N0+2N0 CONTACTS '1N0+1N0' IS TERMINATED IN TBS 1-24, REMAINING CONTACTS ARE FOR INTERNAL USE.
- ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32
2. CIS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
3. OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
4. OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
5. CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
6. EPT - ELECTRONIC POSITION TRANSMITTER
(CONTACTLESS TYPE, FOR INCHING DUTY)
7. RI-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
8. FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
9. M - MOTOR 3Ø 415V 50 Hz AC SUPPLY
10. TORQUE SWITCH BYPASS WITH LIMITSWITCH BOTH ON OPEN & CLOSE DIRECTION TO BE DONE INTERNALLY.

REV	DATE	ALTERED
		CHD & APPD

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

	BHARAT HEAVY ELECTRICALS LTD.		NAME	SIGN	DATE
365-121	UNIT: HIGH PRESSURE BOILER PLANT TITICOMPARA Rd.-680014.		D/RN	N.P.ESWAR	17/03/05
DEPT VL	-		SCALE	MIS	NO OF PAGES
CODE			WEIGHT (KG)	-	-
TITLE	WIRING DIAGRAM (TERMINAL PLAN)			CARD CODE	REV
				U 01	0
				DRAWING NO.	
				3-V-MISC-24283	

Size A3

	UPPUR 2x800MW STPP (UNIT-1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST)	

QUALITY ASSURANCE FOR
INSTRUMENTS



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR LEVEL GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS / DRWGS	P	W	V	
	TYPE						
	MODEL/ TAG NO.						
	DAIL SIZE						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS, PROCESS CONNECTION	ONE / LOT		P	W	V	
3	ACCURACY			P	W	V	
4	MATERIAL TC FOR			P	V	V	
	BODY ISO.						
	VALVE						
	GAUGE GLASS						
5	HYD. TEST	SEE NOTE-1 BELOW		P	W	V	
6	ACCESSORIES AS APPLICABLE			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TRANSMITTER

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECKS FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	VISUAL.						
	MODEL/TAG No						
2	PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	REPEATABILITY			P	W	V	
5	HYSTERESIS			P	W	V	
6	EFFECT OF TEMP VARIATION ON ACCURACY			P	W	V	
7	SPAN / ZERO ADJUSTMENT	ONE / TYPE		P	W	V	
8	EFFECT OF SUPPLY VOLTAGE VARIATION			P	W	V	
9	EFFECT OF LOADING (500 OHM METERS)			P	W	V	
10	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
11	BURN-IN TEST	ONE / TYPE		P	W	V	
12	DEGREE OF PROTECTION			P	W	V	
13	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- When material correlation are not available manufacturer's compliance to be provided.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.

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TYPE TEST REQUIREMENT

	Calibration / Material test / Bore concentricity test / Insulation test ($\leq 500 \text{ M}\Omega$ at 500V DC) as per ISA, Hydro test for TW. Bore concentricity: $\pm 5\%$ of wall thickness, Accuracy test.
8.	Thermocouple assembly
	Calibration / Material test, Insulation test ($\geq 500 \text{ }\Omega$ at 500 V, DC) as per ISA, Hydro static test (1.5 times max. pr.), Bore concentricity : $\pm 5\%$ of wall thickness.
9.	Thermowells
	Material test / Bore concentricity : $\pm 5\%$ of wall thickness / Hydrostatic test for TW (1.5 times max. pr.)
10.	Level Guages
	Hydrostatic test / Material test / Seat leakage test / Ball check test.
11.	Level switches (Magnetic)
	Material test / Contact rating test / Hydro test / Calibration test.
12.	Flow Switch
	Material test / Hydro static test (1.5 times max. pr.) / function test.
13.	Flow glasses
	Material test / Hydrostatic test (1.5 times max. pr.) / function test.
14.	Variable area flow meters
	Calibration test / Material test / Hydrostatic test (1.5 times max. pr.)
15.	Flow element
	100% Radiography test / Hydro test / Calibration test, IBR Certificate.
	Calibration test for flow element shall be witnessed by Owner.
16.	Control valves/Pneumatic block valve/Pressure regulating valve – Refer chapter 11.
17.	Position transmitters
	Calibration / hysteresis and Accuracy test
18.	Electro Pneumatic Convertors
	Calibration test / Accuracy test
19.	Solenoid valves
	Hydrotest / Seat leakage test / CV test / Coil insulation test
20.	Air filter regulators
	Calibration test / Accuracy test
21.	Junction Boxes
	Test for degree of protection / Material test
22.	Tests for terminal blocks
	Test for moulding for flame resistant, Non-hygroscopic and Decarbonised / Insulation test between terminals / Insulation between terminal block and frame.
23.	Thermocouple extension cable & Instrumentation Cables and Fiber Optical Cables



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	a) IBR certificate form III C b) Hydrostatic test : ANSI B 16.34 c) Seat leakage test : As per ANSI B 16-104 d) CV test: As per ISA procedure e) Magnetic particle test ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 DegC) f) Liquid penetration test: ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 DegC) g) Radiography test: ANSI B 16.34 special class h) Calibration and Hysteresis test i) Actuator leakage test
36.	Pressure Regulating Valve (Pneumatic & Hydraculic type)
	a) IBR certificate form III C b) Hydrostatic test : ANSI B 16.34 c) Seat leakage test : As per ANSI B 16-104 d) CV test: As per ISA procedure e) Magnetic particle test ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 DegC) f) Liquid penetration test: ANSI B 16.34 special class (applicable for pr.>70 bar & temp< 400 DegC) g) Radiography test: ANSI B 16.34 special class h) Calibration and Hysteresis test i) Actuator leakage test
38	Wiring Termination & Accessories
	Routine test: Conductor resistance test/High voltage test/Impulse dielectric test/insulation test/Humidity test/Temperature rise test on power circuits/short time current test on power circuits.
	Type test:Annealing test/Test for insulation and sheath/ Flame retardance test - a) Oxygen index, b) Flammability / Test for acid gas generation/test for water absorption/wet dielectric test
39	Marshalling/System cabinets
	Verification of degree of protection/Electrical tests as detailed under wiring Termination& accessories/Type test and routine test as per relevant Indian standards.
40.	Transmitter/Switch Enclosures & Racks :
	Hydro test, air leak test for piping / tubing and fittings. IBR certification as required for tubing / piping and fittings.
	Notes:



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	1. Test Certificates in addition to inspection at manufacturers works shall be furnished for all the instruments for Owner's review.
	2. Above Test to be witnessed shall be finalized by Owner.
	3. In addition to above test, test as per approved QAP shall also be witnessed by owner.

13.02.05 TYPE TESTING

The BIDDER shall furnish the Type test reports of all type tests as per relevant standards and codes. As well as other specifics test indicated in the specification. A list of such test are given for various equipment in table titled, TYPE TEST REQUIREMENT FOR C&I SYSTEM and under the item special requirement for solid state requirements/systems. For the balance equipments/instruments. type test may be conducted as per manufacturer standards or if required by relevant standards.

- A. Out of these test listed , the bidder /subvendor/manufacturer is required to conduct certain type test specifically for this contract (and witnessed by employer or his authorized representative). Even if the same have been conducted earlier as clearly indicated subsequently such tests.
- B. For the rest, submission of type test , results, and certificates shall be acceptable provided following points
 - i. The same has been carried within last five years from the date of bid opening.
 - ii. The same have been carried out by the bidder/ subvendor on exactly the same model/rating of equipment. (For control valves this shall be same size, type & design).
 - iii. There has been no change in the components from the offered equipments and tested equipments.
 - iv. The test has been carried out as per the latest standards along with amendements as on the date of bid opening.
 - v. The test should have been either carried out at any Govt. approved laboratory and test witnessed by a client of Government Department / Government
- C. In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the bidder/sub-vendor within the quoted price and no extra cost will be payable by the owner on this account.

13.02.05.1 As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main bidder or his authorized representative and balanced have to be approved by the employer.



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The schedule of conduction of type test/submission of reports shall be submitted and finalized during pre award discussion.

- 13.02.05.2** For the type test to be conducted, bidder shall submit detailed test procedure for approval by owner. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable). , recording of different parameters, intervals of recording precaution to be taken etc. for the test to be carried out.

13.02.05.4 TYPE TEST REQUIREMENTS FOR C&I SYSTEMS

S.No.	Item	Test requirement	Standard	Test to be specifically conducted	Owner's Approval required on Test Certificate
1	Electrical metering instruments	As per standards	IS 1248	No	Yes



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2	Thermocouple	Degree of Protection Test	IS - 13947	No	No.
3	Junction Box	Degree of Protection Test	IS - 13947	Yes	Yes
4	RTD	As per standards	IEC-60751	No	No
5	Electronic Transmitter	As per standards	BS 6447/IEC 60770	No	Yes
6	E/P convertor	As per standards	Manufacturing standard	No	Yes

12	Local gauges	Degree of protection test	IS 13947	No	No
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equipment/Systems (minimum five nos – details shall be furnished during detailed engineering). This will include the following:-

Interfacing requirements including cables / co-axial cables / gate ways/all type of hardwares/interposing relays/ softwares for exchange of signals for information & controls are in bidder scope.

1.07.00 SYSTEM PARTICULARS

System particulars are as follows:

Tropicalisation:

1. All equipment supplied against this specification shall be given tropical & fungicidal treatment in view of the severe climatic conditions prevailing at site as described under project data.
2. Tropical protection shall conform to IS:3202 entitled "Climate Proofing of Electrical Equipment" or BI:CP-1014:1963 entitled "Protection of Electrical Power Equipment Against Climatic condition".

Gases and fumes Sulphur dioxide and/or trioxide fumes mildly present. Climate is tropical conducive to fungus growth.

Dust particles Heavily dusty with abrasive dust and coal particles of size 5 to 100 microns present in the atmosphere in large quantity.

1.08.00 CODES AND STANDARDS

1.08.01 All equipments, system and service covered under this specification shall comply with the requirements of the latest statutes regulations and safety codes as applicable in the locality where the equipments/systems will be installed. The Bidder shall fully acquaint himself with these requirements and shall ensure compliance with them.

The equipments, systems and services furnished as per this specification shall conform to the codes and standards mentioned in Cl. no. 1.08.02 of this Section. However in the event of any conflict between the requirements of two standards or between the requirements of any standard and this specification, the more stringent requirements shall apply unless confirmed otherwise by the Owner in writing. The decision of the Owner shall be final and binding in all such cases.

The Bidder's scope of supply shall include some items such as thermowells, and other in-line devices for main steam, hot reheat, cold reheat, feed water system falling under the purview of Indian Boiler Regulation (IBR) Act. It shall be the responsibility of the Bidder to obtain the necessary approval of the concerned Inspecting Authority/Chief Inspector of Boilers for the design and design calculations and manufacturing and erection procedures as called for under the IBR act for all items requiring such certifications.



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The requirements of statutory authorities (e.g. MOEF, Inspectors of factories, IBR, TAC, BEE, CPCB/TNPCB, TAC, IEGC, CEA, CERC, IEA etc) with regards to various plants areas like Main plant, Fuel oil plant/system, Chlorination Plant, Fire Fighting system, Emission Measurement, Ambient Air Monitoring system etc. shall be complied, even if not actually spelt out.

1.08.02 Reference Codes and Standards

The design, manufacture, inspection, testing, site calibration and installation of all equipment and systems covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable ANSI, ASME, IEEE, NEC, NEMA, ISA, DIN, VDE, NFPA, IEC, EIA, TIA, ASTM, ISO and Indian Standards and their equivalents. Bidder to note that in no case, OEM/manufacturers own standards shall be accepted.

~~1.08.02.01 Temperature Measurement~~

- ~~1. Performance Test Code for temperature measurement ASME PTC 19.3 (1974 – R 1998)~~
- ~~2. Temperature measurement - Thermocouples ANSI-MC 96.1 – 1982, IEC 584~~
- ~~3. Temperature measurement by electrical resistance thermometers - IS-2806.~~
- ~~4. Thermometer-element-platinum resistance IS-2848, IEC 751/DIN 43760~~
- ~~5. RTD Design Code – DIN EN 60751:1996, BS EN 60751 : 2008~~
- ~~6. Thermowell Design Code – ASME PTC 19.3 TW – 2010~~

~~1.08.02.02 Pressure Measurement~~

- ~~1. Performance Test Code for pressure measurement - ASME PTC 19.2 (2010)~~
- ~~2. Bourdon tube pressure and vacuum gauges - IS 3624, IS 3602, ASME B 40.1~~
- ~~3. Electronic transmitters - BS 6447.~~
- ~~4. Process operated switch devices - BS 6134.~~

1.08.02.03 Electronic measuring Instruments & Control hardware

1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973), IS 9319
2. Safety requirements for electrical and electronic measuring and controlling instrumentation - ANSI C 39.5 - 1974.
3. Compatibility of analog signals for electronic industrial process instruments - ISA-S 50.1:ANSI MC 12.1 - 1975.
4. Dynamic response testing of process control instrumentation - ANSI MC 4.1 (1975): ISA-S26 (1968).
5. Surge withstand capability (SWC) tests - ANSI C 37.90A (1974)/C37.90.1 – 2012, IEEE Std. 472 (1974). IEC – 255.4.
6. Printed circuit boards - IPC TM-650, IEC 326 C
7. General requirements and tests for printed wiring boards - IS 7405 (Part-I) - 1973
8. Edge socket connectors - IEC 130-11.



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9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2.
10. Dimensions of attachment plugs & receptacles ANSI C73-1973.
11. Direct acting Electrical Indicating Instruments: IS-1248-1968.
12. IEC 61326 Electrical equipment for measurement, control and laboratory use – EMC requirements.

1.08.02.04 Instrument Switches and Contacts

1. Contact rating - AC services NEMA ICS Part-2 125, A600
2. Contact rating - DC services NEMA ICS Part-2-125, N600.

1.08.02.05 DDCMIS, DCS, PLC & other Control System

1. Application of Safety Instrumented System – ANSI/ISA 84.01/IEC 61511 2004 & IEC 61508.
2. Functional Safety - Safety Instrumented System for Process Sector – IEC – 61151 & IEC 61508.
3. IEEE Application Guide for Distributed Digital Control Monitoring for Power Plant – IEEE 1046
4. Fossil Fuel Power Plant Steam Turbine Bypass System – ANSI/ISA – 77.13.01
5. Human System Interface Design Review Guide lines – NUREG – 700
6. Annunciation Sequence and Specification – ANSI/ISA 18.1
7. "IEEE 1050, IEEE guide for Instrumentation & control system grounding in generating station",
8. ANSI/ISA-77.44.01-2007 - Fossil Fuel Power Plant - Steam Temperature Controls
9. ANSI/ISA-RP77.60.05-2001 (R2007) - Fossil Fuel Power Plant Human-Machine Interface: Task Analysis
10. ANSI/ISA-77.42.01-1999 (R2006) - Fossil Fuel Power Plant Feedwater Control System – Drum-Type
11. ANSI/ISA-77.20-1993 (R2005) - Fossil Fuel Power Plant Simulators - Functional Requirements
12. ANSI/ISA-77.41.01-2005 - Fossil Fuel Power Plant Boiler Combustion Controls
13. ANSI/ISA-RP77.60.02-2000 (R2005) - Fossil Fuel Power Plant Human-Machine Interface: Alarms
14. ANSI/ISA-77.70-1994 (R2005) - Fossil Fuel Power Plant Instrument Piping Installation
15. ANSI/ISA-TR77.60.04-1996 (R2004) - Fossil Fuel Power Plant Human-Machine Interface-Electronic Screen Displays
16. ANSI/ISA-77.43.01-1994 (R2002) - Fossil Fuel Power Plant Unit/Plant Demand Development-Drum Type
17. ANSI/ISA-77.13.01-1999 - Fossil Fuel Power Plant Steam Turbine Bypass System.
18. ISA-99/IEC 62433-2-1- Industrial Communication Networks – Network and System Security – Establishing an industrial automation and control system security program.
19. "IEEE 1100-2005, IEEE recommended practice for Powering and Grounding Electronic Equipment".
20. IEC 61508 Functional Safety of Electrical/Electronic/Programmable Electronic Safety –Related Systems



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1.08.02.08 Control Valves

1. Control Valve sizing - Incompressible fluids - ISA S39.2 - 1972.
2. Control valve sizing - Compressible fluids - ISA S39.3 - 1973, ISA S39.4 - 1974.
3. Face to face dimensions of control valves - ANSI B16.10
4. ISA Hand book of control valves - ISBN B1047-087664-234-2.
5. Valves - flanged, threaded and welding end : ANSI B 16.34(2009)
6. Casting : ASTM A 216 / A 351 (2008)
7. Welded end connection : As per ASME boiler and pressure vessel code / ANSI.B 16.34(2009), B16.25 (2009), B 16.11(2009).
8. Defect removal: ANSI B 16.34 2009.
9. Cleaning : ASTM A 380 2006.
10. CV test : As per ISA procedure S 75.02 (2008).
11. Control Valve seat leakage : ANSI B16.104/FCI 70.2

1.08.02.09 Enclosures

1. Types of enclosures - NEMA Std. ICS-6-110.15 through 110.22 (Type 4 to 13).
2. Racks, panels, and associated equipment - EIA: RS-310-B (ANSI C83.9 - 1972)
3. Protection Class for Enclosure, Cabinets, Control Panels and Desks - IS-13947.

1.08.02.10 Apparatus, enclosures and installation practices in hazardous areas

1. Classification of hazardous area - NFPA Art. 500, Vol.70-1984.
2. Electrical Instruments in hazardous dust locations - ISA-RP 12.11
3. Intrinsically safe apparatus - NFPA Art.493 Vol.4.1978
4. Purged and pressurized enclosure for electrical equipment in hazardous location - NFPA Art. 496 1982.

1.08.02.11 Sampling System

1. Stainless steel material of tubing and valves for sampling system - ASTM A269-82 Gr TP316.
2. Submerged helical coil heat exchangers for sample coolers ASTM D 11-98.
3. Water and Steam in power cycle - ASME PTC 19.11(2008).
4. Standard methods of sampling system - ASTM D 1066-69.

1.08.02.12 Annunciators

1. Specifications and guides for the use of general purpose annunciators - ISA RP 18.1-1979.
2. Surge withstand capability tests - ANSI C.37.90a - 1974 and IEEE std. 472-1974.
3. Alarm Management System - ISA 18.2 - 2009 or latest edition.

1.08.02.13 Interlocks, Protections

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1. Relays and relay system associated with electric power apparatus - IEEE std.3.13.
2. Surge withstand capability tests - ANSI C.37.90a - 1974 and IEEE Std. 472 - 1974.
3. General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS-6875 (Part-I) 1973.
4. Turbine water damage prevention - ASME - TDP-1980.
5. Boiler safety interlocks - NFPA Section 85B, 85D, 85E, 85F, 85G, VDE 0116, Section 8.7, VDE 0160, NFPA 8502/ 8503, & EN50156-1:2004.
6. Turbine safety interlocks - IEC 61508 and IEC 61511 or VDE 0116, Section 8.7, VDE 0160.

1.08.02.14 Process Connection and Piping:

1. Codes for pressure piping power piping ASME B31.1.
2. Seamless carbon steel pipe ASTM A-106.
3. Forged and Rolled Alloy steel pipe flanges, forged fittings, valves and parts - ASTM A-182.
4. Material for socket welded fittings - ASTM A-105.
5. Seamless ferrite alloy steel pipe - ASTM A-335.
6. Pipe fittings of wrought carbon steel and alloy steel - ASTM A-234.
7. Composition bronze or metal castings - ASTM B-62.
8. Seamless copper tube, bright annealed ASTM B-168.
9. Seamless copper tube - ASTM B-75.
10. Dimensions of fittings - ANSI B-16.11
11. Valves flanged and butt welding ends - ANSI B16.34.
12. Nomenclature for Instrument tube fittings ISA-RP-42.1 - 1982.
13. **Hydrogen Piping and Pipelines:** piping in gaseous and liquid hydrogen service and pipelines in gaseous hydrogen service - ASME B31.12.

1.08.02.15 Instrument Tubing

1. Seamless carbon steel pipe - ASTM - A106.
2. Material for socket weld fittings - ASTM - A105.
3. Dimensions of fittings - ANSI B16.11
4. Code for pressure piping, welding, hydrostatic testing - ANSI B31.1.

1.08.02.16 Cables

1. Thermocouple extension wires/cables - ANSI C 96.1 - 1982.
2. Colour coding of single or multi-pair cables - VDE 0815
3. Guide for design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422 - 1977.
4. Requirements of vertical tray flame test - IEEE 383 - 1974.
5. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33 - 81.
6. Oxygen index and temperature index test - ASTM D-2863.
7. Smoke generation test - ASTM D-2843 and ASTM E-662.



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8. Acid gas generation test - IEC-754-1.
9. Swedish chimney test - SEN - 4241475 (F3)
10. Instrumentation cables and internal wiring IS-1554 (Part-I, 1976) and IS-5831(1984).
11. Standard for Control, Thermocouple Extension and Instrumentation cable - NEMA WC57-2004 IEC S-73-532, Rev. 2, 2004)□
12. PVC insulated (heavy duty) Electric cables for working voltages upto and including 1100V - IS:1554 (Part-I)
13. Conductors for insulated electric cables and flexible cords. - IS:8130
14. PVC insulation and sheath of electric cables - IS:5831
15. Mild steel wires, strips and tapes top armoring cables - IS:3975
16. Water Immersion Test - VDE 0815
17. Drums for electric cables - IS : 1048.
18. Sectional Specification for Instrumentation and Control Cables - BS EN 50288 - 7:2005.
19. IEC 60228 Conductors of Insulated Cables
20. IEC 60332 Test on Electrical Cables under Fire Conditions
21. IEC 60811 Common test methods for insulating and sheathing materials of electric cables and optical cables.
22. IEC 61537 Cable management – Cable tray systems and cable ladder systems
23. IEC 61280 Field testing method for measuring single mode fibre optic cable

1.08.02.17 Cable Trays, Conduits

1. IEEE Guide for the design and installation of cable systems in power generating station (cable trays, support systems, conduits) - IEEE Std. 422 - 2012, NFPA-70-1984.
2. Metal Cable Tray Systems - NEMA VE-1 - 2009.
3. Galvanising of Carbon steel cable trays - ASTM A-386-78.
4. Code of Practice for Installation and maintenance of Power cables – IS : 1255.
5. IEEE 1185: IEEE Recommended Practice for Cable Installation in Generating Stations and Industrial Facility.
6. NEMA VE 2 (2013) – Cable Tray Installation Guidelines.

1.08.02.18 Flow measurement

1. ASME Performance Test Code PTC-19.5 (2004), ISA RP3.2
2. BS 1042
3. ISO 5167
4. Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi – ASME MFC – 3M.

1.08.02.19 Surge Protection System

1. Surge withstand capability tests - ANSI C37.90a-1974. IEEE Std. 472 – 1974



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SUB VENDOR LIST

Sl No	Package Name	Supplier Name	Supplier Communication Address
1	LEVEL GAUGE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
2	LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com
3	LEVEL GAUGE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
4	TRANSMITTERS	ABB LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com
5	TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
6	TRANSMITTERS	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
7	TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com
8	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
9	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,
10	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,
11	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,
12	TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
13	TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com
14	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com
15	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com
16	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in

Sl No	Package Name	Supplier Name	Supplier Communication Address
17	TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com
18	JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com
19	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com
20	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com
21	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net
22	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net, jmajmera@yahoo.com
23	INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
24	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-fit.com
25	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com
26	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com
27	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com
28	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
29	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com
30	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
31	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
32	INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,

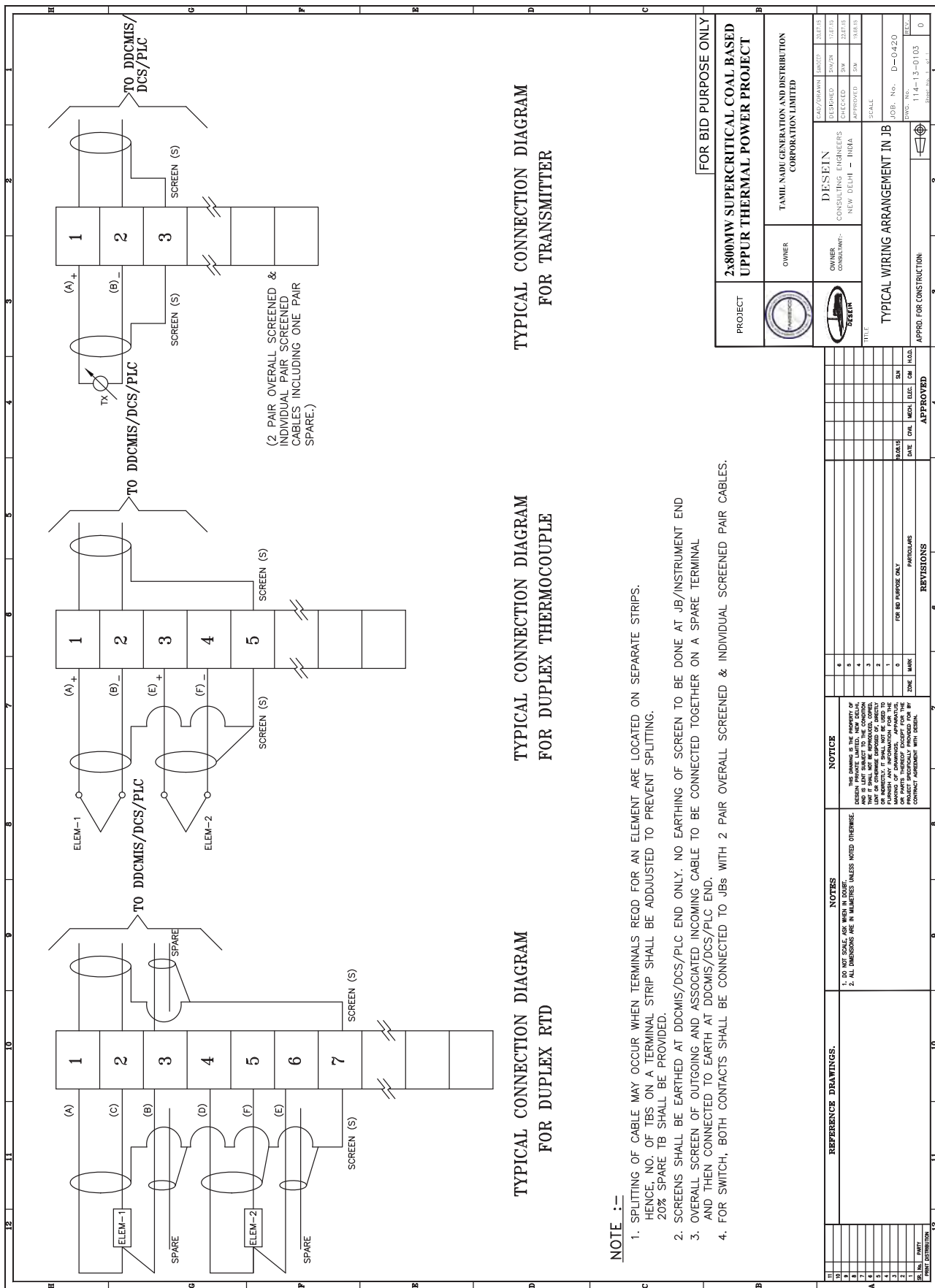
NOTE:

1. The above sub-vendor list is tentative & reference only. However Sub-Vendor List is subject to BHEL/ end user approval without any commercial/ delivery implication.

2. New Sub-Vendor if proposed by Vendor during contract stage shall subject to BHEL/ end user approval without any commercial/ delivery implication.

	UPPUR 2x800MW STPP (UNIT-1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST)	

INSTRUMENTATION CABLE,
CABLE INTERCONNECTION AND
TERMINATION PHILOSOPHY



NOTE :-

- SPLITTING OF CABLE MAY OCCUR WHEN TERMINALS REQD FOR AN ELEMENT ARE LOCATED ON SEPARATE STRIPS. HENCE, NO. OF TBS ON A TERMINAL STRIP SHALL BE ADJUSTED TO PREVENT SPLITTING. 20% SPARE TB SHALL BE PROVIDED.
- SCREENS SHALL BE EARTHED AT DDCMIS/DCS/PLC END ONLY. NO EARTHING OF SCREEN TO BE DONE AT JB/INSTRUMENT END
- OVERALL SCREEN OF OUTGOING AND ASSOCIATED INCOMING CABLE TO BE CONNECTED TOGETHER ON A SPARE TERMINAL AND THEN CONNECTED TO EARTH AT DDCMIS/DCS/PLC END.
- FOR SWITCH, BOTH CONTACTS SHALL BE CONNECTED TO JBS WITH 2 PAIR OVERALL SCREENED & INDIVIDUAL SCREENED PAIR CABLES.

TYPICAL CONNECTION DIAGRAM FOR TRANSMITTER

TYPICAL CONNECTION DIAGRAM FOR DUPLEX THERMOCOUPLE

TYPICAL CONNECTION DIAGRAM FOR DUPLEX RTD

FOR BID PURPOSE ONLY	
PROJECT	2x800MW SUPERCRITICAL COAL BASED UPPER THERMAL POWER PROJECT
OWNER	TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION LIMITED
OWNER CONSULTANT	DESEIN CONSULTING ENGINEERS NEW DELHI - INDIA
DESIGNER	DESEIN CONSULTING ENGINEERS NEW DELHI - INDIA
SCALE	
TITLE	TYPICAL WIRING ARRANGEMENT IN JB
JOB. No.	D-0420
DWG. No.	114-13-0103
Rev. No.	0
APPRO. FOR CONSTRUCTION	

NO.	REVISIONS	DATE	BY	CHK.	APP.	REVISIONS
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

8.04.04.4 INSTRUMENTATION CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY

The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted group Junction Boxes (JBs) at strategic locations is done and consequently cable with higher numbers of pairs are extensively used between field & Marshalling panels. The details of termination to be followed are mentioned in the given table below:-

Application	Type of Termination		
FROM (A)	TO (B)	END A	END B
Valves/Dampers Drives (Integral Junction Box)	Marshalling/ Marshalling- cum Termination Cubicle/ Local group JB	Plug connector in	Post mount cage clamp type
Transmitters, Process Actuated switches mounted in LIE/LIR	Integral Junction Box of LIE/LIR	Plug connector in	Cage clamp (Rail mount type)
RTD heads	Local Junction Box	Plug Connector in	Cage clamp (Rail mount type)
Thermocouple	Local Junction Box	Plug Connector in	Cage clamp (Rail mount type)
Other Field mounted Instruments	Local JB/ Group JB	Plug Connector in	Cage clamp (Rail mount type)
RTD heads	Temperature transmitter	Plug Connector in	Screwed Cage Clamp Type
Thermocouple	Temperature Transmitter	Plug Connector in	Screwed Cage Clamp Type
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/LIR/Group JB's.	Group JB	Cage clamp (Rail mount type)	Cage clamp (Rail mount type)
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/LIR/Group JB/ MCC/SWGR	Marshalling/ Marshalling - cum Termination Cubicles.	Cage clamp (Rail mount type)	Cage clamp (Post mounted type)
Marshalling cubicle/Termination System Cabinets	Electronic system Cabinet	Cage clamp (Post mounted type)	Plug-in connector/other system as per Mfr's standard
Marshalling/ Termination System Cabinets	UCD mounted equipments	Cage clamp (Post)	Plug in Connector/ Cage



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		mounted type)	clamp Type (rail mounted)
DDCMIS/PLC cabinets	OWS, Printer etc.	Plug connector in	Plug Connector in

Notes

1. For Analog signals, individual pair shielding & overall shielding & for Binary signals, only overall shielding of instrumentation cables (> 2 pair) shall be provided.
2. Signal and Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands for Explosion proof area, Flame proof area and high vibration prone area.
3. All screwed connections shall be provided with double compression type Nickel-plated brass cable glands.
4. All spare contacts/terminals on relays, control switches, limit switches or similar devices, process switches, duplex RTDs & Duplex T/Cs shall be wired to accessible terminal blocks/JBs for future connections. All wiring leaving a junction box or enclosure shall leave from terminal blocks and not from other devices in the enclosure. Two (2) pair (individual & overall shielded) cables shall be provided for terminating the thermocouples, transmitters & switches i.e Analog & Binary signals to local JB's. Similarly four (4) pair (individual & overall shielded) cables shall be provided for terminating the Duplex (3 wire) RTD to local JB's.

Four (4) pair (individual & overall shielded) cables shall be provided for terminating the switches to local JB's, where both NC & NO contacts are used in DDCMIS/DCS/PLC.
5. Separate mutipaired cable shall be provided for each drive between MCC/SWGR and DDCMIS/PLC.
6. 10% spare pairs or min 1 pair cable (which ever is more) shall be provided with all type of cables.

8.04.04.5 Conduits

Conduits shall be generally used for interconnecting cables from instruments to local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS:9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant lead coated galvanised steel with, water leak, fire and rust proof protected for the areas of Mills, Drum, Main steam, RH steam Air Heaters and Furnace, BFPDT's.



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And for remaining application, water leak, fire and rust proof flexible GI conduits shall be provided. The temperature rating of flexible conduit shall be suitable for actual application.

The Bidder shall install conduits according to the general routing as approved by owner and shall coordinate conduit locations with other works.

All grounding bushings within all enclosures shall be wired together and connected internally to the enclosure grounding lug or grounding bus with 8 AWG bare copper conductors. Conduit runs to individually mounted equipment shall be grounded to the Owner's cable tray grounding conductor with 12 AWG bare copper conductor. All grounding bushing, clamps, and connectors shall be subject to approval of the owner.

All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanised steel fittings shall be used with steel conduits. All flexible conduit fittings shall be liquid tight, galvanised steel. The end fittings shall be compatible with flexible conduit supplied.

All individually mounted equipment and devices shall be connected to the supply conduit, using not more than one metre of flexible conduit adjacent to the equipment or device. Flexible conduit shall be installed in all conduit runs, which are supported by both building steel and structures subject to vibration or thermal expansion. This shall include locations where conduit supported by building steel enters or becomes supported by the turbine generator foundation and where conduit supported by building steel or foundation becomes supported by steam generator framing.

Special areas, such as control rooms in which external noise is to be minimized, shall have flexible conduit in conduit runs where the runs cross from the main Building framing to the control room framing.

Conduit supports shall be furnished and installed in accordance with these specifications. Support material shall comply with the following requirements.

- i) Hanger rods shall be 12 mm diameter galvanized threaded steel rods.
- ii) Single conduit supports shall be one-hole cast metal straps and clamp backs unless other types are acceptable to the Employer. Multiple conduit bank supports shall be constructed of special galvanized support channels with associated conduit clips.

Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specification and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform with NEC requirements for the area classification.

Bidder shall provide double locknuts on all conduit termination not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall



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	UPPUR 2x800MW STPP (UNIT-1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST)	

MANDATORY SPARES LIST

2x800 MW UPPUR TPS - BTG Package

LIST OF MANDATORY SPARES

CONTROL & INSTRUMENTATION

Sl. No	Description		Quantities are per unit. In case of common system, quantities shall be doubled.	TANGEDCO Remarks	Categorization	Remarks of BHEL Units
1.00.01	Measuring and Field Instruments		The quantity of mandatory spares indicated herein shall be as per package basis			
1.00.01.01	Indicators, Recorders, Electrical Metering and Skid Mounted Instruments				III	Lot price considered for (i) and (ii)
(i)	Indicators, recorders and meters offered from each model for the project. These instruments shall be supplied with three sets of blank scales.	Nos.	10 % of Installed of each type/Model or a minimum of one number for each model and type, whichever is more.			
(ii)	For skid mounted instruments	Nos.	10% of total number of instruments, valves, C&I equipment, C&I item etc. for each Type and model or a minimum of one number for each model and type, whichever is more.			

Sl. No	Description		Quantities are per unit. In case of common system, quantities shall be doubled.	TANGEDCO Remarks	Categorization	Remarks of BHEL Units
1.00.01.03	Temperature Transmitters and Electronic Transmitters (For Pressure, DP, Temp, Flow, Level), Process Transmitters, Level & Flow Transmitter for each type, Rotameters, Sight Flow indicators, Temperature, Pressure, Flow & Level Switch, safety & Protection switches, Gauges, Process meters, Junction Boxes, Position Transmitters/switches, Analysers, Transducer or any other instrument etc.	Nos.	i.) 10% of total number of each item offered for each model and type for the project or a minimum of one number, whichever is more. ii.) 10% of Electronic card/PCB assembly and power supply card/module for each type, model & rating of Transmitter, analysers & Flow Meters.		III	Included

Sl. No	Description		Quantities are per unit. In case of common system, quantities shall be doubled.	TANGEDCO Remarks	Categorization	Remarks of BHEL Units
1.00.01.04	Level Gauges	Nos.	a) 10% or 2 nos. whichever is more of each type of illuminators with holder and reflector. b) 20% or 5 nos. whichever is more of each type of bulb. c) 10% or 2 nos. whichever is more of each type of bi-color rollers. d) 10% or 2 nos. whichever is more of each type of glass along with pair of gaskets (cushion & wet gaskets). e) 10% or 2 nos. whichever is more of each type of gaskets for gauge cocks/valve bonnet/ packing. f) 10% or 2 nos. whichever is more of each type scale.			included

1.00.07	Erection hardware					III	Lot price considered for 1.00.07.01 to 1.00.07.06
1.00.07.01	Instrument valves, manifold, fittings, impulse pipe, impulse tubes, drains pipes,	Nos.	Ten (10) percent of each type, rating, model number & Size installed				

Sl. No	Description		Quantities are per unit. In case of common system, quantities shall be doubled.	TANGEDCO Remarks	Categorization	Remarks of BHEL Units
1.00.07.02	Condensate pots of each type, rating , model no. & Size installed	Nos.	Ten (10) percent of total number of Installed or four numbers whichever is higher .			
1.00.07.03	Manifold	Nos.	Ten (10) percent of each type & Size installed			
1.00.07.04	Fittings	Nos.	Ten (10) percent of each type & Size installed			

1.00.13	Mandatory Spares for Solenoid valves, Control valves, Power Cylinder, Control Dampers, Actuators, Flow Elements and Accessories				II	
(A)	Following spares shall be furnished for control valves, Power Cylinder, Control Dampers as applicable.				LOT PRICE FURNISHED FOR ALL ITEMS AS APPLICABLE TO SCOPE UNDER SL.NO.1.00.13. THE ITEM BEING BOUGHT OUT, THE APPLICABILITY OF SPARE SHALL BE AS THE OEM STANDARDS. HOWEVER THE TOTAL RATE QUOTED SHALL REMAIN UNCHANGED.	
a.	Control valve stem packing.			One set of spare for each control valve		
b.	Molded rubber diaphragms			Two nos. for each control valve.		
c.	O-rings and rubber gaskets			One sets of for each control valve.		
d.	Lubricants for gaskets			100 percent qty. for gaskets for each control valve on one year consumption basis.		

Sl. No	Description		Quantities are per unit. In case of common system, quantities shall be doubled.	TANGEDCO Remarks	Categorization	Remarks of BHEL Units
e.	Limit switches and Valve positioner /smart positioner.		2 sets of limit switches and 1 set of valve positioner /smart positioner for each control valve.			
f.	Position transmitter (4-20mA).		20 percent for total qty. of control valve.			
g.	Valve trims (such as plug, stem, seat ring / cage, guide bushing, stem lock pin, packing retaining ring, etc).		One (1) for each control valve.			
h.	Actuator		One of each type or min 10% for each type and size whichever is more.			
i.	Solenoid valves		20 percent or min 2 no. of each type for total qty. of control valves.			
j.	I to P converters and Pressure regulators.		20% or min 2 no. of each type for total qty. of I to P converters and 20% or min 2 no. of each type for total qty. of Pressure regulators.			
k.	Air filter regulator & Air lock relay		One (1) set of for each control valve.			

	UPPUR 2x800MW STPP (UNIT-1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR FUEL OIL HANDLING SYSTEM & MISC. TANKS(CST)	

KKS TAGGING PHILOSOPHY

TYPICAL KKS		
SL NO	KKS TAG	DESCRIPTION
1	LCR01CL501	CONDENSATE STORAGE TANK LEVEL (LEVEL GAUGE)
2	LCR01CL502	CONDENSATE STORAGE TANK LEVEL (LEVEL GAUGE)
3	EGB01CL001	HSD DAY TANK LEVEL (LEVEL TRANSMITTER)
4	EGB01CL002	HSD DAY TANK LEVEL (LEVEL TRANSMITTER)
5	EGB01CL501	HSD DAY TANK LEVEL (LEVEL GAUGE)
6	EGB01AA001	HSD DAY TANK I/L MOTORISED VALVE
7	EGB01AA002	HSD DAY TANK O/L MOTORISED VALVE
Etc...		

NOTES:-

1.IF THE NUMBER OF EQUIPMENT/INSTRUMENTS CHANGES, THE KKS FOR THE SAME SHALL BE FINALIZED DURING DETAILED ENGINEERING.

2.FOR INSTRUMENTS KKS 6th AND 7th PLACE VALUE OF KKS CODE SHALL BE CHANGED FOR CORRESPONDING EQUIPMENT AS FOLLOWS:-

- 1.FOR PRESSURE -CP
- 2.FOR TEMPERATURE/GT/AT/TEMP SENSOR-CT
- 3.FOR LEVEL-CL

FOR INSTRUMENTS 8th,9th AND 10th PLACE VALUE OF KKS CODE SHALL BE CHANGED FOR CORRESPONDING EQUIPMENT AS FOLLOWS:-

- 2.FOR PRESSURE/LEVEL GAUGE-501
- 3.FOR LEVEL TRANSMITTERS-001

**TITLE****2x800 MW UPPUR STPP****TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM**

SPECIFICATION NO.: PE-TS-425-166-A001

REV.: 00

Section: I

Date: 25/10/2017

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**APPENDIX – I
LIST OF COMMISSIONING SPARES**



**2x800 MW UPPR TPS
TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLINGS SYSTEM**

SPECIFICATION No: PE-TS-425-166-A0001

SECTION : I

REV 00

LIST OF COMMISSIONING SPARES

SL. NO.	DESCRIPTION OF ITEMS	QUANTITY
1	CAF Gasket of size 1.5m X1.5m X 3 mm thk for each tank	1 lot
2	Nuts, bolts & washers of each size (nos. of bolts, nuts & washers as required for each nozzle) as per approved Drg.	1 lot
3	Any other item required for successful commissioning of the tanks (to be specified clearly by bidder)	

**TITLE****2x800 MW UPPUR STPP****TECHNICAL SPECIFICATION FOR
FUEL OIL HANDLING SYSTEM**

SPECIFICATION NO.: PE-TS-425-166-A001

REV.: 00

Section: I

Date: 25/10/2017

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**APPENDIX – II
DRAWINGS / DOCUMENTS SUBMISSION PROCEDURE**

Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the Bidder for lifting the equipment and accessories covered under the specification.

8.00.00 DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY BIDDER

8.01.00 Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required ensuring a completely engineered plant shall be provided in respect of mechanical, electrical, control & instrumentation, civil & structural works as per the scope.

The Bidder shall furnish engineering data/drgs. in accordance with the schedule of information as specified in Technical Specification and data sheets.

8.02.00 The number of copies/prints/CD-ROMs/manuals to be furnished for various types of documents is given in Annexure-I attached with Chapter 3.

8.03.00 The documentation that shall be provided by the Bidder is indicated in various sections of specification. The documentation shall include but not be limited to the following:

Basic Engineering Documentation

Prior to commencement of the detailed engineering work, the Bidder shall furnish a Plant Definition Manual within 4-6 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum:

- i. System description of all the mechanical, electrical, control & instrumentation & civil systems.
- ii. Technology scan for each system / sub-system & equipment.
- iii. Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options.
- iv. Optimization studies including thermal cycle optimization.
- v. Sizing criteria of all the systems, sub-systems including various piping systems/ equipment/ structures/ equipment foundations along with all calculations justifying and identifying the sizing and the design margins.
- vi. Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups.
- vii. Operation Philosophy and the control philosophy of the Main Plant and other plants.



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- viii. General Layout plan of the power station incorporating all facilities in Bidder's as well as those in the Owner's scope. This drawing shall also be furnished in the form of floppy discs to the Owner for engineering of areas not included in Bidder's scope.
- ix. Basic layouts and cross sections of the main plant building (various floor elevations), boiler, fuel oil area and other areas included in the scope of the Bidder.
- x. Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.
- xi. The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalised with the Owner.
- xii. After approval of Plant Definition Manual / Design Basis Report, Bidder shall furnish detailed technical specification of all system / packages of the Plant.
 - i. Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.
 - ii. Flow diagrams, Process & Instrumentation Diagrams alongwith write-up and system description.
 - iii. Start-up curves for turbine, boiler and both turbine and boiler combined together as a unit for various start-ups, viz. cold, warm and hot start-up.
 - iv. Piping isometric, composite layout and fabrication drawings.
 - v. Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules.
 - vi. Technical data sheets for all bought out and manufactured items. Bidder shall use the specifications as a base for placement of orders on their sub-vendors.
 - vii. Detailed design calculations for components, system/sub-system,, piping etc., wherever applicable including sizing calculations for all auxiliaries as per criteria specified elsewhere in specification.
 - viii. Boiler pressure part schedule and sizing calculations. Boiler performance data and boiler design dossier.
 - ix. Transient, hydraulic and thermal stress analysis of piping and system wherever applicable & input and output data alongwith stress analysis isometrics showing nodes.



- x. Thermal cycle information (heat balance diagrams, boiler performance calculations, condenser and heat exchanger thermal calculations etc.).
- xi. Characteristic Curves/ Performance Correction Curves. Hydraulic & Mechanical design calculations for condensers & heaters.
- xii. Comprehensive list of all terminal points which interface with Owner's facilities giving details of location, terminal pressure, temperature, fluid handled & end connection details, forces, moments etc.
- xiii. Power supply single line diagram, block logics, control schematics, electrical schematics, etc.
- xiv. Protection system diagrams and relay settings.
- xv. Interconnection diagrams.
- xvi. Cable routing plan.
- xvii. Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc.
- xviii. Alarm and annunciation list and alarms & trip set points.
- xix. Sequence and protection interlock schemes.
- xx. Type test reports and power system stability study report.
- xxi. Control system configuration diagrams and card circuit diagrams and maintenance details.
- xxii. Detailed software manuals & source software listing.
- xxiii. Detailed flow chart for digital control system.
- xxiv. Mimic diagram layout.
- xxv. Civil Task drawings(for the Engineering by Owner),Design and Drawings for the Civil & Structural works in the scope of the Bidder.
- xxvi. Model study reports wherever applicable.
- xxvii. Functional & guarantee test procedures and test reports.



- xxviii. Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.
- xxix. Documentation in respect of commissioning as listed out elsewhere in this specification.
- xxx. The Bidder while submitting the above documents / drawings for approval / reference as the case may be, shall mark on each copy of submission the reference letter alongwith the date vide which the submissions are made.

8.03.01**Instruction Manuals**

The Bidder shall submit to the Owner, draft Instruction Manuals for all the equipment covered under the Contract by the end of one year from the date of his acceptance of the Letter of Award. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalization and approval of the Owner the Instruction Manuals shall be submitted as indicated in Annexure-I. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Owner. The Instruction Manuals shall comprise of the following.

Erection Manuals

The erection manuals shall be submitted atleast three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum.

- a) Erection strategy.
- b) Sequence of erection.
- c) Erection instructions.
- d) Critical checks and permissible deviation/tolerances.
- e) List of tool, tackles, heavy equipment like cranes, dozers, etc.
- f) Bill of Materials
- g) Procedure for erection.
- h) General safety procedures to followed during erection/installation.
- i) Procedure for initial checking after erection.
- j) Procedure for testing and acceptance norms.
- k) Procedure / Check list for pre-commissioning activities.
- l) Procedure / Check list for commissioning of the system.



- m) Safety precautions to be followed in electrical supply distribution during erection

Operation & Maintenance Manuals

- i. The operating and maintenance instructions together with drawings (other than shop drawings) of the equipment, as completed, shall be in sufficient detail to enable the Owner to operate, maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give a step by step procedure for all operations likely to be carried out during the life of the plant / equipment including, operation, maintenance, dismantling and repair including periodical activities such as chemical cleaning of the generator. Each manual shall also include a complete set of drawings together with performance/rating curves of the equipment and test certificates wherever applicable. The contract shall not be considered to be completed for purposes for taking over until these manuals have been supplied to the Owner.
- ii. If after the commissioning and initial operation of the plant, the manuals require any modification / additions / changes, the same shall be incorporated and the updated final instruction manuals shall be submitted to the Owner for records.
- iii. A separate section of the manual shall be for each size/ type of equipment and shall contain a detailed description of construction and operation, together with all relevant pamphlets and drawings.
- iv. The manuals shall include the following :
 - a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.
 - b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.
 - c) Where applicable, fault location charts shall be included to facilitate finding the cause of maloperation or break down.
- v. Detailed specifications for all the consumables including lubricant oils, greases, chemicals etc. system/equipment/assembly/sub-assembly - wise required for the complete plant.
- vi. On completion of erection, a complete list of bearings / equipment giving their location, and identification marks etc. shall also be furnished to the Owner indicating lubrication method for each type/category of bearing.

8.03.02

Plant Handbook



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The Bidder shall submit to the Owner a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipment and systems covering the complete project including

1. Design and performance data.
2. Process & Instrumentation diagrams.
3. Single line diagrams.
4. Sequence & Protection Interlock Schemes.
5. Alarm and trip values.
6. Performance Curves.
7. General layout plan and layout of main plant building and auxiliary buildings.
8. Important Do's & Don't's

The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Owner's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities.

8.03.03 **Project Completion Report**

The Bidder shall submit a Project Completion Report at the time of handing over the plant.

8.03.04 **Drawings**

- (a.) All documents submitted by the Bidder for Owner's review shall be in electronic form (soft copies) along with the desired number of hard copies as per Annexure-I. The soft copies to be supplied shall be either in CDs, or through direct transfer via E-mail, etc. depending upon the nature/volume/size of the document. The drawings submitted for approval could be in the Image form.
- (b.) Final copies of the approved drawings shall be submitted on CD-ROM along with the requisite number of hard copies as per Annexure-I.
- (c.) The completed plant documentation with equipment drawings, data sheets, P&ID, BOQ, schematics, logic diagrams, test reports and quality plan, etc. shall be furnished to Owner.
- (d.) All documents/text information shall be in latest version of MS Office.



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- (e.) All drawings submitted by the Bidder including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipment and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules.
- (f.) Each drawing submitted by the Bidder (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Owner, Consultant, name of the Project, system designation, the specifications title, the specification number, drawing/document number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.
- (g.) The Bidder shall also furnish a "Master Drawing List" which shall be a comprehensive list of all drawings/ documents/ calculations envisaged to be furnished by him during the detailed engineering to the Owner. Such list should clearly indicate the purpose of submission of these drawings i.e. "FOR APPROVAL" or "FOR INFORMATION ONLY".
- (h.) Similarly, all the drawings/ documents submitted by the Bidder during detailed engineering stage shall be stamped "FOR APPROVAL" or "FOR INFORMATION" prior to submission.
- (i.) The furnishing of detailed engineering data and drawings by the Bidder shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Owner will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipment provided by others and external connections & dimensions which might affect plant layout. The review by the Owner should not be construed to be a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Owner / Project Manager shall not relieve the Bidder of any of his responsibilities and liabilities under this contract.
- (j.) After the approval of the drawings, further work by the Bidder shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Owner.
- (k.) All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Bidder's risk. The Bidder is expected not to make any changes in the design of the equipment /system, once they are approved by the Owner. However, if some changes are necessitated in the design of the equipment/system at a later date, the Bidder may do so, but such



changes shall promptly be brought to the notice of the Owner indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification.

- (l.) Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Owner prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/representative of Owner based on requirements of such piping indicated in approved / finalized Flow Scheme / Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package.
- (m.) Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the Bidder well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability.
- (n.) As Built Drawings

After final acceptance of individual equipment/system by the Owner, the Bidder will update all original drawings and documents for the equipment/ system to “as built” conditions.

- (o.) Drawings must be checked by the Bidder in terms of its completeness, data adequacy and relevance with respect to Engineering schedule prior to submission to the Owner. In case drawings are found to be submitted without proper endorsement for checking by the Bidder, the same shall not be reviewed and returned to the Bidder for re-submission. The Bidder shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data/drawings at site which are needed as an input to the engineering. The Bidder shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Owner’s scope and submit all necessary drawings/ documents for the same.
- (p.) The Bidder shall submit adequate prints of drawing/data/document for Owner’s review and approval. The Owner shall review the drawings and return one (1) copy to the Bidder authorizing either to proceed with manufacture or fabrication, or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Bidder to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule.



- (q.) All engineering data submitted by the Bidder after final process including review and approval by the Owner shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Owner in writing.

8.04.00 **Engineering Information Submission Schedule**

Prior to the award of Contract, a Detailed Engineering Information Submission Schedule shall be tied up with the Owner. For this, the bidder shall furnish a detailed list of engineering information alongwith the proposed submission schedule. This list would be a comprehensive one including all engineering data / drawings / information for all bought out items and manufactured items. The information shall be categorised into the following parts.

- (a.) Information that shall be submitted for the approval of the Owner before proceeding further, and
- (b.) Information that would be submitted for Owner's information only.

The Engineering Information Schedule shall be updated monthwise.

The schedule should allow adequate time for proper review and incorporation of changes/ modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be duly considered while determining the overall performance and progress.

8.05.00 **Engineering Progress and Exception Report**

8.05.01 Report giving the status of each engineering information including

- (a.) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission
- (b.) Drawings which were not submitted as per agreed schedule.

8.05.02 The draft format for this report shall be furnished to the Owner within four (4) weeks of the award of the contract, which shall then be discussed and finalized with the Owner.

8.06.00 **Co-Ordination Meetings**

8.06.01 The Bidder shall be called upon to organize and attend monthly Design/ Co-ordination Meetings with the Owner/Owner's representatives, Project Consultant during the period of contract. The Bidder shall attend such meetings at his own cost at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.



- 8.06.02 The Bidder should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the Bidder shall submit all drawings as per the agreed Engineering Information Submission Schedule. The drawings submitted by the Bidder will be reviewed by the Owner as far as practicable within three (3) weeks from the date of receipt of the drawing. The comments of the Owner shall then be discussed across the table during the above co-ordination Meetings wherein best efforts shall be made by both sides to ensure the approval of the drawing.
- 8.06.03 The Bidder shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Bidder shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.
- 8.06.04 Should any drawing remain unapproved for more than six (6) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.
- 8.06.05 Any delays arising out of failure by the Bidder to incorporate Owner's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Bidder to alter the Contract completion date.
- 8.07.00 **Design Improvements**
- The Owner or the Bidder may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly.
- If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Bidder proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.
- 8.08.00 **Equipment Bases**
- A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Owner. Each base plate which support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.
- 8.09.00 **Protective Guards**
- Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.
- 8.10.00 **Lubricants, Servo Fluids and Chemicals**

