Annexure-V

Pre-Bid Clarification Format

ANNEXURE-V: PRE-BID CLARIFICATION FORMAT FOR WATER STORAGE TANKS Dtd: 26.08.15

Sl. No.	Section / Part/Subsection	Page No.	Clause No.	Bid Specification	Bidder's Query	Purchaser's Reply Dtd: 26.08.15
1	Annexure12	1	Sl. No.3.1.1 a	Charges of Rs.5/- per/sq.mtr rent for office premises	Please clarify whether the rent is lump sum for field execution time or is t per Month. Will the office be near Foundations or away. We have only P&I Diagram But not layout to understand the position.	Charges will be on per month basis. Office and main store area will be around 3 KM from proposed project area within ONGC premises.
2	Annexure12	1	Sl No.3.1.1 .b	Chargeable. Land for Storage yard shall be provided by BHEL/ONGC on chargeable basis @ Rs. 5.00 per Sq M.	Kindly inform us the location of Material Stores I.e., How far it is from field work and the rent of Rs.5 /-per sq mtr is Lumpsum or Rent per month.	Please refer reply of point number – 1.
3	Annexure12	1	Sl No.3.2.1	Electricity for construction purposes3 Phase 415/440 V (To be specified whether chargeable or free), Chargeable @ Rs 5 per KWH.	Please indicate that It is obligation of BHEL to provide Construction Power on Chargeable Basis and is there any quantum limitation . And we also wish to know that power point will be for each tank and at what distance from tank foundation-?	Construction power will be provided on chargeable basis @ Rs 5 per KWH without any limit. Electricity will be provided at one point near construction site, distance will be approx 500m. (Distance is only estimated, It may vary up to any extent depending on site condition).
					Procedure of Erection of Tank: we wish to adopt conventional procedure I.e.,Derrick and chain blocks etc for erection and occasional use of Mobile Hydra Crane for placement of shell	Bidder may adopt regular Storage Tank Erection Practices/Procedures.

					courses. In case this procedure is banned we Should know beforehand.	
					For Economy in execution we propose to prefabricate, blast clean and apply Primer etc and dispatch to site to avoid storage. Final Painting will be done After completion of water fill test. We need to have your concurrence. Pro Rata Payment for field work will be claimed along with supply of materials.	Acceptable. However E&C cost shall be minimum 35 % of Total cost as per Price Bid Format(Annexure-VIII).
					We will only follow your specification where ever required thickness I side tied But not Plant Corrosion Allowance Schedule, if any.	Bidder to consider Thicknesses of Bottom, Shell and Roof Plate as indicated in the tender specification. Bidder to ensure that the indicated thicknesses shall meet the following requirements as per API-650/IS803. #. External Pressure calculation #. Overturning stability of tank due to wind #. Anchor bolt Design #. Seismic analysis Or else bidder may consider higher thicknesses of Shell/Roof and Bottom plates to meet the above design calculations.
4	Annexure I Data sheet for water storage tanks	Pg.No. 5 of 8	Cl.No. 5i, ii & iii.	Surface Preparation: Manual Wire Brushing conforming to SA 2-1/2 Standard.	From the referred clause we understood that surface preparation will be manual wire brushing. But manual wire brushing standard is	Revised Annexure-I, Datasheet for Water Storage Tanks is enclosed wherein revised painting details are indicated.

				Note: In ONGC Hazira complex no sand blasting or shot blasting shall be done.	ST2, where as referred clause indicated SA2-1/2. Please check and confirm.	
5	Annexure I Data sheet for water storage tanks	Pg.No. 5 of 8	Cl.No. 5i.	Primer: One Coat of Unmodified epoxy resin along with Polyamide hardener DFT: Minimum 40 micron per coat Paint: Three(3) coats of unmodified epoxy resin along with Aromatic Adduct Hardener DFT: Minimum 40 micron per coat. Total Thickness: Total Thickness of primer and paint shall not be less than 400 micron.	Total thickness of primer and paint (i.e 160 micron) is not matching with indicated total thickness of 400 microns. Please check and clarify.	Refer our reply against S.No. 4 above.
6	P&ID for Cooling water system.			CW Water storage tank	Piping material specification for following nozzles are not indicated in the P&ID please provide the same. 10" Spare Nozzle 8" Spare Nozzle 2" Drain Nozzle 3" LT Nozzles.	11D Piping Material Specification is applicable for all the nozzles. Revised Annexure-II, Piping Material Specifications are enclosed with these clarifications.
7	P&ID for Mixed Bed Unit and Associated system.			DM Water storage tank	Piping material specification for following nozzles are not indicated in the P&ID please provide the same. 6" Spare Nozzle 8" Spare Nozzle	11A PMS are applicable for all the Nozzles of DM Water Storage Tank.

					2" Drain Nozzle 3" LT Nozzles 3" Recirculation Lines 1" Reciirculation Lines 8" Emergency Makeup water pumps 1" Condensate from Steam condensate transfer pumps 2" Normal makeup water pumps.	
8	P&ID for Mixed Bed Unit and Associated system.			Intermediate DM Water storage tank	Piping material specification for following nozzles are not indicated in the P&ID please provide the same. 8" Spare Nozzle 6" Spare Nozzle 2" Drain Nozzle 3" LT Nozzles 10" Vent line 10" Overflow line 4" Nozzle to Regeneration pumps	Following PMS are applicable for Nozzles. • 12A for 8" Spare Nozzle • 12A for 6" Spare Nozzle • 11A for 2" Drain Nozzle • 12A for 3" LT Nozzles • 11A for 10" Vent line • 11A for 10" Overflow line • 12A for 4" Nozzle to Regeneration pumps
9	Annexure I Data sheet for water storage tanks	Pg.No. 5 of 8	Cl.No. 5i	Internal Painting of the Tank	Under the scheme of painting for internal surface of tanks you have indicated un modified polyamide cured epoxy resin with abduct hardener but thickness per coat is indicated as 40 Microns DFT for three coats of finish paint and primer of 40 microns DFT . The overall DFT is specified as 400 microns. Kindly refer to Spn No. PY 51186 Annexure 1 page no 6 of 8. Tender no. T7b1O9091.	Refer our reply against S.No. 4 above.

	Additional Clarifications Dtd: 26.08.15					
1.						**Suggestions for the Shell Course Height for Intermediate DM Water Tank:** The Shell Course considered by Purchaser (1.5x4) can be preferably altered as 2x2 and 1.5 x1.
2.						**Suggestions for the Shell Course Height for DM water and CW Makeup Tank:** The Shell Course considered by Purchaser (1.5x7) can be preferably altered as 1.8x1 and 1.5 x5.
3.						**Refer Annexure XIII:** Typical Seal Pot and Breather Tanks for DM & Intermittent DM water Storage Tanks. MoC of seal pot and Breather tank including all nozzles shall be of **Carbon Steel**. **11A PMS** is applicable for nozzles associated with these tanks.

Note: During Preparation of Pre-Bid Queries, Complete Tender Specification Doc. No. PY-51186(along with all Annexures) and the Enclosed Check List(Refer Annexure-VII) shall also be referred.

SIGNATURE : _____
NAME : _____

DESIGNATION : _____
COMPANY : _____
DATE : _____

COMPANY SEAL

Annexure-I

Revised Datasheet for Water Storage Tanks(Rev01)

S.No.	Description	Unit	Value/Specification		
			CW make-Up Water Storage Tank	**DM Water Storage Tank**	**Intermediate Water Storage Tank**
1	**General**				
1.1	Type of Tank		Conical roof type, Vertical atmospheric steel tank. **(MSEP)**	Conical roof type, Vertical atmospheric steel tank. Tank shall have 3 layers of PP balls of 50 mm dia. Also it shall be provided with CO2 absorbers. **(MSEP)** **<u>Notes</u>:** **1) Seal Pot and Breather Tanks including piping from DM Water Storage Tank to these tanks are in bidders scope of supply. For Details refer Annexure-XIII** **2) 3 layers of Polypropylene Balls of diameter 50mm each to be provided for DM Water & Intermittent DM Water Storage tanks in addition to CO2 Absorbers.**	Conical roof type, Vertical atmospheric steel tank. Tank shall have 3 layers of PP balls of 50 mm dia. Also it shall be provided with CO2 absorbers. **(MSEP)** **<u>Notes</u>:** **1) Seal Pot and Breather Tanks including piping from DM Water Storage Tank to these tanks are in bidders scope of supply. For Details refer Annexure-XIII** **2) 3 layers of Polypropylene Balls of diameter 50mm each to be provided for DM Water & Intermittent DM Water Storage tanks in addition to CO2 Absorbers.**
1.2	Quantity of Tanks	Nos	1	1	1
1.3	Fluid stored		Filtered Water	DM Water	DM Water
2	**Design Features**				
2.1	Tank Design Code		IS803, API 650	IS803, API 650	IS803, API 650
2.2	Wind Load		Calculation for wind effect shall be in accordance with IS: 875-1987(part-3) **<u>Note</u>: As per design calculation, if required, vendor shall provide required no. of wind girders**	Calculation for wind effect shall be in accordance with IS: 875-1987(part-3) **<u>Note</u>: As per design calculation, if required, vendor shall provide required no. of wind girders**	Calculation for wind effect shall be in accordance with IS: 875-1987(part-3) **<u>Note</u>: As per design calculation, if required, vendor shall provide required no. of wind girders**

2.3	Earthquake Consideration		Seismic Load Design Criteria (1) Design Code/Zone IS: 1893, Parts 1 & 4 / Zone III (2) Soil Type Type III	Seismic Load Design Criteria (1) Design Code/Zone IS: 1893, Parts 1 & 4 / Zone III (2) Soil Type Type III	Seismic Load Design Criteria (1) Design Code/Zone IS: 1893, Parts 1 & 4 / Zone III (2) Soil Type Type III
2.4	Design Liquid		Water	Water	Water
2.5	Net Capacity of Tank	cu.m.	1000	1000	50
2.6	Dimension of tank (DiaxHeight)	m x m	12.5 x 9.3 (Refer Annexure-X)	12.5 x 9.3 (Refer Annexure-X)	4 x 5.5 (Refer Annexure-X)
2.7	Design Metal Temperature	°C	80	80	80
2.8	Design Pressure		Full of Water + Atmospheric Pressure	Full of Water + Atmospheric Pressure	Full of Water + Atmospheric Pressure
2.9	Density of Design liquid	kg/cu.m	1000	1000	1000
2.10	Thickness provided for				
a	Shell mm	mm	Total 7 Courses 6.0 (1st course) & 5.0 (remaining courses)	Total 7 Courses 6.0 (1st course) & 5.0 (remaining courses)	Total 4 Courses 5.0 (All courses)
b	Roof Plate	mm	5.0 (Including Corrosion Allowance)	5.0 (Including Corrosion Allowance)	5.0 (Including Corrosion Allowance)
c	Bottom Plate	mm	6.0 (Including Corrosion Allowance)	6.0 (Including Corrosion Allowance)	6.0 (Including Corrosion Allowance)
2.11	Corrosion Allowance	mm	0.0 mm (Since coating is provided)	0.0 mm (Since coating is provided)	0.0 mm (Since coating is provided)
2.12	Joint Efficiency of weld joints		0.7	0.7	0.7
2.13	Design wind speed	m/s	44	44	44
3	**Material of construction**				
3.1	Shell, Roof & Bottom plate		IS2062 Gr.E250 B	IS2062 Gr.E250 B	IS2062 Gr.E250 B
3.2	**Shell & Roof appurtenances**				
a	**For Manholes**				
	Size and location		600NB & One each on shell and roof	600NB & One each on shell and roof	600NB & One each on shell and roof
	Necks, flanges and coveraplates		IS2062 Gr.E250 B, conform to IS803	IS2062 Gr.E250 B, conform to IS803	IS2062 Gr.E250 B, conform to IS803

	Bolts & Nuts		IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.
b	**For Nozzles**				
	No. and size of Shell, Roof, Vent and Drain Nozzles		As per P&ID for Cooling Water System, Drg No. 2-38101-04546(Sh 02 of 02)) enclosed as Annexure-IX	P&ID for Mixed Bed Unit and Associated Unit , Drg No. 1-38101-06496 enclosed as Annexure-IX	P&ID for Mixed Bed Unit and Associated Unit , Drg No. 1-38101-06496 enclosed as Annexure-IX
	No. and size of spare nozzles		One spare inlet(8" 150#) and one spare outlet nozzle(10", 150#) shall be provided.	One spare inlet(6" 150#) and one spare outlet nozzle(8", 150#) shall be provided.	One spare inlet(6" 150#) and one spare outlet nozzle(8", 150#) shall be provided.
	Inlet Nozzles		All inlet nozzles shall be routed from bottom of tank	All inlet nozzles shall be routed from bottom of tank	All inlet nozzles shall be routed from bottom of tank
	Nozzle necks		As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)
	Flanges and counter-flanges		As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)
	Bolts & Nuts		IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.
Note: All Nozzles(Inlet/outlet/Recirculation/Instrumentation/Drain/Overflow/Make-Up) on the shell(except manhole) shall be provided with SS Wire Mesh to prevent blocking of PP Balls.					
c	**Fittings**				
	Dimensional standard		As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)
	End connection		As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)
3.4	**Gaskets**		As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)
3.5	Structurals, stairways and platforms		IS2062 Gr.E250 A	IS2062 Gr.E250 A	IS2062 Gr.E250 A

3.6	Foundation bolts & Nuts		IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.
3.7	Hand rail		32NB, IS:1239 MEDIUM CLASS (GI)	32NB, IS:1239 MEDIUM CLASS (GI)	32NB, IS:1239 MEDIUM CLASS (GI)
3.8	Earthing lugs & Nameplate		Austenitic Stainless Steel (SS304)	Austenitic Stainless Steel (SS304)	Austenitic Stainless Steel (SS304)
4	**Accessories**				
4.1	Spiral stair case		Yes	Yes	Outside Cage ladder shall be provided
4.2	Hand railing		Yes	Yes	Yes
4.3	Anchor chairs & foundation bolts		Yes	Yes	Yes
4.4	Mechanical Level Gauge		Yes, Float and Board type Mechanical Level gauge **(Bidder's Scope of Supply)**	Yes, Float and Board type Mechanical Level gauge **(Bidder's Scope of Supply)**	Yes, Float and Board type Mechanical Level gauge **(Bidder's Scope of Supply)**
4.5	Level Transmitter		Yes, 2 No's, Side Mounted, Diaphragm Remote Seal Type. **(Excluded from Bidder Scope of Supply. Only Nozzle along with Counter Flanges, Gaskets, Studnuts to be provided by bidder)**	Yes, 1 No., Side Mounted, Diaphragm Remote Seal Type. **(Excluded from Bidder Scope of Supply. Only Nozzle along with Counter Flanges, Gaskets, Studnuts to be provided by bidder)**	Yes, 1 No., Side Mounted, Diaphragm Remote Seal Type. **(Excluded from Bidder Scope of Supply. Only Nozzle along with Counter Flanges, Gaskets, Studnuts to be provided by bidder)**
4.6	Gauge Hatch Nozzle with hinged cover		Yes	Yes	Yes
4.7	Earthing lugs		Yes, 2 No's	Yes, 2 No's	Yes, 2 No's
4.8	Cathodic Protection		Not Required.	Not Required.	Not Required.
5	**Painting**				
i.	**Internal Painting of the Tank(Reference: As per S.No. 7 of Cl. 3.0, Sub-Section 2.15, Surface Preparation and Painting, Vol-III, Doc. No. 5111168-ME-SPC-100-001)**				
01	Surface Preparation		Manual Wire Brushing conforming to ST-2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done. Hence manual Wire Brushing shall	Manual Wire Brushing conforming to ST-2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done. Hence manual Wire Brushing shall be adopted.	Manual Wire Brushing conforming to ST-2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done. Hence manual Wire Brushing shall

			be adopted.		be adopted.
	Primer		02 Coats of High Build Chlorinated Rubber Zinc Phosphate Primer. **DFT:** 50 micron per coat	02 Coats of High Build Chlorinated Rubber Zinc Phosphate Primer. **DFT:** 50 micron per coat	02 Coats of High Build Chlorinated Rubber Zinc Phosphate Primer. **DFT:** 50 micron per coat
	Finish Paint		02 Coats of Chlorinated Rubber Paint **DFT:** 30 micron per coat	02 Coats of Chlorinated Rubber Paint **DFT:** 30 micron per coat	02 Coats of Chlorinated Rubber Paint **DFT:** 30 micron per coat
	Total Thickness		Total Thickness of primer and finish paint shall be 160 micron.	Total Thickness of primer and finish paint shall be 160 micron.	Total Thickness of primer and finish paint shall be 160 micron.
	Colour Shade		White	White	White
ii.	**External Painting of the Tank(Reference: As per S.No. 1 of Cl. 3.0, Sub-Section 2.15, Surface Preparation and Painting, Vol-III, Doc. No. 5111168-ME-SPC-100-001)**				
01	Surface Preparation		Manual Wire Brushing conforming to ST-2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done. Hence manual Wire Brushing shall be adopted.	Manual Wire Brushing conforming to ST-2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done. Hence manual Wire Brushing shall be adopted.	Manual Wire Brushing conforming to ST-2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done. Hence manual Wire Brushing shall be adopted.
	Primer Coat		02 Coats of Epoxy Zinc Phosphate Primer. **DFT:** 35 micron per coat	02 Coats of Epoxy Zinc Phosphate Primer. **DFT:** 35 micron per coat	02 Coats of Epoxy Zinc Phosphate Primer. **DFT:** 35 micron per coat
	Intermediate Coat		01 Coat of Epoxy High Build Mio Paint. **DFT:** 100 micron per coat	01 Coat of Epoxy High Build Mio Paint. **DFT:** 100 micron per coat	01 Coat of Epoxy High Build Mio Paint. **DFT:** 100 micron per coat
	Finish Coat		01 Coat of Acrylic Polyurethane Paint. **DFT:** 50 micron per coat	01 Coat of Acrylic Polyurethane Paint. **DFT:** 50 micron per coat	01 Coat of Acrylic Polyurethane Paint. **DFT:** 50 micron per coat
	Total Thickness		Total Thickness of primer and finish paint shall be 220 micron.	Total Thickness of primer and finish paint shall be 220 micron.	Total Thickness of primer and finish paint shall be 220 micron.
	Colour Code				
iii.	**Bottom Plate Underside Painting(Reference: As per Industrial Practice)**				

	Surface Preparation		Manual Wire Brushing conforming to ST-2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done. Hence manual Wire Brushing shall be adopted.	Manual Wire Brushing conforming to ST-2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done. Hence manual Wire Brushing shall be adopted.	Manual Wire Brushing conforming to ST-2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done. Hence manual Wire Brushing shall be adopted.
	Primer Coat	01	One Coat of Primer (DFT: 30-40 Micron per Coat)	One Coat of Primer (DFT: 30-40 Micron per Coat)	One Coat of Primer (DFT: 30-40 Micron per Coat)
	Finish Coat		Three(3) Coats of Coaltar Epoxy (DFT: 60-80 Micron per Coat)	Three(3) Coats of Coaltar Epoxy (DFT: 60-80 Micron per Coat)	Three(3) Coats of Coaltar Epoxy (DFT: 60-80 Micron per Coat)

Notes for Surface Preparation and Painting

a) Surface Preparation by Manual Wire Brush: ST-2 01

ST 2 Thorough scraping and wire-brushing - machine brushing - grinding - etc. The treatment shall remove loose mill scale, rust and foreign matter. Subsequently, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It should then have a faint metallic sheen. The appearance must correspond to the prints designated ST 2.

b) External Painting 01

Primer (P-6) : Epoxy zinc phosphate primer

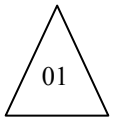
Type and composition : Two pack of Polyamide cured epoxy resin medium pigmented with zinc phosphate
Volume solids : 40% (min)

Intermediate Coat (P-7): Epoxy high build MIO paint (Intermediate coat)

Type and composition : Two pack of Polyamide cured epoxy resin medium pigmented with micaceous iron oxide
Volume solids : 50% (min)

Finish Coat (F-2): Acrylic Polyurethane paint
Type and composition : Two pack Acrylic resin and isocyanate hardener suitably pigmented.
Volume solids : 40% (min)

c) Internal Painting



Primer (P-2) : High build chlorinated rubber zinc phosphate primer

Type and composition : Single pack Chlorinated rubber medium plasticized with unsaponifiable plasticiser pigmented with zinc phosphate
Volume solids : 35-40% (min)

Intermediate Coat : NA

Finish Coat (F-3): Chlorinated Rubber paint
Type and composition : Single pack Plasticised chlorinated rubber medium with chemical & weather resistant pigments..
Volume solids : 30% (min)

d) Following activities to be ensured while performing surface preparation and painting

1) All primers and finish coats should be cold cured and air dried unless otherwise specified.
2) Selected chlorinated rubber paint should have resistance to corrosive atmosphere and suitable for marine/saline environment.
3) All paints shall conform to relevant Indian Standard and shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation, quality and workmanship should be ensured.
4) In case of use of epoxy tie coat, manufacturer should demonstrate satisfactory test for inter coat adhesion.
5) All primers should be top coated immediately as per manufacturer's recommendations.
~~6)~~ **In ONGC Hazira complex no sand blasting or shot blasting shall be done.** ~~All equipment shall be protected with anti-corrosive coat and after final painting only shifted to project site for further erection. Touch – up painting for the damage area during transportation can be done at project site.~~

Annexure-II

Revised Piping Material Specification(Rev01)

BHARAT HEAVY ELECTRICALS LIMITED
Project Engineering & Systems Division (PE&SD)
HYDERABAD – 32

PEMC- 06119

Rev No. **00**

TITLE

PIPING MATERIAL SPECIFICATION (PMS)

Project :	**1X51 MW COMBINED CYCLE CAPTIVE POWER PLANT, HAZIRA**
Customer :	**M/s OIL & NATURAL GAS CORPORATION (ONGC)**
Consultant :	**M/s FICHTNER CONSULTING ENGINEERS (INDIA) PVT. LTD.**

Ref Doc		Revisions:	Prepared by:	Checked by:	Approved by:	Date:
		Refer to record of revisions	(Chintan)	(Badari)	(M.S.S.N)	31.07.15

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1.0 INTRODUCTION :

This document "Piping Material Specification (PMS)" covers the various Piping Classes applicable for ONGC Hazira – 1x51MW Combined Cycle Captive Power Plant. This PMS has been prepared to meet the process requirements of various services as applicable for the project.

2.0 PIPING MATERIAL SPECIFICATION (PMS):

The PMS forms the basis for design, procurement, fabrication and testing of piping systems.

In general, PMS includes the following:

- Applicable Pressure-Temperature Ratings
- Selected Pipe Sizes and Thicknesses
- Details of Flanges & Pipe Fittings
- Details of Valves
- Details of other Piping components such as Bolts, Nuts, Gaskets etc.,
- Details of Miscellaneous items such as Strainer, Steam Trap etc.,

The PMS does not cover the special requirements such as Motor Operated Valves (MOVs), Special features such as Limit Switches, Lock-open facility etc. For these requirements / features, please refer to the respective Process & Instrumentation Diagrams (P&IDs) and Contractual requirements.

3.0 APPLICABLE CODES & STANDARDS:

All the piping shall be designed in accordance with ASME B31.1, IBR latest standards as applicable. The other standards to be followed for each piping components such as for pipes, fittings, valves etc are specified elsewhere in this document or in the individual piping material specifications.

4.0 PMS DESIGNATION CODE:

A standard philosophy is followed for unique designation of each PMS. Every PMS is designated with 'three alpha-numeric characters', such as 11A, 45C etc.

The PMS documents have been provided limiting to the set of services operating within the pressure and temperature combinations applicable for the project.

Each character is based on specific piping data as described below:

(i) 'First Character' indicates pressure rating :
- 1 - #150 rating

- 2 - #300 rating
- 3 - #600 rating
- 4 - #900 rating
- 5 – #1500 rating
- 6 – #2500 rating

(ii) 'Second character' indicates the piping material :

- 1 - Carbon Steel (ASTM A106 Gr B, A672 Gr B60, A105, IS:3589 or equivalent)
- 2 - Stainless Steel (ASTM A312 TP 321 or equivalent)
- 3 - Low Alloy Steel (ASTM A335 P11 or equivalent)
- 4 - High Alloy Steel (ASTM A335 P22 or equivalent)
- 5 - Very High Alloy Steel (ASTM A335 P91 or equivalent)

(iii) Third character indicates the variants with in the class rating

- A – Flanged valves, Non IBR lines
- B – Butt Welded valves, Non-IBR Lines
- C – Butt Welded valves, IBR Lines
- D – Flanged valves, Non IBR lines
- G – Other specific services (such as Vacuum lines etc.)

5.0 TECHNICAL REQUIREMENTS OF PIPING :

5.1. Pipes:

Pipe dimensions shall be in accordance with ASME B36.10, IS:1239, IS:3589 for wrought steel and wrought iron pipes, to ASME B36.10, B36.19 for stainless steels pipes. Minimum process line shall be of ¾" size.

Where ever, Pipe thickness mentioned as 'CAL' in PMS, if any, the same shall be calculated by BHEL, based on the applicable codes of ASME B31.1 and IBR. The letter 'M' indicated in PMS shall be understood as the schedule or thickness same as the pipe thickness selected.

5.2. Flanges:

In general, flanges shall supply in accordance with ANSI B 16.5 up to 24" (#150 -1500 rating), ANSI B 16.5 up to 12" #2500. 24" and above shall be as per ANSI B16.47 series 'B'. Also, AWWA C207 Class D shall be followed for Cooling Water Service (For sizes 26" & above).

Hardness of flange shall be 20 BHN more than that of gasket.

Flanges shall be supplied in accordance with Technical Delivery Conditions (TDC) for ANSI flanges doc. No. AA 08511401 (BHEL Corporate Standard)

5.3. Pipe Fittings:

Forged steel fittings shall be in accordance with ANSI B 16.11. For items not covered under B16.11, reference may be made to BS 3799 or MSS-SP-std.

Butt welded steel fittings shall be in accordance with ANSI B 16.9. For items not covered under B16.9, reference may be made to MSS-SP-std.

Pipe Fittings shall be supplied in accordance with Technical Delivery Conditions (TDC) for ANSI flanges Doc.No. HY0851495 (BHEL-Hyderabad internal standard).

All fittings shall be of seamless construction unless otherwise specified. Where ever, welded construction is permitted as per PMS, the same shall be 100% radiographed.

For BW fittings having different wall thickness at each end, the greater one shall be employed and the end shall be matched to suit the respective thickness.

All welded fittings (if specified, in piping material specification) shall be double welded. Inside weld projections shall not exceed 1.6 mm and the welds shall be ground smooth at least 25 mm from the ends.

For fitting made out of welded pipe (if applicable as per piping material specification), the pipe itself shall be of double welded type, manufactured with addition of filler material and made by employing automatic welding only.

All welded fittings (if applicable as per piping material specification) shall be normalized and tempered for AS.

Bevel end of all BW fittings shall undergo 100% MP/DP test.

Usage of unions shall be restricted to utilities and instrumentation.

Use of 90 degree elbows for making 45 degree elbow is not permitted.

5.4. Fabricated elbows (Mitres), Tee, and Reducers :

Miters, Tees and reducers are to be fabricated using pipe having higher thickness than corresponding pipe/elbow as specified in PMS. Rolled and welded pipes made out of plates (EFSW pipes) where ever specified in PMS are allowed for manufacturing the miters, Tees and reducers.

90 degree bends (Mitres) shall have minimum four pieces up to 24" size and five pieces from 26" size. 45 degree Mitre shall be made out with minimum three pieces.

Welded fittings shall be 100% radiographed by X-ray. Ultrasonic testing in lieu of radiographic examination shall not be acceptable

5.5. Gaskets :

Non-metallic gaskets shall confirm to B16.11 (corresponding to B16.5) up to 24" and B16.21 (corresponding to B16.47B) for beyond 24". Metallic Spiral wound gasket (MSW) and Ring joint gaskets (RTJ) shall confirm to B16.20.

Spiral would gaskets shall be of self-aligning type. Outer centering ring is mandatory and shall be of minimum CS material. Inner ring material shall be same as spiral strip material and as minimum for the following.

- 26" and above gaskets
- All size gaskets for Vacuum service. H-grade stainless steel, SS-347 and SS-321.
- All size gaskets for Hydrogen and process + Hydrogen Services.
- All sizes gaskets for CRYO classes.
- All sizes where class temperature is higher than 427 Deg. C.
- All sizes for classes 900# and above.
- All gaskets with PTFE filler.

Asbestos filler shall not be used as filler for spiral wound gaskets.

Full face gaskets shall have bolt holes punched out.

Gaskets where CA filter is specified, Grafoil filer will also be acceptable.

5.6. Bolting :

Threads shall be unified (UNC for # 1" and BUN for 1" dia) as per ANSI B1.1. with class 2A fit for Studs. M/c Bolts and jack screws and class 2 B for nuts.

Stud bolts shall be threaded full length with two heavy hex nuts. Length tolerance shall be in accordance with the requirement of table F2 of Annexure F of ASME 16.5.

The nuts shall be double chamfered, semi-finished, heavy hexagonal type and shall be made by hot forged process.

Wherever ferritic steel flanges mate with stainless steel flanges over 371 Deg. C, bolting material shall be ASTM A 193 Gr B16 / A 194 Gr 4H.

5.7. Special Requirements for Austenitic Stainless Steel :

The following special requirements for Austenitic stainless steel are to be taken care of.

- All items / parts shall be supplied in solution-annealed condition.
- Use of threaded connections are prohibited

5.8. Test Reports

Test reports for all mandatory tests (as well as supplementary, wherever specified) shall be furnished.

5.9. Marking

- All items shall be marked (stamped / etched) in accordance with applicable codes / standards / specification. The item code, if available shall also be marked.
- For ease of identification, the color of painted strips, wherever applicable, shall be as per applicable standard.
- Paint or ink for marking shall not contain any harmful metal or metal salts such as zinc, lead or copper which cause corrosive attack on heating.
- Special items / smaller items shall have attached corrosive resistance tag providing salient features.

5.10. Dispatch

- All items shall be dry, clean and free from moisture, dirt and loose foreign materials of any king.
- All items shall be protected from rust, corrosion, and any mechanical damage during transportation, shipment and storage.
- Rust preventive on machined surfaces to be welded shall be easily removable with petroleum solvent or shall not be harmful to welding.
- Ends shall be suitable protected and the protectors shall be securely and tightly attached.
- Each variety and size of item shall be supplied in separate packaging marked with purchase order No, item code (if available), and the salient specifications.

6.0 DESIGN BASIS FOR PMS

6.1. Ratings :

The Pressure-Temperature ratings are specified based on ASME B16.5.

6.2. Pipes :

Pipe thicknesses have been calculated as per the applicable codes ASME B31.1 and IBR as applicable, considering the corrosion allowance indicated in respective PMS documents. The pipe thickness is arrived after applying the manufacturing tolerance.

Unless specified in PMS, in general, the pipes of sizes upto 14" are considered seamless and sizes above 14" shall be of welded type.

6.3. Fittings :

In general, end connections for pipe fittings are considered as below, unless specified in respective PMS:

- Socket Weld (SW) end connection upto 2" size
- Butt Weld (BW) end connection upto 2" size

For actual end connections of pipe fittings, the respective PMS shall be referred.

6.4. Valves :

In general, end connections of the valves are considered as below, unless specified in respective PMS:

For valves upto 2" size
- Socket Weld (SW) end connection

For valves of size above 2",
- Butt-Welded ends for IBR & Vacuum lines, for all the ratings
- Flanged / Screwed connections for Non-IBR lines

For actual end connections of valves, the respective PMS shall be referred.

7.0 LIST OF ANNEXURES :

Sl.No.	Annexure No.	PMS	RATING	BASIC MATERIAL	APPLICABLE SERVICES	Rev. No.
1.	Annexure-1	**11A**	#150	Carbon Steel (A106GrB)	Natural Gas, Lub Oil, Blow Down, Vents, OWS, Lub Oil, Chemical Drains, Flare lines, Condensate, Make-up water , Water Wash, Nitrogen, Service Air.	00
2.	Annexure-2	**11C**	#150	Carbon Steel (A106GrB)	LP Steam, CBD Vent, EBD line (HRSG) etc. Hrsg Services : CBD Line, EBD Line, Evap. Conn. To Drain Headers, Sat. Steam Pipes.	00
3.	Annexure-3	**11D**	#150	Carbon Steel (IS1239/ 3589)	Cooling Water Lines	00
4.	Annexure-4	**11E**	#150	Carbon Steel (Galvanized)	Instrument Air, Service Water, Potable Water	00
5.	Annexure-5	**11G**	#150	Carbon Steel (A106GrB)	CEP suction, CEP minimum recirculation, Ejector drains to condenser	00
6.	Annexure-6	**12A**	#150	Stainless Steel	DM Water	00
7.	Annexure-7	**14C**	#150	Alloy Steel (A335P22)	Steam line downstream of Bypass PRDS valve	00
8.	Annexure-8	**21A**	#300	Carbon Steel (A106GrB)	Natural Gas	00
9.	Annexure-9	**21C**	#300	Carbon Steel (A106GrB)	HP Steam, MP Steam, LP Steam, LP Feed Water(BFP Discharge), HRSG Services: SH Drain To Drain Header, Drain Header To BD Tank, Econ. Common Drain To DH-1, Start-Up Vent.	00
10.	Annexure-10	**22A**	#300	Stainless Steel	Natural gas lines near GTG (downstream of filter)	00
11.	Annexure-11	**24C**	#300	Alloy Steel (A335P22)	MP steam downstream of Control Valves in PRDS system, Auxiliary Steam	00
12.	Annexure-12	**31A**	#600	Carbon Steel (A106GrB)	Natural Gas	00

13.	Annexure-13	**31C**	#600	Carbon Steel (A106GrB)	HRSG SERVICES : CBD Line, EBD line, Feedwater pipe, Saturated Steam Pipes, Desuperheater spray line	00
14.	Annexure-14	**34C**	#600	Alloy Steel (A335P22)	HP Steam Downstream Of Control Valves Of PRDS System	00
15.	Annexure-15	**41C**	#900	Carbon Steel (A106GrB)	VHP Feedwater, HRSG Services : Eco. To Drum Pipe, Econ. Inlet And Outlet Pipes	00
16.	Annexure-16	**42A**	#900	Stainless Steel	Chemical Dosing to HP dosing	00
17.	Annexure-17	**44C**	#900	Alloy Steel (A335P22)	Spray Water Line Near Desuperheaters, Spray Water Line In Aux. PRDS, HRSG Services : Desuperheater Inlet And Outlet Pipes	00
18.	Annexure-18	**45C**	#900	Alloy Steel (A335P91)	VHP steam	00
19.	Annexure-19	**54C**	#900	Alloy Steel (A335P22)	HRSG Services : VHP Main Steam Line (Upto HRSG MSSV), Common Superheater Drain Line, Start-Up Vent	00
20.	Annexure-20	Dwg.No.4-381-01-02488			STANDARD VENT, DRAIN, THERMOWELL & PRESSURE CONNECTION DETAILS	02

BHARAT HEAVY ELECTRICALS LIMITED
Project Engineering & Systems Division (PE&SD)
HYDERABAD – 32

Rev. No.	Date	Revision Details	Revised By	Checked By	Approved By
00	31.07.15	First issue	(Chintan)	(Badari)	(M.SSN)

PE&SD-Mech.	PIPING MATERIAL SPECIFICATION	11D

Customer:	ONGC HAZIRA
ANSI CLASS:	150
MATERIAL:	CARBON STEEL
CORR.ALL.	1.0 mm
Special requirement	NON IBR

ANNEXURE-3	
to PEMC-06119	
Rev.00	31.07.15

TEMPERATURE (Deg.C) & PRESSURE (kg/cm2 g) RATINGS

TEMP	38	50	100															
PRESS.	7.00	7.00	7.00															

SERVICE: COOLING WATER LINES

ITEM	SIZE	DESCRIPTION
MAINT. JOINTS	ALL	FLANGED (TO BE KEPT MINIMUM)
PIPE JOINTS	ALL	SW COUPLING (REF NOTE-5)
		BUTT WELDED AS PER ANSI B16.25
DRAINS	ALL	1" OR AS PER BHEL STD. DRG. NO.4-38101-02488
VENTS	ALL	1" OR AS PER BHEL STD. DRG. NO.4-38101-02488
TEMP. CONN.	M33X2	INSTALLATION AS PER BHEL STD. DWG.NO 4-38101-02488
PRESS. CONN.	1/2"	INSTALLATION AS PER BHEL STD. DWG.NO 4-38101-02488

NOTES

1. WELDED PIPE SHALL HAVE ONLY LONGITUDINAL WELD MADE BY EMPLOYING AUTOMATIC WELDING.
2. MINIMUM THICKNESS OF FITTING SHALL BE IN LINE WITH THE PIPE SCHEDULE/THICKNESS.
3. NPT CONNECTIONS ARE PERMITTED IN THERMAL RELIEF VALVES ONLY.
4. MSW GASKET SHALL BE SELF ALIGNING TYPE WITH INNER RING OF SPIRAL STRIP MATERIAL.
5. BALL VALVES SHALL NOT BE USED BEYOND 200 DEG CEN & PR. 7.03 KG/CM2(G)
6. NDT REQUIREMENTS AS PER BHEL STD. DOC. NO. GT 57124
7. ALL FLANGED VALVES ABOVE 24" SIZE SHALL HAVE FLANGED END AS PER AWWA C207 CL D.
8. USE BUTTERFLY VALVES INSTEAD OF GATE VALVE FROM 10" ON WARDS IN WATER SERVICE UP TO 70 DEG CEN. BUTTER FLY VALVE SHALL BE OF PN 10 RATED WITH DESIGN PRESSURE OF 10 KG/CM2 (g).
9. FORGINGS ARE ACCEPTABLE IN LIEU OF PLATE MATERIAL FOR BLIND FLANGES AND SPACER & BLINDS.
10. NDT REQUIREMENTS AS PER BHEL STD DOC NO GT 57124

ITEMS	TYPE	ENDS	DIA. RANGE (INCH)		SCH/ THK/ RATING	FACE FINISH / RADIUS	DIM / DESG. STD.	BASIC MATERIAL CARBON STEEL		NOTE	Revision
			LOW	HIGH				DESCRIPTION	BHEL SPEC		
PIPES	WELDED PIPE	BE	½	2	HVY		IS1239	IS1239 PART 1	AA10152	1	
	WELDED PIPE	BE	3	6	HVY		IS1239	IS1239 PART 1	AA10152	1	
	WELDED PIPE	BE	8	18	10.0		IS3589	IS3589 Gr FE330	GT57880	1	
	WELDED PIPE	BE	20	38	10.0		IS3589	IS3589 Gr FE330	GT57880	1	
	WELDED PIPE	BE	24	38	10.0		IS3589	IS3589 Gr FE330	GT57880	1	
	WELDED PIPE	BE	40	42	12.0		IS3589	IS3589 Gr FE330	GT57880	1	
FLANGES	SLIP ON	RF	½	1½	300	125AARH	B16.5	ASTM A 105	AA7246106		
	SLIP ON	RF	2	24	150	125AARH	B16.5	ASTM A 105	AA7246101		
	SLIP ON (HUB TYPE)	FF	26	42	150	125AARH	AWWA-C207 CL.D	ASTM A 105			
	BLIND	RF	½	1½	300	125AARH	B16.5	ASTM A 105	HY7246772		
	BLIND	RF	2	24	150	125AARH	B16.5	ASTM A 105	HY7246166		
	BLIND	FF	26	52	150	125AARH	AWWA-C207 CL.D	ASTM A285 GRC			
	FIGURE8 BLANK	FF	½	1½	300	125AARH	B16.48	ASTM A 105	GT57083		
	FIGURE8 BLANK	FF	2	8	150	125AARH	B16.48	ASTM A 105	GT57083		
	SPACER & BLIND	FF	10	24	150	125AARH	B16.48	ASTM A 105	GT57083		
	SPACER & BLIND	FF	26	42	150	125AARH	MNF STD AS PER 31.3	ASTM A285 GRC			
FITTINGS	ELBOWS 90 DEG	SW	½	2	3000		B16.11	ASTM A 105			
	ELBOWS 90 DEG	BW	3	14	M	R=1.5D	B16.9	ASTM A 234 GR WPB	HY7242695	2	
	ELBOWS 90 DEG	BW	16	24	M	R=1.5D	B16.9	ASTM A 234 GR WPB-W	HY7242695	2	
	MITRE 90	BW	26	42	M	R=1.5D	BHEL STD.	IS3589 GR FE 410	GT57220-0	2	
	ELBOWS 45 DEG	SW	2	2	M	R=1.5D	B16.9	ASTM A 105		2	
	ELBOWS 45 DEG	BW	3	14	M	R=1.5D	B16.9	ASTM A 234 GR WPB		2	
	ELBOWS 45 DEG	BW	16	24	M	R=1.5D	B16.9	ASTM A 234 GR WPB-W		2	
	MITRE 45	BW	26	42	M	R=1.5D	BHEL STD.	IS3589 GR FE 410		2	

PE&SD-Mech.	PIPING MATERIAL SPECIFICATION	11D

Customer:	ONGC HAZIRA	ANNEXURE-3	
ANSI CLASS:	150	to PEMC-06119	
MATERIAL:	CARBON STEEL	Rev.00	31.07.15
CORR.ALL.	1.0 mm		
Special requirement	NON IBR		

FITTINGS	EQ. TEE	SW	½	2	3000		B 16.11	ASTM A 105	AA7242510	
	EQ. TEE	BW	3	14	M		B 16.9	ASTM A 234 GR WPB	AA7242511	2
	EQ. TEE	BW	16	24	M		B 16.9	ASTM A 234 GR WPB-W	AA7242511	2
	EQ. TEE	BW	26	42	M		B 16.9	ASTM A 234 GR WPB-W		2
	CON. RDCR	BW	2	14	M,M		B 16.9	ASTM A 234 GR WPB		2
	CON. RDCR	BW	16	24	M,M		B 16.9	ASTM A 234 GR WPB-W		2
	CON. RDCR	BW	26	42	M,M		BHEL STD.	IS 3589 GR FE 410		2
	ECC. RDCR	BW	2	14	M,M		B 16.9	ASTM A 234 GR WPB		2
	ECC. RDCR	BW	16	24	M,M		B 16.9	ASTM A 234 GR WPB-W		2
	ECC. RDCR	BW	26	42	M,M		BHEL STD.	IS 3589 GR FE 410		2
	CAP	NPT(F)	½	1½	3000		B 16.11	ASTM A 105	HY7242579	
	CAP	SW	2	2	M		B 16.9	ASTM A 105	HY7242570	
	CAP	BW	3	42	M		B 16.9	ASTM A 234 GR WPB	HY7242570	
	FULL COUPLING	NPT/NPT	½	1½	3000		B 16.11	ASTM A 105	HY7242595	3
	FULL COUPLING	SW	½	1½	3000		B 16.11	ASTM A 105	AA7242520	3
	VI (HALF CPLG)	SW	½	1½	3000		B 16.11	ASTM A 105		
	NIPPLE	BW / NPT	½	¾	S160		B 16.11	ASTM A106 GRB		3
	NIPPLE	BW / NPT	1	1½	S80		B 16.11	ASTM A106 GRB		3
	NIPPLE	NPT/NPT	½	¾	S160		B 16.11	ASTM A106 GRB		3
	NIPPLE	NPT/NPT	1	1½	S80		B 16.11	ASTM A106 GRB		3
VALVES	GATE	SW	½	1½	800		API 602	A 105	AA7521468	
	GATE	SW	2	2	800	B16.5	API 600	A 216 GR. WCB	AA7521408	
	GATE	FL	3	8	150	B16.5	API 600	A 216 GR. WCB	AA7521408	
	GLOBE	SW	½	1½	800		BS 5352	A 105	AA7501468	
	GLOBE	SW	2	2	800	B16.5	BS 1873	A 216 GR. WCB	AA7501408	
	GLOBE	FL	3	16	150	B16.5	BS 1873	A 216 GR. WCB	AA7501408	
	CHECK (PISTON LIFT)	SW	½	2	800		BS 5352	A 105	AA7531468	
	DUEL PLATE CHECK	FF	3	24	150			A 216 GR. WCB		
	DUEL PLATE CHECK	FF	26	42	150			A 216 GR. WCB		
	BUTTER FLY	WAFER WITH LUGS	10	24	150	B16.5	BS 5155	A 216 GR. WCB	GT57213-07	
	BUTTER FLY	FL	26	42	150	AWWA-C207	BS 5155	A 126 CLB;	GT57213-07	
BOLT & GASKET	STUD + 2NUTS		M12	M27			B 18.2	A 193 GR B7/ A194 2H	HY7142198	
	STUD + 2NUTS		M30	M70			B 18.2	A 193 GR B7/ A194 2H	HY7142299	
	GASKET		½	1½	300		B 16.20	NAB MSW (SS316)+ PTFE FILL	AA7240358	4
	GASKET		2	24	150		B 16.20	NAB MSW (SS316)+ PTFE FILL	AA7240345	4
	GASKET		10	24	150		B 16.21	CNAF NBR B16.5 FF		
	GASKET		26	42	150		B 16.21	CNAF NBR AWWA-C207D FF		
MISC.	Y-TYPE STRAINER	SW	½	1½	800		B 16.11	B: A 105; INT: SS 304		
	Y-TYPE STRAINER	BW	2	42	150		MNF. STD	B: A 234 WPB, INT. SS304		
	RE JOINT	FL	2	48	150		MNF. STD	IS 2062, NEOPRENE RUBBER		
	AIR RELEASE VALVE	FL	1½	8	150		IS14845	IS 216 WCB		

PE&SD Mech.	PIPING MATERIAL SPECIFICATION	11D

Customer:	**ONGC HAZIRA**
ANSI CLASS:	150
MATERIAL:	CARBON STEEL
CORR ALL:	1.0 mm
Special Requirement:	Non IBR

ANNEXURE-3	
to PEMC-06119	
Rev.00	31.07.15

BRANCH CONNECTION CHART

LEGEND

E	TEES BUTT WELD
H	HALF COUPLING
P	PIPE TO PIPE
R	REINFORCED
S	SOCKOLETS
T	TEES SW
W	WELDOLETS

BRANCH PIPE SIZE (IN INCHES)	¼	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64
64																																									
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48																																	E	R	R						
46																																E	R	R	R						
44																															E	R	R	R	R						
42																														E	R	R	R	R	R						
40																													E	R	R	R	R	R	R						
38																												E	R	R	R	R	R	R	R						
36																											E	R	R	R	R	R	R	R	R						
34																										E	R	R	R	R	R	R	R	R	R						
32																									E	R	R	R	R	R	R	R	R	R	R						
30																								E	R	R	R	R	R	R	R	R	R	R	R						
28																							E	R	R	R	R	R	R	R	R	R	R	R	R						
26																						E	R	R	R	R	R	R	R	R	R	R	R	R	R						
24																					E	R	R	R	R	R	R	R	R	R	R	R	R	R	R						
22																																									
20																				E	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R						
18																			E	R		R	R	R	R	R	R	R	R	R	R	R	R	R	R						
16																		E	R	R		R	R	R	R	R	R	R	R	R	R	R	R	R	R						
14																	E	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	R	R						
12																E	R	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	R	R						
10															E	R	R	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	R	R						
8														E	R	R	R	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	R	R						
6													E	R	R	R	R	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	R	R						
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3½																																									
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2½																																									
2							T		H		H		H	H	H	H	H	H	H	H		H	H	H	H	H	H	H	H	H	H	H	H	H	H						
1½						T	T		H		H		H	H	H	H	H	H	H	H		H	H	H	H	H	H	H	H	H	H	H	H	H	H						
1¼																																									
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½		T	T	T		T	T		H		H		H	H	H	H	H	H	H	H		H	H	H	H	H	H	H	H	H	H	H	H	H	H						
¼																																									

RUN PIPE SIZE (INCHES)

PE&SD

PIPING MATERIAL SPECIFICATION

11A

Customer:	ONGC HAZIRA
ANSI CLASS:	150
MATERIAL:	CARBON STEEL
CORR.ALL.	1.0 mm
Special requirement	NON IBR

ANNEXURE-1	
to PEMC-06119	
Rev.00	31.07.15

TEMPERATURE (Deg.C) & PRESSURE (kg/cm^2 g) RATINGS

TEMP	-29	38	50	100	150	200	250	300	325	350	375	400			
PRESS.	19.99	19.99	19.58	18.05	16.11	14.07	12.34	10.40	9.48	8.57	7.55	6.63			

SERVICE

NATURAL GAS, LUBE OIL, BLOW DOWN, VENTS, OWS, LUB OIL, CHEMICAL DRAINS, FLARE LINES, CONDENSATE, MAKE-UP WATER, WATER WASH, UTILITY LINES, NITROGEN, SERVICE AIR.

ITEM	SIZE	DESCRIPTION
MAINT. JOINTS	ALL	FLANGED (TO BE KEPT MINIMUM)
PIPE JOINTS	2" AND BELOW	SW COUPLING (REF NOTE-5)
	ABOVE 2"	BUTT WELDED AS PER ANSI B16.25
DRAINS	ALL	1" & AS PER BHEL STD. DRG. NO.4-38101-02488
VENTS	ALL	1" & AS PER BHEL STD. DRG. NO.4-38101-02488
TEMP. CONN.	M33X2	INSTALLATION AS PER BHEL STD. DWG.NO 4-38101-02488
PRESS. CONN.	1/2"	INSTALLATION AS PER BHEL STD. DWG.NO 4-38101-02488

NOTES

1. WELDED PIPE SHALL HAVE ONLY LONGITUDINAL WELD MADE BY EMPLOYING AUTOMATIC WELDING.
2. MINIMUM THICKNESS OF FITTING SHALL BE IN LINE WITH THE PIPE SCHEDULE/ THICKNESS.
3. NPT CONNECTIONS ARE PERMITTED IN THERMAL RELIEF VALVES ONLY.
4. MSW GASKET SHALL BE SELF ALIGNING TYPE WITH INNER RING OF SPIRAL STRIP MATERIAL.
5. BALL VALVES SHALL NOT BE USED BEYOND 200 DEG CEN & PR 7.03 KG/CM2(G)
6. NDT REQUIREMENTS AS PER BHEL STD. DOC. NO. GT 57124

BRANCH CONNECTION CHART

LEGEND

E	TEES BUTT WELD
H	HALF COUPLING
P	PIPE TO PIPE
R	REINFORCED
S	SOCKOLETS
T	TEES SW/ SCRD
W	WELDOLETS

BRANCH PIPE (INCH)	¼	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	22	24	26	30	32	34	36	40	42	44	48
48																						E								
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20																				E		R								
18																			E	R		R								
16																		E	R	R		R								
14																	E	R	R	R		R								
12																E	R	R	R	R		R								
10															E	R	R	R	R	R		R								
8														E	R	R	R	R	R	R		R								
6													E	R	R	R	R	R	R	R		R								
5																														
4											E		R	R	R	R	R	R	R	R		R								
3½																														
3									E		R		R	R	R	R	R	R	R	R		R								
2½																														
2							T		H		H		H	H	H	H	H	H	H	H		H								
1½						T	T		H		H		H	H	H	H	H	H	H	H		H								
1¼																														
1				T		T	T		H		H		H	H	H	H	H	H	H	H		H								
¾			T	T		T	T		H		H		H	H	H	H	H	H	H	H		H								
½		T	T	T		T	T		H		H		H	H	H	H	H	H	H	H		H								
¼																														

RUN PIPE (INCH)

BHEL Maharatna Company — Golden Jubilee 50 Years

PE&SD

PIPING MATERIAL SPECIFICATION

11A

Customer:	ONGC HAZIRA
ANSI CLASS:	150
MATERIAL:	CARBON STEEL
CORR.ALL.	1.0 mm
Special requirement	NON IBR

ANNEXURE-1
to PEMC-06119
Rev.00 — 31.07.15

ITEMS	TYPE	ENDS	DIA. RANGE (INCH) LOW	DIA. RANGE (INCH) HIGH	SCH/ THK/ RATING	FACE FINISH / RADIUS	DIM / DESG. STD.	BASIC MATERIAL CARBON STEEL DESCRIPTION	BASIC MATERIAL CARBON STEEL BHEL SPEC	NOTE	Revision
PIPES	SEAMLESS	BE	½	2	S80		B 36.10	A106 GRB	AA10455		
	SEAMLESS	BE	3	14	STD.		B 36.10	A106 GRB	AA10455		
	EFSW	BE	16	24	STD.		B 36.10	ASTM A 672 GR. B 60	AA10457	1	
FLANGES	WELD NECK	RF	½	1½	300	125AARH	B 16.5	ASTM A 105	AA7246306		
	WELD NECK	RF	2	24	150	125AARH	B 16.5	ASTM A 105	HY7246361		
	BLIND	RF	½	1½	300	125AARH	B 16.5	ASTM A 105	HY7246772		
	BLIND	RF	2	24	150	125AARH	B 16.5	ASTM A 105	HY7246166		
	FIGURE8 BLANK	RF	½	1½	300	125AARH	B 16.48	ASTM A 105	GT57083-06		
	FIGURE8 BLANK	RF	2	8	150	125AARH	B 16.48	ASTM A 105	GT57083-06		
	SPACER & BLIND	RF	10	24	150	125AARH	B 16.48	ASTM A 105	GT57083-06		
FITTINGS	ELBOWS 90 DEG	SW	½	¾	3000		B 16.11	ASTM A 105	AA7242501		
	ELBOWS 90 DEG	SW	1	2	3000		B 16.11	ASTM A 105	AA7242501		
	ELBOWS 90 DEG	BW	3	14	M	R=1.5D	B 16.9	ASTM A 234 GR WPB	HY7242695	2	
	ELBOWS 90 DEG	BW	16	24	M	R=1.5D	B 16.9	ASTM A 234 GR WPB-W	HY7242695	2	
	ELBOWS 45 DEG	SW	2	2	M	R=1.5D	B 16.9	ASTM A 105	HY7242566	2	
	ELBOWS 45 DEG	BW	3	14	M	R=1.5D	B 16.9	ASTM A 234 GR WPB	HY7242566	2	
	ELBOWS 45 DEG	BW	16	24	M	R=1.5D	B 16.9	ASTM A 234 GR WPB-W	HY7242566	2	
	EQ. TEE	SW	½	¾	3000		B 16.11	ASTM A 105	AA7242510		
	EQ. TEE	SW	1	2	3000		B 16.11	ASTM A 105	AA7242510		
	EQ. TEE	BW	3	14	M		B 16.9	ASTM A 234 GR WPB	AA7242511	2	
	EQ. TEE	BW	16	24	M		B 16.9	ASTM A 234 GR WPB-W	AA7242511	2	
	CON. RDCR	BW	2	14	M,M		B 16.9	ASTM A 234 GR WPB	HY7242692	2	
	CON. RDCR	BW	16	24	M,M		B 16.9	ASTM A 234 GR WPB-W	HY7242692	2	
	CAP	SW	2	2	M		B 16.9	ASTM A 105	HY7242570		
	CAP	BW	3	24	M		B 16.9	ASTM A 234 GR WPB	HY7242570		
	FULL COUPLING	NPT/ NPT	½	¾	3000		B 16.11	ASTM A 105	HY7242595	3	
	FULL COUPLING	NPT/ NPT	1	1½	3000		B 16.11	ASTM A 105	HY7242595	3	
	FULL COUPLING	SW	½	¾	3000		B 16.11	ASTM A 105	AA7242520		
	FULL COUPLING	SW	1	1½	3000		B 16.11	ASTM A 105	AA7242520		
	VI (HALF CPLG)	SW	½	¾	3000		B 16.11	ASTM A 105	TC56213		
	VI (HALF CPLG)	SW	1	1½	3000		B 16.11	ASTM A 105	TC56213		
	NIPPLE	BW / NPT	½	¾	S80		B 16.11	A106 GRB	HY7242578	3	
	NIPPLE	BW / NPT	1	1½	S80		B 16.11	A106 GRB	HY7242578	3	
	NIPPLE	NPT/ NPT	½	¾	S80		B 16.11	A106 GRB	HY7242580	3	
	NIPPLE	NPT/ NPT	1	1½	S80		B 16.11	A106 GRB	HY7242580	3	
VALVES	GATE	SW	½	1½	800		API 602	ASTM A 105	AA7521468		
	GATE	SW	2	2	800		API 600	ASTM A 105	AA7521468		
	GATE	FL	3	24	150		API 600	ASTM A 216 GR. WCB	AA7521408		
	GLOBE	SW	½	1½	800		BS5352	ASTM A 105	AA7501468		
	GLOBE	SW	2	2	800		BS1873	ASTM A 105	AA7501468		
	GLOBE	FL	3	16	150		BS1873	ASTM A 216 GR. WCB	AA7501408		
	Reg GLOBE VLV	SW	½	1½	800		BS5352	ASTM A 105	HY7511943		
	Reg GLOBE VLV	SW	2	2	800		BS1873	ASTM A 105	HY7511943		
	Reg GLOBE VLV	FL	3	12	150		BS1873	ASTM A 216 GR. WCB	AA7511408		
	CHECK (PISTON LIFT)	SW	½	1½	800		BS5352	ASTM A 105	AA7531468		
	CHECK (PISTON LIFT)	SW	2	2	800		BS1868	ASTM A 105	AA7531468		
	CHECK	FL	3	24	150		BS1868	ASTM A 216 GR. WCB	AA7541408		
	BALL	FL	½	2	300		BS5351	ASTM A 105	GT57066-06		
	BALL	FL	3	16	150		BS5351	ASTM A 216 GR. WCB	GT57066-06		
BOLT & GASKET	STUD + 2NUTS		M12	M27			B 18.2	A 193 GR B7/ A194 2H	HY7142198		
	STUD + 2NUTS		M30	M70			B 18.2	A 193 GR B7/ A194 2H	HY7142299		
	GASKET		½	1½	300		B 16.20	NAB MSW (SS316) + PTFE FILL	HY7240363	4	
	GASKET		2	24	150		B 16.20	NAB MSW (SS316) + PTFE FILL	HY7240362	4	
MISC	STEAM TRAP	RF	1	1	300	THERMODYNAMIC	MNF. STD.	B: A 105; INT: SS304	GT57278-00		
	Y-TYPE STRAINER	SW	½	1½	800		B 16.11	B: A 105; INT: SS304	HY7577468		
	Y-TYPE STRAINER	FL	2	24	150		B 16.5	B: A 216 WCB; INT: SS304	HY7577408		

B : BODY; INT : INTERNALS

PE&SD-Mech.

PIPING MATERIAL SPECIFICATION

12A

Customer:	ONGC HAZIRA
ANSI CLASS:	150
MATERIAL:	STAINLESS STEEL
CORR.ALL.	0.0 mm
Special requirement	NON IBR

ANNEXURE-6	
to PEMC-06119	
Rev.00	31.07.15

TEMPERATURE (Deg.C) & PRESSURE (kg/cm2 g) RATINGS

TEMP	-29	38	50	100	150	200	250	300	325	350	375	400	425		
PRESS.	19.37	19.37	18.97	17.34	16.01	14.07	12.34	10.40	9.48	8.57	7.55	6.63	5.61		

SERVICE: DM WATER

ITEM	SIZE	DESCRIPTION
MAINT. JOINTS	ALL	FLANGED (TO BE KEPT MINIMUM)
PIPE JOINTS	2" AND BELOW	SW COUPLING (REF NOTE-5)
	ABOVE 2"	BUTT WELDED AS PER ANSI B16.25
DRAINS	ALL	1" & AS PER BHEL STD. DRG. NO.4-38101-02488
VENTS	ALL	1" & AS PER BHEL STD. DRG. NO.4-38101-02488
TEMP. CONN.	M33X2	INSTALLATION AS PER BHEL STD. DWG.NO 4-38101-02488
PRESS. CONN.	1/2"	INSTALLATION AS PER BHEL STD. DWG.NO 4-38101-02488

NOTES

1. WELDED PIPE SHALL HAVE ONLY LONGITUDINAL WELD MADE BY EMPLOYING AUTOMATIC WELDING.
2. MINIMUM THICKNESS OF FITTING SHALL BE IN LINE WITH THE PIPE SCHEDULE/ THICKNESS.
3. NPT CONNECTIONS ARE PERMITTED IN THERMAL RELIEF VALVES ONLY.
4. MSW GASKET SHALL BE SELF ALIGNING TYPE WITH INNER RING OF SPIRAL STRIP MATERIAL.
5. BALL VALVES SHALL NOT BE USED BEYOND 200 DEG CEN & PR. 7.03 KG/CM2(G)
6. NDT REQUIREMENTS AS PER BHEL STD. DOC. NO. GT 57124
7. ALL ITEMS SHALL BE SUPPLIED IN SOLUTION ANNEALED CONDITION.
8. THESE SIZES ARE NOT A PREFFERED SCHEDULE IN BHEL. AVOID SELECTION OF THIS SIZE IF POSSIBLE.

BRANCH CONNECTION CHART

LEGEND

E	TEES BUTT WELD
H	HALF COUPLING
P	PIPE TO PIPE
R	REINFORCED
S	SOCKOLETS
T	TEES SW/ SCRD
W	WELDOLETS

BRANCH PIPE (INCH)	RUN PIPE NB																												
	¼	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	22	24	26	30	32	34	36	40	42	44	48
48																															
44																															
42																															
40																															
36																															
34																															
32																															
30																															
26																															
24																						E									
22																															
20																				E		R									
18																			E	R		R									
16																		E	R	R		R									
14																	E	R	R	R		R									
12																E	R	R	R	R		R									
10															E	R	R	R	R	R		R									
8														E	R	R	R	R	R	R		R									
6													E	R	R	R	R	R	R	R		R									
5																															
4												E		R	R	R	R	R	R	R		R									
3½																															
3									E		R		R	R	R	R	R	R	R	R		R									
2½																															
2							T		H		H		H	H	H	H	H	H	H	H		H									
1½						T	T		H		H		H	H	H	H	H	H	H	H		H									
1¼																															
1				T		T	T		H		H		H	H	H	H	H	H	H	H		H									
¾			T	T		T	T		H		H		H	H	H	H	H	H	H	H		H									
½		T	T	T		T	T		H		H		H	H	H	H	H	H	H	H		H									
¼																															

PE&SD-Mech.

PIPING MATERIAL SPECIFICATION

12A

Customer:	ONGC HAZIRA
ANSI CLASS:	150
MATERIAL:	STAINLESS STEEL
CORR.ALL.	0.0 mm
Special requirement	NON IBR

ANNEXURE-6
to PEMC-06119
Rev.00 | 31.07.15

ITEMS	TYPE	ENDS	DIA. RANGE (INCH) LOW	DIA. RANGE (INCH) HIGH	SCH/ THK/ RATING	FACE FINISH / RADIUS	DIM / DESG. STD.	BASIC MATERIAL STAINLESS STEEL DESCRIPTION	BASIC MATERIAL STAINLESS STEEL BHEL SPEC	NOTE	Revision
PIPES	SEAMLESS	BE	½	¾	S40S		B36.19	A312 TP321	AA10755		
	SEAMLESS	BE	1	1½	S40S		B36.19	A312 TP321	AA10755		
	SEAMLESS	BE	2	6	S40S		B36.19	A312 TP321	AA10755		
	SEAMLESS	BE	8	8	S40S		B36.19	A312 TP321	AA10755		
	SEAMLESS	BE	10	12	S40S		B36.19	A312 TP321	AA10755	8	
FLANGES	WELD NECK	RF	½	1½	300	125AARH	B16.5	A182 F321	HY7246375		
	WELD NECK	RF	2	12	150	125AARH	B16.5	A182 F321	HY7246374		
	BLIND	RF	½	1½	300	125AARH	B16.5	A182 F321	HY7246774		
	BLIND	RF	2	12	150	125AARH	B16.5	A182 F321	HY7246775		
	FIGUREB BLANK	FF	½	1½	300	125AARH	B16.48	A182 F321	GT57083-06		
	FIGUREB BLANK	FF	2	8	150	125AARH	B16.48	A182 F321	GT57083-06		
	SPACER & BLIND	FF	10	12	150	125AARH	B16.48	A182 F321	GT57083-06		
FITTINGS	ELBOWS 90 DEG	SW	½	2	3000		B16.11	ASTM A182 F321	AA7242501		
	ELBOWS 90 DEG	BW	3	8	M	R=1.5D	B16.9	ASTM A 403 GR WP321-S		2	
	ELBOWS 90 DEG	BW	10	12	M	R=1.5D	B16.9	ASTM A 403 GR WP321-WX		2	
	ELBOWS 45 DEG	SW	2	2	M	R=1.5D	B16.9	ASTM A 403 GR WP321-S	HY7242558	2	
	ELBOWS 45 DEG	BW	3	8	M	R=1.5D	B16.9	ASTM A 403 GR WP321-S	HY7242558	2	
	ELBOWS 45 DEG	BW	10	12	M	R=1.5D	B16.9	ASTM A 403 GR WP321-WX	HY7242558	2	
	EQ. TEE	SW	½	1½	3000		B16.11	ASTM A182 F321	AA7242510		
	EQ. TEE	SW	2	2	M		B16.9	ASTM A 403 GR WP321-S	HY7242693	2	
	EQ. TEE	BW	3	8	M		B16.9	ASTM A 403 GR WP321-S	HY7242693	2	
	EQ. TEE	BW	10	12	M		B16.9	ASTM A 403 GR WP321-WX	HY7242693	2	
	CON. RDCR	BW	2	8	M		B16.9	ASTM A 403 GR WP321-S	HY7242694	2	
	CON. RDCR	BW	10	12	M		B16.9	ASTM A 403 GR WP321-WX	HY7242694	2	
	FULL COUPLING	NPT/ NPT	½	1½	3000		B16.11	ASTM A182 F321	HY7242595	3	
	FULL COUPLING	SW	½	1½	3000		B16.11	ASTM A182 F321	AA7242520		
	VI (HALF OPLG)	SW	½	1½	3000		B16.11	ASTM A182 F321			
	NIPPLE	BW / NPT	½	1½	S40S		B16.11	ASTM A182 F321		3	
	NIPPLE	NPT/ NPT	½	1½	S40S		B16.11	ASTM A182 F321		3	
VALVES	GATE	SW	½	1½	800		API 602	A 182 GR. F304			
	GATE	SW	2	2	800		API 600	A 182 GR. F304			
	GATE	FL	3	12	150		API 600	A 351 GR CF8	AA7521418		
	GLOBE	SW	½	1½	800		BS5352	A 182 GR. F304	AA7501478		
	GLOBE	SW	2	2	800		BS1873	A 182 GR. F304	AA7501478		
	GLOBE	FL	3	12	150		BS1873	A 351 GR. CF8	AA7501418		
	Reg. Globe valve	SW	½	1½	800		BS5352	A 182 GR. F304			
	Reg. Globe valve	SW	2	2	800		BS1873	A 182 GR. F304			
	Reg. Globe valve	FL	3	12	150		BS1873	A 351 GR. CF8	HY7511516		
	CHECK (PISTON LIFT)	SW	½	1½	800		BS5352	A 182 GR. F304			
	CHECK (PISTON LIFT)	SW	2	2	800		BS1868	A 182 GR. F304			
	CHECK	FL	3	12	150		BS1868	A 351 GR. CF8			
	BALL	FL	½	1½	150		BS5351	A 182 GR. F304	GT57066-06	5	
	BALL	FL	2	12	150		BS5351	A 351 GR. CF8	GT57066-06	5	
	B:BODY, T:TRIM, BB:BOLTED BONNET, S:STELLITED										
BOLT & GASKE	STUD + 2NUTS		M12	M27			B18.2	A 193 GR B7/ A194 2H	HY7142198		
	STUD + 2NUTS		M30	M70			B18.2	A 193 GR B7/ A194 2H	HY7142299		
	GASKET		½	1½	300		B16.20	NAB MSW (SS316)+ PTFE FILL	HY7240363	4	
	GASKET		2	14	150		B16.20	NAB MSW (SS316)+ PTFE FILL	HY7240362	4	
MISC	Y-STRAINERS	FL	½	1½	800		MFG STD	B:A 182 GR. F321 ;INT-SS304	GT57309-00		
	Y-STRAINERS	FL	2	12	150		MFG STD	B:A 403 GR. WP321 ;INT-SS304	GT57310-00		