



**BHARAT HEAVY ELECTRICALS LIMITED**  
**PIPING CENTRE, CHENNAI - 17**  
**QUALITY ASSURANCE & CONTROL DEPT.**


**PROJECT NAME :- ONGC HAZIRA - ( 1 X 51 MW ) CCPP**  
**BHEL CUSTOMER Nos : 7254**

**QPNo: 7254:QPC:11**  
**REV.NO: 01**  
**Date : 11.01.2016**

**PAINTING SCHEME FOR PIPING**

Sl. NO	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat			Finish coat		Total DFT Microns (Min.)	REMARKS		
			Primer	No of coats & DFT	Paint	No of coats & DFT	Shade	Paint	No of coats & DFT			Shade	
1	2	3	4	5	6	7	8	9	10	11	12	13	
1	Insulated Piping, components ( MS, HRH, CRH, extraction steam , BFD , Aux Steam lines, ... ) Temp. : Above 60 deg. C	SSPC-SP3/ Power Tool Cleaning	Red oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744	2 ( 30 microns per coat. )	---	---	---	---	---	---	60		
2	Uninsulated Piping, components (Condensate lines ...)	Blast cleaning to Sa2½ with surface profile 35-50 microns	Epoxy Polyamide resin based Zinc Phosphate Primer	2 ( 35 microns per coat )	Epoxy resin with MIO	1 ( 100 microns per coat. )	---	Epoxy Polyamide enamel finish Paint	1 \$ ( 50 microns per coat )	Smoke Grey Shade No 692 of IS 5 (Refer Note- 1)	220	170 @ Shop 50 @ Site	
3	Structures	Blast cleaning to Sa2½ with surface profile 35-50 microns	Epoxy Polyamide resin based Zinc Phosphate Primer	2 ( 35 microns per coat )	Epoxy resin with MIO	1 ( 100 microns per coat. )	---	Epoxy Polyamide enamel finish Paint	1 \$ ( 50 microns per coat )	Smoke Grey Shade No 692 of IS 5 (Refer Note- 1)	220	170 @ Shop 50 @ Site	
4	Hangers & Supports-(CLH,VLH)	Blast cleaning to Sa2½ with surface profile 35-50 microns	Epoxy Zinc rich primer to IS 14589 Gr. II, % VS = 35 Min	1 ( 40 microns per coat )	---	---	---	Aliphatic Acrylic Polyurethane paint, %VS = 40 min	1 ( 30 microns per coat )	Phirozi Blue Shade No.176 of IS 5	70		
5	Pipe Clamps.	SSPC-SP3/ Power Tool Cleaning	Red oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744	1 ( 30 microns per coat. )	---	---	---	Synthetic enamel paint long oil alkyd to IS 2932	2 ( 20 Microns per Coat )	Note - 2	70		
6	Stainless steel / Galvanized items				No paint								

**\$ :- To be applied at site.**  
**Note 1 :- The final colour shade applied at site after erection shall be as per Customer colour coding scheme.**  
**Note 2 :- Smoke grey shade for Carbon Steel ; White shade for Alloy Steel Clamps.**

PREPARED BY:   
 APPROVED BY: 

VIVEKANANDA YELLU, Sr. Engr / QA  
 PARAMESWARARAN, H, DGM / QA

# FICHTNER INDIA

FICHTNER Consulting Engineers (I) Pvt. Ltd.,  
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CIN : U74210TN1987PTC014366

## VENDOR DRAWING / DOCUMENT TRANSMITTAL LETTER

Oil and Natural Gas Corporation Ltd.,  
Cogeneration & Steam System,  
ONGC Nagar (PO), Hazira Plant,  
Gujarat  
Surat – 394 518

**Kind attn:**  
Mr.Sudheer Mishra  
Chief Engineer - Mechanical

**PROJECT: 1 X 51 MW Captive Combined Cycle Power Project at Hazira Plant**  
**CLIENT: Oil & Natural Gas Corporation Limited, Hazira**

**Our Ref No. :** 5111168-3000-ME-VDT-405

**Date:** 13.01.2016

**Your Ref No.:** Mail

**Date:** 11.01.2016

### SUB: COMMENTS ON DRAWINGS/DOCUMENTS

Please find enclosed the following vendor drawing(s) / document(s) reviewed with the action code as indicated for your necessary action.

The documents / drawings have been reviewed as noted with regard to general conformity with the Contract specifications and requirements. The Vendor / Contractor is responsible for correctness of design, calculation and details. Approval of this document does not relieve the Vendor / Contractor of his responsibility in carrying out the work correctly and fulfilling the complete requirements of the contract nor does it limit the Purchaser's rights under the Contract.

Sl. No.	Drawing / Document No.	Rev. No.	Description	Action
1	7254 QPC 11	1	Painting Scheme for Piping	A
2	-	-	Compliance Sheet	-

**NOTE :** Action Code

<b>A</b>	Drawing Approved as submitted.	<b>B</b>	Drawing Approved with comments. Proceed with fabrication considering comments
<b>C</b>	Drawing Not Approved correct the original drawing duly incorporating our comments and resubmit for Approval.	<b>D</b>	Correct the original drawing duly incorporating our comments and submit for records.
<b>E</b>	Our comments are marked up on the drawing.	<b>F</b>	See attached memo.
<b>H</b>	Information furnished on the drawing is noted.	<b>I</b>	Drawing reviewed against our previous comments and other revisions highlighted and identified by Vendor.
<b>J</b>	Drawing returned without review	<b>K</b>	Print not enclosed

Thanking you and assuring you of our best attention.

Very truly yours  
for **FICHTNER** Consulting Engineers  
(India) Private Limited



**Sathya Subramanya N**  
Project Manager



**R KIRAN KUMAR**  
Lead Engineer(Mech.)

CC: i) Mr. Rajpurohit R C, DGM(E)-PM

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CIN : U74210TN1987PTC014366

## VENDOR DRAWING / DOCUMENT TRANSMITTAL LETTER

Oil and Natural Gas Corporation Ltd.,  
Cogeneration & Steam System,  
ONGC Nagar (PO), Hazira Plant,  
Gujarat  
Surat – 394 518

**Kind attn:**  
Mr.Sudheer Mishra  
Chief Engineer - Mechanical

**PROJECT: 1 X 51 MW Captive Combined Cycle Power Project at Hazira Plant**  
**CLIENT: Oil & Natural Gas Corporation Limited, Hazira**

**Our Ref No. :** 5111168-3000-ME-VDT-191

**Date:** 12.08.2015

**Your Ref No.:** Mail

**Date:** 11.08.2015

### SUB: COMMENTS ON DRAWINGS/DOCUMENTS

Please find enclosed the following vendor drawing(s) / document(s) reviewed with the action code as indicated for your necessary action.

The documents / drawings have been reviewed as noted with regard to general conformity with the Contract specifications and requirements. The Vendor / Contractor is responsible for correctness of design, calculation and details. Approval of this document does not relieve the Vendor / Contractor of his responsibility in carrying out the work correctly and fulfilling the complete requirements of the contract nor does it limit the Purchaser's rights under the Contract.

Sl. No.	Drawing / Document No.	Rev. No.	Description	Action
1	ONGC-451	2	Manufacturing Quality Plan of Chimney	A

#### **NOTE :** Action Code

<b>A</b>	Drawing Approved as submitted.	<b>B</b>	Drawing Approved with comments. Proceed with fabrication considering comments
<b>C</b>	Drawing Not Approved correct the original drawing duly incorporating our comments and resubmit for Approval.	<b>D</b>	Correct the original drawing duly incorporating our comments and submit for records.
<b>E</b>	Our comments are marked up on the drawing.	<b>F</b>	See attached memo.
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# FICHTNER INDIA

Thanking you and assuring you of our best attention.

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for **FICHTNER** Consulting Engineers  
(India) Private Limited



**Sathya Subramanya N**  
Project Manager



**R KIRAN KUMAR**  
Lead Engineer(Mech.)

CC: i) Mr. Rajpurohit R C, DGM(E)-PM


PROJECT TITLE : 51 MW COMBINED CYCLE COGENERATION CAPTIVE POWER PLANT PROJECT  
 OWNER : OIL & NATURAL GAS CORPORATION (ONGC), HAZIRA, GUJARAT, INDIA  
 OWNER'S CONSULTANT : FICHTNER CONSULTING ENGINEERS INDIA PVT LTD (FCE)  
 EPC CONTRACTOR : BHARAT HEAVY ELECTRICALS LIMITED (BHEL)

REVIEW OF : Manufacturing Quality Plan - CHIMNEY - QP NO. ONGC 451 REV 02 DTD  
 11.08.15

Document No.	Description	Revision	Reviewer	MARK-UP?	ONGC/FCE Comments dated 28.07.2015	BHEL reply dated : 31-07-2015	ONGC/FCE Comments dated 05.08.2015	BHEL reply Dated : 11-08-2015	ONGC/FCE Comments dated 12.08.15 on Rev 02 doc
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	Raw materials: Inspection of materials on receipt shall be checked for Thickness. Kindly include	Incorporated in the revised MQP	--	--	Noted and point closed
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	Circumferential Joints: Check for Long seam orientation, surface offset, bow bend, length shall be included	Incorporated in the revised MQP	--	--	Noted and point closed
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	Erection flange / gusset plate welding - 100% MT /PT shall be carried out. Kindly indicate	Not in manufacturing scope	FI have advised to kindly discuss with other units of BHEL for the cloud points for scope clarity. Since these are site activities, shall be covered in FQP 's by any of the other units of BHEL. BHEL to confirm the same.	Discussed. It will be taken care of FQP's at site by Power sector regions.	Noted. BHEL shall ensure that the FQP's are submitted for review and approval before installation.
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	Lug plate/stiffening/support plate/sampling provision/earthing lug fitup and welding - Check for elevation, size, orientation, weld appearance and fillet size. Kindly indicate	Not in manufacturing scope			
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	Post weld Heat Treatment (PWHT) -If required-- on base ring / compression ring weld. Please include	Not applicable	--	--	Noted and point closed
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	Base ring/compression ring/ erection flange : Check for water level, plumb level, length, out of squareness measurement. Kindly include	Not in manufacturing scope	FI have advised to kindly discuss with other units of BHEL for the cloud points for scope clarity. Since these are site activities, shall be covered in FQP 's by any of the other units of BHEL. BHEL to confirm the same.	Discussed. It will be taken care of FQP's at site by Power sector regions.	Noted. BHEL shall ensure that the FQP's are submitted for review and approval before installation.
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	Any machined / gas cut edges shall be subjected to 100% PT to ensure check for laminations	Incorporated in the revised MQP			
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	Legends: C - Customer / Customer appointed TPI. Kindly revise	Incorporated in the revised MQP	--	--	Noted and point closed
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	verification of as built drawings shall be included	Not applicable. We comply the Engineering drawing requirement.	--	--	Noted and point closed
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	Consultant details shall be indicated in Title block	Incorporated in the revised MQP	--	--	Noted and point closed
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	Clause 3.0 & 3.1: Final inspection / painting & Preservation: Customer shall witness. Kindly update	100% witnessed by BHEL/BHEL AIA and verified by Customer / Customer appointed TPI. -PDI by Customer / Customer appointed TPI.	--	--	Noted and point closed
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	BHEL shall submit the Field quality plan for our review	Not in manufacturing scope- Power sector region	FI have advised to kindly discuss with other units of BHEL for the cloud points for scope clarity. Since these are site activities, shall be covered in FQP 's	Discussed. It will be taken care of FQP's at site by Power sector regions.	Noted. BHEL shall ensure that the FQP's are submitted for review and approval before installation.

REVIEW OF : Manufacturing Quality Plan - CHIMNEY - QP NO. ONGC 451 REV 02 DTD  
11.08.15

Document No.	Description	Revision	Reviewer	MARK-UP?	ONGC/FCE Comments dated 28.07.2015	BHEL reply dated : 31-07-2015	ONGC/FCE Comments dated 05.08.2015	BHEL reply Dated : 11-08-2015	ONGC/FCE Comments dated 12.08.15 on Rev 02 doc
ONGC451	Manufacturing Quality Plan - CHIMNEY	0	ME	NO	Details of final Painting schedule at site shall be furnished	Not in manufacturing scope- Power sector region	by any of the other units of BHEL. BHEL to confirm the same.		

 <b>Ranipet</b>	<b>Manufacturer's Name &amp; Address</b> BHEL, BAP Ranipet 632 406		<b>MANUFACTURING QUALITY PLAN</b> Item/Sub system: <b>CHIMNEY</b>		<b>Project</b> : ONGC Hazira Plant CCPP 51 MW ONGC Hazira Complex Surat Gujarat.	
	Rev.No: 02 Date: 11-08-2015 Page No: 1 of 4		QP No.: ONGC 451		Customer :M/s. ONGC Customer No : R4H9 Consultant : FICHTNER Consulting Engineers(I) Pvt Ltd. BANGALORE-560095 Contractor :BHEL- RANIPET -6	

Sl No	Components & Operation	Characteristics	Type Of Check	Quantum Of Check	Reference Documents	Acceptance Standard	Format Of Records	Agency			Remarks	
								M	B	C		
1	2	3	4	5	6	7	8	9			10	
1.0	Raw materials	Chem. & tensile Properties	Chem. & Tensile test and Thickness	Each heat	Respective Material Specification		TC	P	V	V		
1.1	Plates and structural											
2.0	In process Control	WELDERS ARE QUALIFIED TO AWS D1.1 & PROCEDURES ARE PREQUALIFIED.										
2.1	Welding	Weld size & Finish	Visual/ Measurement	100%	Drawing		DR	P	W	V		
2.2	Butt weld	Soundness of weld	RT/MPI	Note -1	BHE : NDT:RP:RT: 01/01		Report	P	V	V	RT Film review	
2.3	Fillet weld	Soundness of weld	MPI/LPI	10%	BHE : NDT:RP:MT :01/02		Report	P	W	V		
2.4	Shells	Over all Dimensions	Measurement	100%	BHE : NDT:RP:PT : 01/02		Report	P	W	V		
2.5	Trial assembly	Assembly dimension	Measurement	Ref(G3 & G5)	Drawing- (Ref(G3 & G5)		DR	P	W	V		
3.0	Final Inspection	Proper painting preservation and identification.	Visual/DFT Measurement	100%	Ref Note-3 & General Note for identification		--	P	W	V		
3.1	Painting & preservation & identification of shells											
3.2	Dispatch	PDI by Customer / Customer appointed TPI										

**Note-1:**

- (1) Chimney Base plate butt welds more than 50 mm 100% RT.
- (2) Chimney Shell Plate butt welds 100% MPI (both sides of joint)
- (3) All Back gouged area 100% LPI.
- (4) Fillet welds 100 % visual and 10% LPI

**Legends:**


M – Manufacturer / Subcontractor, B - BHEL / BHEL's Authorized Inspection Agency C-Customer / Customer appointed TPI, P - Perform, V - Verification, W - Witness, DR - Dimension Report, T C - Test Certificate, I R - Inspection Report,

**Prepared By**

*[Signature]*

**Reviewed & Approved By**

*[Signature]*

 Ranipet	<b>Manufacturer's Name &amp; Address</b> BHEL, BAP Ranipet 632 406		<b>MANUFACTURING QUALITY PLAN</b> Item/Sub system: <b>CHIMNEY</b>		Project : ONGC Hazira Plant CCPP 51 MW Customer : M/s. ONGC Customer No : R4H9 Consultant : FICHTNER Consulting Engineers(I) Pvt Ltd. BANGALORE-560095 Contractor : BHEL- RANIPET -6	
	<b>Components &amp; Operation</b> 2		<b>Characteristics</b> 3		<b>Quantum Of Check</b> 5	
<b>Type Of Check</b> 4		<b>Acceptance Standard</b> 7		<b>Format Of Records</b> 8		
<b>Reference Documents</b> 6		<b>Agency</b> M B C		<b>Remarks</b> 10		

### SHELL FABRICATION GUIDE LINES:

#### G.1 Shell Plate Preparation

1. Ensure the edge preparation of each shell plate before pre band operation. (EP shall be on ID side )
2. Ensure the Length, Width and diagonal of each shell plate as per drawing and in no case plate shall be out of straightness by more than 2mm to entire length.
3. Shell radius shall be checked with template and the chord length of the template shall be 1/3 to 1/5 of the diameter

#### G.2 WELDING :

1. All butt weld of thickness more than 6 mm shall be double V with back gouging / grinding and root LPI and final MPI.
2. Butt joints of base plates of thickness 50 mm and above shall be UT /RT tested.
3. All butt joints of shell welds shall be MPI tested. For plate thickness more than 10mm shall be tested with MPI on both sides.

#### G.3 Base plate assembly

1. Check the dimension of base plate and stool plate segments.
2. Match drill base plate and stool plate and enlarge the hole in base plate as per drawing and Check the holes pitch after drilling.
3. Check the coaxially of bottom and stool plate Holes after completion of full welding by suitable plug type gauge.
4. Check Vertical assembly dimension for base assly. with Bottom Chimney shell ( first shell ).

#### G.4 Dimensional check of Individual shell

- 1 Check the height, Top and Bottom shell diameter, Axis deviation , Top and bottom face out ovality, Diagonal.

#### Legends:


M – Manufacturer / Subcontractor, B - BHEL / BHEL's Authorized Inspection Agency C-Customer / Customer appointed TPI, P - Perform, V - Verification, W - Witness, DR - Dimension Report, T C - Test Certificate, IR - Inspection Report,

#### Prepared By

*(Signature)*

#### Reviewed & Approved By

*(Signature)*

 <b>Manufacturer's Name &amp; Address</b> BHEL, BAP Ranipet 632 406 Ranipet		<b>MANUFACTURING QUALITY PLAN</b> Item/Sub system: <b>CHIMNEY</b>		Project : ONGC Hazira Plant CCPP 51 MW Customer : ONGC Hazira Complex Surat Gujarat. Customer No : M/s. ONGC Consultant : R4H9 Contractor : FICHTNER Consulting Engineers(I) Pvt Ltd. BANGALORE-560095 :BHEL-RANIPET -6	
Components & Operation 2		Characteristics 3		QP No.: ONGC 451 Rev.No: 02 Date: 11-08-2015 Page No: 3 of 4	
Type Of Check 4		Quantum Of Check 5		Reference Documents 6	
Acceptance Standard 7		Format Of Records 8		Agency M B C 9	
SI No 1		Remarks 10			

### G.5 Trial assembly (Shells)

- Horizontal Trial assembly shall be carried out for Flanged Chimney shells (only when there is variation in thickness in adjacent joining shells ) after dimensional check of individual shells. For other flanged shells (where there is no variation in thickness in adjacent joining shells ) and un flanged shells, only individual dimensional check is applicable.
- Shells to be trial assembled shall be placed on the leveled Horizontal supports.
- Shell circumferential mismatch shall be checked on the ID of the shell with 1 meter straight edge at the shell joining area with in 2mm (where ever turn buckle , wedges are used to bring the mismatch with in 2 mm and the same area to be supported with temporary support and the same to be removed after correcting the permanent stiffener as shown in the drawing. )
- Root gap between the adjacent shells to be with in limits as specified in the drawing. Ovality of shell shall be maximum 4mm.

### General Note:

- For all circumferential joint, match marking shall start with C1,C2..... CXX and for all longitudinal joints(seam joint) , match marking shall start with L1,L2,..... LXX (match mark starts from chimney base plate splits).
- Assembly reference line in each chimney height reference line at every 5 meters shall be punched and bordered with paint.
- All site weld joints shall be applied with weld able primer to a distance of 25 mm from the weld joint.
- Circumferential Joints: Check for Long seam orientation, surface offset , bow bend and length.
- Any machined / gas cut edges shall be subjected to 100% PT to ensure check for lamination.

### Note 2:

All Other items of Chimney other than mentioned above like Handrails, Platform, and Ladder, Ducts, Stiffeners, etc will be inspected by BHEL/BHEL's AIA and Dispatched.

### General comments::

- For items witnessed by Purchaser as " Witness point" a copy of CHP clearance reports will be furnished.
- For stage under "V" category copies of relevant documents shall be maintained by the manufacture at his shop for verification.
- For items identified for inspection by purchaser as per column "C" the extent of checking shall be as per column " 6" or as per random Samples as decided by the purchaser.

### Legends:


M - Manufacturer / Subcontractor, B - BHEL / BHEL's Authorized Inspection Agency C-Customer / Customer appointed TPI, P - Perform, V - Verification, W - Witness, DR - Dimension Report, T C - Test Certificate, I R - Inspection Report,

### Prepared By

*[Signature]*

### Reviewed & Approved By

*[Signature]*

 <b>Ranipet</b>		<b>Manufacturer's Name &amp; Address</b> BHEL, BAP Ranipet 632 406		<b>MANUFACTURING QUALITY PLAN</b> Item/Sub system: <b>CHIMNEY</b>		Project : ONGC Hazira Plant CCPP 51 MW Customer : ONGC Hazira Complex Surat Gujarat. Customer No : M/s. ONGC Consultant : R4H9 Contractor : FIGHTNER Consulting Engineers(I) Pvt Ltd. BANGALORE-560095 :BHEL-RANIPET -6			
		QP No.: ONGC 451 Rev.No: 02 Date: 11-08-2015 Page No: 4 of 4		Quantum Of Check : 5 Reference Documents : 6 Acceptance Standard : 7 Format Of Records : 8 Agency : 9 M B C		Remarks : 10			
Sl No	Components & Operation	Characteristics	Type Of Check	Quantum Of Check	Reference Documents	Acceptance Standard	Format Of Records	Agency	Remarks
1	2	3	4	5	6	7	8	M B C	10

**Note 3: Painting scheme:**

SL.no	Description	Surface preparation	Primer DFT in µm	Intermediate DFT in µm	Finish DFT in µm	Total DFT in µm
1.0	Foundation materials 87010	Surface preparation Power tool cleaning (st 3)	Primer DFT in µm Temporary rust preventive (Dry type)	NIL	NIL	NIL
2.0	Insulated surface (out side ) chimney Shell including Chimney base 87100 chimney ,Ducts , strakes 87 150	Blast Cleaning to Sa 2 ½ (SSPC SP 10 with profile 35-50 µm)	One coat of Inorganic Ethyl Zinc Silicate as per IS 14946 Volume of solids 60% DFT 65 µm	NIL	Three coats of Heat resistance aluminum paint as per IS 13183 GR II to a coating thickness of 3X20 = 60 µm (min)	120 µm (min)
3.0	Flue gas path (Inside) Chimney sheel 87 100, Chimney Ducts 87 150	Blast Cleaning to Sa 2 ½ (SSPC SP 10 with profile 35-50 µm)	Two coats of red oxide Zinc phosphate primer as per IS 12744 to a DFT of 2X30 = 60 µm	NIL	NIL	60 µm (min)
4.0	Floor grills Hand rails , posts Ladder 87 300	Hot dip Galvanizing to 610gms /Sq m and coating thickness of 85 microns (min)				
5.0	Platforms 87 300 (other than in SI No 4) Painter Trolley 87 200 (other than SS)	Blast Cleaning to Sa 2 ½ (SSPC SP 10 with profile 35-50 µm)	One coat of Inorganic Ethyl Zinc Silicate as per IS 14946 Volume of solids 60%. DFT 65 µm. Followed by one coat of Epoxy based Zinc phosphate primer as per IS 13238, volume of solids 40 % . DFT 40 µm.	One coat of Epoxy MIO/T102 pigmented paint volume of solids 50 to 60%. DFT 100 µm	One coat of Aliphatic acrylic polyurethane finish paint as per IS 13213 to a DFT of 40 µm. Grey shade no. 692 of IS 5	245 µm(min)

**Record of Revision**

Rev 00 Dtd 02-04-2015 -- Original Issue
Rev 01 Dtd 31-07-2015 -- Updated as per ONGC/FCE comments in MQP
Rev 02 Dtd 11-08-2015 -- Updated as per ONGC/FCE Comments in (format) reply

**Legends:**

M - Manufacturer / Subcontractor, B - BHEL / BHEL's Authorized Inspection Agency C-Customer / Customer appointed TPI, P - Perform, V - Verification, W - Witness, DR - Dimension Report, T C - Test Certificate, I R - Inspection Report,

**Prepared By**

*W. S. J.*

**Reviewed & Approved By**

*R. V. A.*


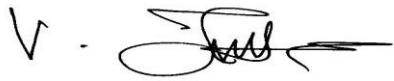


**PAINTING & COATING SCHEDULE FOR ONGC HAZIRA PROJECT**

Sl.No.	Equipment/ Surface	Units involved	Area/ Location	Arrangement (Indoor / Outdoor)	Temp.	Surface Preparation	Primer or 1 <sup>st</sup> Coat Name of paint /DFT	2 <sup>nd</sup> Coat Name of paint /DFT	3 <sup>rd</sup> Coat Name of paint /DFT	Total DFT	Colour	Remarks
<b>PIPING &amp; VALVES</b>												
A	<b>Valves -BHEL Trichy</b>											
A.1	Safety valves	HPBP-Trichy			400/600 Deg. F	SA2½	One coats of heat resistant Silicone Aluminum paint - DFT 20m/coat.	One coats of heat resistant Silicone Aluminum paint - DFT 20m/coat.	One coats of heat resistant Silicone Aluminum paint - DFT 20m/coat.	60		
A.2	Conventional valves ( Gate, Globe, Check)	HPBP-Trichy			400/600 Deg. C	Blast cleaning to SA 2 1/2 or SSPC-SP-10	One coats of heat resistant Silicone Aluminum paint - DFT 20m/coat.	One coats of heat resistant Silicone Aluminum paint - DFT 20m/coat.	One coats of heat resistant Silicone Aluminum paint - DFT 20m/coat.	60		
A.3	Silencers	HPBP-Trichy			>400 Deg. C	Blast cleaning to SA 2 1/2 or SSPC-SP-10	One coat of Inorganic Zinc Ethyl silicate to IS14946—DFT 75µ/coat.	One coat of Heat Resistant Silicone Aluminum paint IS13183 Gr. II - DFT 20 micron/coat.	One coat of Heat Resistant Silicone Aluminum paint IS13183 Gr. II - DFT 20 micron/coat.	115		
A.4	IBR piping input - Piping centre	PC Chennai			60 deg.C and Above	SSPC-SP3/Power Tool Cleaning	2 coats of Red oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744	-----	-----	Total DFT = 60 microns min. Shade : Redoxide		IBR Piping shall be insulated at site.
A.5	Uninsulated Carbon Steel Piping with Operating Temp <= 93 Deg C (Outdoor)	PC Chennai		Indoor	<= 93 Deg C	SP-6	3-5 mils (76-127 microns) of Inorganic Zinc	4-6 mils (102-152 microns) of Epoxy	3-5 mils (76-127 microns) of Polyurethane	60 microns	Redoxide	2nd & 3rd Coat in Shop or Field
A.6	Uninsulated Carbon Steel Piping with Operating Temp > 93 & <= 400 Deg C (Outdoor/Indoor)	PC Chennai		Indoor	> 93 & <= 400 Deg C	SP-10	3-5 mils (76-127 microns) of Inorganic Zinc	1.5-2.5 mils (38-64 microns) of Silicone Aluminium	1.5-2.5 mils (38-64 microns) of Silicone Aluminium			2nd & 3rd Coat in Shop or Field
A.7	Insulated Carbon Steel / Stainless Steel Piping with Operating Temp <= 200 Deg C (Outdoor/Indoor)	PC Chennai		Indoor	<= 200 Deg C	SP-7/15	6-8 mils (152-203 microns) of High Temp Epoxy Phenolic with Glass Flakes	-	-			
A.8	Uninsulated Stainless Steel Piping with Operating Temp <= 93 Deg C (Outdoor/Indoor)	PC Chennai		Indoor	<= 93 Deg C	SP-7/15	4-6 mils (102-152 microns) of Epoxy Mastic	3-5 mils (76-127 microns) of Polyurethane	-			
A.9	Insulated Carbon Steel / Stainless Steel Piping with Operating Temp > 200 Deg C (Outdoor/Indoor)	PC Chennai		Indoor	> 200 Deg C	SP-3	First coat of inorganic zinc silicate primer.	-	Finish Coat Of Zinc Free Air Curing Finish	165-215 microns		Shade : Redoxide
A.10	Ball Valves	Piping , PE&SD		Out Door	Less than 60 Deg C	Blast cleaning to SA 2 1/2 or SSPC-SP-10	1 coat of Inorganic Zinc silicate primer @65-75µ DFT/coat	1 coat of Epoxy Zinc PH Primer @40µ DFT/coat	1 coat of High Build Epoxy finish paint @100µ DFT/coat	205 to 215	BLUE	
A.11	Butter Fly Valves	Piping , PE&SD	ACW Pump House	Out Door	Less than 60 Deg C	Blast cleaning to SA 2 1/2 or SSPC-SP-10	Epoxy zinc phosphate primer (P-6), DFT-35 Microns	Epoxy High Building Coating (F-6) DFT: 100 Microns	Epoxy High Building Coating (F-6) DFT: 100 Microns	235	SEA GREEN	
A.12	AIR RELEASE VALVES	Piping , PE&SD	ACW Pump House	Out Door	Less than 60 Deg C	Blast cleaning to SA 2 1/2 or SSPC-SP-10	Epoxy zinc phosphate primer (P-6), DFT-35 Microns	Epoxy High Building Coating (F-6) DFT: 100 Microns	Epoxy High Building Coating (F-6) DFT: 100 Microns	235	SEA GREEN	
A.13	Gate Valves -(P91)	Piping , PE&SD	Indoor or Outdoor		400/600 Deg. C	Blast cleaning to SA 2 1/2 or SSPC-SP-10	One coats of heat resistant Silicone Aluminum paint - DFT 20m/coat.	One coats of heat resistant Silicone Aluminum paint - DFT 20m/coat.	One coats of heat resistant Silicone Aluminum paint - DFT 20m/coat.	60		
A.14	Steam Traps	Piping , PE&SD	Indoor or Outdoor		400/600 Deg. C	Blast cleaning to SA 2 1/2 or SSPC-SP-10	One coats of heat resistant Silicone Aluminum paint - DFT 20m/coat.	One coats of heat resistant Silicone Aluminum paint - DFT 20m/coat.		40		
A.15	Pipe hangers	Piping , PE&SD	Indoor or Outdoor		Less than 60 Deg C	Blast cleaning to SA 2 1/2 or SSPC-SP-10	Prime-Two coats Prime Epoxy zinc phosphate primer (P-6) each 35micron thick	Intermediate coat- Epoxy high build MIO paint (P-7) of DFT 100 microns thickness	Finish- coat-Acrylic Polyurethane paint (F-2) of DFT 50	220		
A.16	Structural steel for pipe supports	Piping , PE&SD	Indoor or Outdoor		Less than 60 Deg C	Blast cleaning to SA 2 1/2 or SSPC-SP-10	Prime-Two coats Prime Epoxy zinc phosphate primer (P-6) each 35micron thick	Intermediate coat- Epoxy high build MIO paint (P-7) of DFT 100 microns thickness	Finish- coat-Acrylic Polyurethane paint (F-2) of DFT 50	220		Surface preparation, primer coating, painting shall be done by Mechanical contractor. Structural steel shall be supplied directly from Mill.
A.17	Piping (LP Piping)	Piping , PE&SD	Indoor or Outdoor	Indoor or Outdoor	Less than 60 Deg C	Blast cleaning to SA 2 1/2 or SSPC-SP-10	Prime-Two coats Prime Epoxy zinc phosphate primer (P-6) each 35micron thick	Intermediate coat- Epoxy high build MIO paint (P-7) of DFT 100 microns thickness	Finish- coat-Acrylic Polyurethane paint (F-2) of DFT 50	220	As per Annexure-I	Surface preparation, primer coating, painting shall be done by Mechanical contractor. Pipe Will be supplied only with anti rust coating.
A.18	Bolts Studs and Nuts in Piping Systems on (Flanges, Manhole Covers, Equipment Connection Etc.), A193 B7, A194 2H, A307 B, A563 A.	PESD	Indoor or Outdoor	Indoor or Outdoor	Design	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Finish- coat-Acrylic Polyurethane paint (F-2) of DFT 50	50		All studs and Nuts will be supplied with One Coat of Black Oxidised Protective Coating. Studs shall not be painted. Only Nuts external surface to be painted as per the finishing paint indicated.

**NOTE: FOR ITEMS IN A16, A17 SURFACE PREPARATION AND PRIMER, FINISH PAINTING TO BE DONE AT SITE.**



**ONGC- HAZIRA, GUJARAT - 51MW COMBINED CYCLE POWER PLANT  
DUAL PRESSURE FIRED HRSG BEHIND FRAME 6B GT  
CUSTOMER NO: H1/ 5767  
PAINTING SCHEDULE**

<b>Prepared by</b>	<b>K. Srinivasan Engineer/Plant Lab</b>		<b>Document No: PL: C3 - PS / 5767</b>
<b>Reviewed by</b>	<b>Dr. V. Rajasekharan Manager/Plant lab</b>		<b>Revision No: 01 Dated: 04-06-2015</b>
	<b>AGM/PEM</b>		
<b>Approved by</b>	<b>Dr. Anbazhagan. V DGM / Plant Lab</b>		<b>Sheet No. 1 of 9</b>

**RECORD OF REVISIONS**

<b>Rev. No</b>	<b>Date</b>	<b>Details of revision</b>	<b>Remarks</b>
00	27.04.2015	New	Prepared in line with ONGC bidding document no. 5111168-ME-SPC-100-001 Rev.R1, Vol. III Sec. 2.15 Bid package for combined cycle captive power plant and pre- bid queries to bidding documents issued for ONGC-HAZIRA 51MW CCPP-HRSG project.
01	04-06-2015	Primer and finish paint numbers are indicated as per tender document.	Changes incorporated as per comments for (action code B,K) approval by FICHTNER INDIA 'Transmittal Letter for comments on painting schedule' Ref: No: 5111168-3000-ME-VDT-017 Dt.02.06.2015

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT $\mu\text{m}$ (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
1 PS 1AC	Drum (Except Internals), Drum suspension (Design temperature around 350 <sup>0</sup> C & insulated)  04 –116,176	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 $\mu\text{m}$ per coat	1  <b>P3</b>	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 $\mu\text{m}$ per coat	2  <b>F1</b>	International Orange Shade No: 592 of IS 5	70
2 PS5	<u>Drum internals, Foundation material, Insulation pins and Dd items etc.</u> 04-116,149,158,458,459,; 07-305,306,307,308,311,312; 12-301,302,304,305,306,312,313,314; 19-301,302,304,305,308, 311 to 315; 24- 955,960, 994; 28-700; 35-010,011; 37-810;	SSPC-SP1/ or SSPC – SP3 Solvent / Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=25 $\mu\text{m}$ per coat	1	--	--	--	--	--	25
3 30D	Structures, supports and etc. (uninsulated) Temp: <80 <sup>0</sup> C – 04-144,148; 07-411,412, 504 to 506, 07-507,508; 08-910; 12-901,902,904,905, 12-906,912,913,914; 19-501,901,902, 19-904,905,908,911,912,913,914,915; 24-201,203,206,208,225,401,403,406,408, 425; <u>Boiler supporting structures</u> 35–110,120,131,140,220,540,591,592,593 35-594,597,610;97-457; <u>Galleries, Stair-ways &amp; inter connecting walkways</u> 36-210,220,230,240,390; <u>Oil &amp; gas, Ignitor &amp; Scanner Air system</u> 41-130; 42-076,155,156,270; 43-002,202;	Blast cleaning to SSPC-SP10 (Near white metal) with surface profile 35-50 $\mu\text{m}$	Epoxy zinc phosphate primer to IS13238 to 35 $\mu\text{m}$ per coat	2  <b>P6</b>	Epoxy Based MIO /TiO2 Pigmented Intermediate Coat DFT=100 $\mu\text{m}$ per coat	1  <b>P7</b>	Aliphatic Acrylic PU Paint DFT=50 $\mu\text{m}$ per coat	1#  <b>F2</b>	Smoke grey to Shade no 692 of IS5.	220

# Note: To be applied at site.

S. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT $\mu$ m (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
3 30D (continued)	Duct supports 48-200,422,424,452,454; <u>External Pipelines, tanks &amp; vessels</u> 80-219,273,274,600,601,602; HL-098, 501to 506, 601 to 606;	Blast cleaning to SSPC-SP10 (Near white metal) with surface profile 35-50 $\mu$ m	Epoxy zinc phosphate primer to IS13238 to 35 $\mu$ m per coat	2  P6	Epoxy Based MIO /TiO2 Pigmented Intermediate Coat DFT=100 $\mu$ m per coat	1  P7	Aliphatic Acrylic PU Paint DFT=50 $\mu$ m per coat	1#  F2	Smoke grey to Shade no 692 of IS5.	220
4 PS 3	Components >95° C Insulated other than in Row 5 (Gas path), Headers, Down Comer pipes, Hot and flue gas ducts etc. (Design temperature >125° C but <400° C)  07-206,208,210,212,993; 10-121,135,221,235; 12-850,851,852,853,854,855,900,993; 19- 101,102,701,702,850,851,852,853,854,855,993; 24- 200,202,205,207,220,221,222,260,275, 280,400,402,405,407,460,475,993; 32-055,993;48-993; 80-145,146,147; 81-005,011;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate primer to IS 12744 DFT = 30 $\mu$ m per coat	2  P3	--	--	--	--	Red oxide	60

# Note: To be applied at site.

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate Coat		Finish coat			Total DFT $\mu\text{m}$ (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
5 PS 2/3	Components in the gas path like SH, RH & Economizer coils, loose tubes, and Erection materials, commission spares, etc., Temperature: 735° C (max) – Furnace atmosphere  24-987, 989; 32-110; 35-595,596; HL-101,102,103,121,122,131,132,141, HL-142,151 to 153,161,171; HL-201,202,203,221,222,231,232,241; HL-242,251 to 253,261, 271, 301,302,322, HL- 351 to 353;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Dip coat primer to PR: CHEM: 09 – 03 DFT=35 $\mu\text{m}$ per coat / brush coat primer to IS 12744 DFT = 30 $\mu\text{m}$ per coat	1/ 2*  <b>P3</b>	--	--	--	--	Red oxide	35/ 60*
6 1BB	Hand rails and posts, Stairs and ladders / rungs  36-820, 850;	SSPC-SP3/ Power Tool Cleaning	HB chlorinated rubber based zinc phosphate primer DFT = 50 $\mu\text{m}$ / coat	1  <b>P2</b>	--	--	Synthetic enamel finish (long oil alkyd) to IS 2932 DFT = 20 $\mu\text{m}$ / coat	1  <b>F1</b>	BLACK	90
7 PS 6	Floor Grills, 36-810	Hot dip Galvanizing to a coating weight of 610 g/m <sup>2</sup> (minimum) and to a coating thickness of 87.0 microns (minimum). Refer Notes given below **								

Notes: \*Applicable for brush coat

**PAINTING SCHEME FOR VALVES**

Sl.No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT $\mu$ m (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
8 PS 10	Components working at > 400° C uninsulated silencers, vent pipes, safety and BHEL valves etc.,  24-273,285,290,465,473,480,485,490; 48-482;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. I/DFT 20 $\mu$ m per coat	1  F13	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr. I/DFT 20 $\mu$ m per coat	1  F13	Aluminium	40
9 PS 9B1	Components working at <400° C uninsulated safety and BHEL valves etc.,  24 - 420, 421, 422;	Blast cleaning to SSPC-SP10 (Near white metal) with surface profile 35-50 $\mu$ m	Inorganic Ethyl Zinc Silicate Primer DFT=75 $\mu$ m per coat	1  P10	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr. II/DFT 20 $\mu$ m per coat	2  F11	Aluminium	115
10 PS 15	For CLH & VLH* PGs 07,08,12,17,19,21,24,47,48 & 80  07-511,512;12-501,502,504,505,506; 19-502,504,505,508; 24-204, 404;	Blast cleaning to SSPC-SP10 (Near white metal) with surface profile 35-50 $\mu$ m	Epoxy zinc rich primer to IS14589 Gr. II %VS = 35, (min) DFT = 40 $\mu$ m per coat	1	--	--	Aliphatic Acrylic Polyurethane paint %VS=40.0 (min) DFT=30 $\mu$ m per coat	1  F2	Phirozi blue to Shade no 176 of IS5.	70

**NOTES:**

1. Rust Preventive Coating should be given on HSEFG Bolt and nut threads.
2. Machined surfaces and all retainers are to be applied with a coating of Temporary Rust Preventive oil.
3. All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, Sleeves shall be coated with Temporary Rust Preventive fluid and during execution of civil works; the dried film of coating shall be removed using organic solvents.
4. Final coat of paint (site scope) for boiler structures (Sl. No.3) shall be given immediately after the boiler drum lifting activity without delay.
5. Ground shade/colour of Finish paints & identification tag/Band for equipments, pipings pipe service, boiler supporting structures and other boiler components shall be followed as per tender.
6. PGMA's under Sub-Vendor items are not indicated. Please refer respective Engg. Document.
7. This painting Schedule is valid for ONGC HAZIRA 51MW CCPP - Customer No: H1/5767 –only.
8. No painting is required for auto passivated Stainless Steel, non-ferrous & galvanized components.
9. Wherever inside surfaces of components under PGMA 48 – XXX & others, need protection till erection, two coats of Red-oxide zinc phosphate primer paint to IS12744 to a DFT of 60 microns shall be applied, after power tool cleaning.
10. The Temporary Rust Preventive coating that already been applied on any components, tubes, pipes etc., shall be visually inspected for good adherence. If the coating is intact, direct coating of alkyd based red oxide paints over the coating is permitted. In case, the coating has peeled off over a large area, then the coating is to be removed by suitable solvents / heating to 350 –400 °C for an hour before primer paint application –but, in this case, it should be ensured that the minimum surface cleanliness required for primer paint application shall be SSPC – SP2 (equivalent – Hand Tool cleaning).
11. In components, wherever plates / sheets of thickness less than or equal to 5 mm and rods/tubes<25mm /drain pipes, very small components are used, power tool / hand tool cleaning to SSPC – SP3 / SP2 shall be followed and the painting shall be power tool cleaning + 1 coat of Red oxide + 2 coats synthetic enamel to a DFT of 70 mic. Shade – smoke grey for components other than CLH & VLH of Sl.No.10 & Sl.No. 3.
12. For all commissioning components-erection materials (xx-993) two coats of Red oxide Zinc Phosphate Primer shall be applied to meet the temporary protection till erection, after power tool cleaning.
13. Touch-up painting of damaged areas shall be carried out as per clause applicable painting scheme.

14. All components covered under different PGMA's are to be painted In case any component is left out, the same shall be deemed to be included under the relevant section based on paint logic approved.
15. Only weldable primer shall be applied on surfaces, which required to be welded subsequently at site. For very small components with weldable primer at edges, the entire component shall be applied with weldable primer. At those locations no other paint shall be applied.
16. Painting scheme for all temporary structures (35-391,392,393) shall be PS 1AE i.e. 1 coat of Red oxide Zinc Phosphate primer (Alkyd Base) to IS 12744-DFT- 30 $\mu$  and 2 coats of Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 - DFT-2X20 $\mu$  Shade Yellow –Shade No. 356 of IS 5- Total DFT 70 $\mu$ . The same PS is applicable for all miscellaneous components other than structural items mentioned in Sl.No.3 but the shade will be Smoke Grey –shade no.692 of IS 5.
17. Painting Scheme for Soot Blower components shall be 1AS1 i.e. 1 coat of chlorinated rubber based Zinc Phosphate primer-DFT-50 $\mu$  and 2 coats of Synthetic Enamel paint (Long Oil Alkyd) to IS 2932-DFT-2X20 $\mu$  -Shade Verdigris Green –Shade No. 280 of IS 5- Total DFT 90 $\mu$ . Valve head assembly having high surface temperature (> 200 and <600 deg. C) shall be applied with two coats of heat resistant aluminum paint – Gr. II (up to 400 deg.C) and Gr.I (up to 600 deg.C)

#### Durability of paint system

1. The durability of the coating system is only a typically expected to be as per ISO 12944-5, clause 5.5.
2. It is to be noted that the durability (as noted in ISO) is not a guarantee time.
3. The Durability is indicated in this document only as a technical consideration that can help the owner to plan a maintenance painting programme.
4. It is emphasized that ISO guidelines of durability can be met only if painted components are stored properly; taking due care of all the precautions to ensure that components are not directly in contact with soil & (rain) water (or) any corrosion medium and are stacked properly without damaging the paint coating.
5. The durability is linked to the painting system essentials, which encompasses the condition of the surface painted; surface preparation methodology; type of paint system and coating thickness; care with which the surfaces are handled; the care with which they are stored. Hence due care has to be taken in all aspects. When there is a local damage is done, and maintenance coating is done; it is to be noted that the durability as originally stated cannot be expected.
6. As a good practice, considering the above, it is suggested that sites should inspect the paint condition of the components every three months till erection and do the needful to protect any damaged regions, by suitable maintenance coating. It is necessary for sites to define and adhere to a methodology for proper storage.
7. The durability of painting scheme "PS 30D" for structures falls under Medium durability category (M) - 5 years. The durability of painting scheme "PS 1AC" for drum and its suspension (insulated) falls under Low durability category (L) - 2 years

### Painting Scheme – Details for procurement & application purposes

Sl.No.	Generic nature of paint	Theoretical Covering Capacity Sq.m per Litre.	No. of pack	Volume solids, % (min)**	DFT in microns (min) per coat	Shade	Shade No. to IS5	Mode of appln.	Over coating interval, Hrs.
1	Inorganic ethyl zinc silicate to IS 14946 –Main Coat	8	2	60	65	Grey	--	Spray only	16
2	Epoxy Poly amide cured TiO <sub>2</sub> /MIO pigmented intermediate coat	6	2	60	100	Grey/ Brown	--	## Spray	24
3	Epoxy based Zinc Phosphate primer to IS 13238	10	2	40	35	Grey	---	Brush/ Spray	18
4	Aliphatic acrylic polyurethane paint to IS 13213	10	2	40	30	<b>Smoke grey</b>  Phirozi Blue	692  176	Spray  Spray	24  24
5	Heat resistant Aluminium paint to IS 13183 Grade I/II	10	1	-	20	--	--	Brush / Spray	24
6	Red oxide zinc phosphate primer paint to IS 12744	10	1	--	30	-	--	Brush / Spray	12
7	Red oxide Zinc Phosphate Dip coat primer paint to PR: CHEM: 09-03	10	1	--	35	--	---	Dip	12
8	Long oil alkyd synthetic enamel finish paint to IS2932	10	1	--	15-20	Reqd. shade	Corrpdg. Shade no.	Brush / Spray	12
9	Temporary Rust preventive fluid to PR: CHE: 09 – 04	10	1	--	25	--	--	--	12
10	Epoxy zinc rich primer to IS14589 Gr.II	8	2	35	40	Grey	--	Spray	24
11	HB chlorinated rubber based zinc phosphate primer	10	1	40	50	Grey	--	Brush/ spray	12

## Brush painting is accepted, if recommended by the Paint suppliers. The covering capacity of paints specified is only approximate. The paints and Rust Preventive fluid shall be procured from BHEL's approved suppliers. \*\* Values are indicative.

## SYSTEM OF IDENTIFICATION/COLOUR CODING OF PIPINGS AND FIRE EQUIPMENT

The colour coding system for pipings has been formulated basically on Indian standard; that in itself includes the British & the American standard and follow the system of colour coding as well as positive identification.

However, in some cases of our products ( not included in the Indian standard ), colour bands have been specified as per EIL specifications or proposed, either based on the present system at Ankleshwar Asset or Uran/Hazira plant. It has been ensured that the colour bands do not clash with other products/utilities and the base colour is maintained as per the Indian standard.

The system of colour code consists of a base/ground colour and colour bands/strips superimposed on it. Lettered labels/legends, direction of arrows and danger sign shall also be used as superimposed on colour coding system for positive identification of the contents of a piping system.

The colouring scheme of the valves and hazard indication too are prescribed.

### 1.0 Colour Code System

The system of colour coding consists of a base/ground colour and colour Bands / strips superimposed on it. For identification of piping, the colour code as per Table 1 & 2 (placed at the end )shall be used which is for products being processed and utility items being used in ONGC (Based on Indian standard, British standard and the EIL standard).

### 1.1 Base / Ground Colours

The base/ground colour identifies the basic nature of the fluid carried and distinguishes one fluid from another and has been based on IS 2379:1990 reaffirmed 1996.

#### 1.1.1. How much and where to paint

- a) Base/ ground colour shall be applied throughout the entire length on un-insulated pipelines
- b) Ground colour coating shall be applied at places requiring colour bands ,with minimum 2 meters length or adequate length so that it will not be mistaken as colour band for the following kinds of piping. (As per IS 2379:1990 reaffirmed – 1996 para 6.1.1).
  - i) Insulated pipes at the position of metal cladding.
  - ii) Un-insulated austenitic stainless steel.
  - iii) Plastic and/or plastic coated materials.
  - iv) Pipes of non-ferrous metals like Aluminium, galvanized "piping", etc.

#### 1.1.2. Application

Ground colours as given in Table 1 & 2 shall be applied in one of the following ways : (As per IS 2379:1990 reaffirmed – 1996 para 7.1)

- a) Through out the entire length of the pipings.

- b) As a colour coating of adequate length, (but in no case less than 300 mm) so that it is not mistaken for a colour band.
- c) As a colour panel for pipes which are not accessible on all the sides.
- d) As label attached to pipes which are very small in diameter.
- e) By the use of colour adhesive tapes for pipes with small diameter or which are difficult to access.
- f) Where ever the ground colour are not applied throughout the entire length, it shall be applied at all the places in conjunction with other bands and markings as mentioned in applications- (1.1.1.b).

## 1.2 Colour bands/strips

Colour bands/strips ( as given in Table 1 & 2 )are superimposed on the base/ground colour to distinguish one kind or condition of a fluid from another kind or condition of the same fluid, or one fluid from another but belonging to the same group, for example diesel fuel from the furnace fuel.

### 1.2.1. Identification & Size

- a) The width of colour band shall confirm to the following table shown below : (As per IS 2379:1990 reaffirmed.– 1996 PARA 7.3.3).

NOMINAL PIPE SIZE ( mm)	WIDTH: L (mm)
80 NB and below	25 MM
Over 100 NB up to 150 NB	50 MM
Over 200 NB up to 300 NB	75 MM
Over 350 NB	100 MM

#### NB- Nominal Bore

- b) The relative proportional width of first colour band to the subsequent bands shall be 4:1.

### 1.2.2. Application

- a) Colour bands shall be applied at the following location (IS 2379:1990 – reaffirmed 1996 para 7.3)
  - i) Battery limit points.
  - ii) Intersection point and change of direction points in piping ways.
  - iii) Other points such as midway of each piping way, near valves, junction joints of service appliances, walls, on either side of pipe culverts:
  - iv) For long stretch yard piping at 50m interval; and
  - v) At start and terminating points.
- b) Colour bands shall be arranged in the sequence shown in Table 1 & 2 and the sequence follows the direction of flow.
- c) All uninsulated pipes having temperatures above 100<sup>0</sup> C (Heat resistance aluminium painted) need be identified as special case by using Teflon tape.
- d) For insulated pipes, nominal pipe size means the outside diameter of insulation.

TABLE FOR DIMENSIONS OF ARROW

SN	Outside diameter of pipe (mm)	Size of dimension A,B,C & D (mm)
1.	Upto 200	A=65, B=30, C=95 & D=20
2.	Above 200	A=90, B=30, C=95 & D=30

4. For pipes with small diameter, if the label with a code indication is attached to the pipe, the direction of flow shall be shown by the pointed end of this label.

### 2.3 Hazardous warning

To indicate that a pipeline carries a hazardous material, a band of diagonal strips of black and golden yellow as (per IS 2379:1990 reaffirmed 1996 para 8 (c)) shall be painted on the ground colour at location stated at 1.2.2 – Application (a) and next to the colour coding identification and lettered label. Further if material is flammable or explosive material, chemically active or toxic materials, etc. may be indicated by lettering.

### 2.4 Visibility of Marking

Attention shall be given to visibility with reference to pipe markings. Where lines are located above or below the normal line of vision, the lettering shall be placed below or above the horizontal centerline of the pipe. (As per IS 2379:1990 reaffirmed – 1996 para 10).

### 2.5 Colour of Valves

The valves shall be painted as per the IS 2379:1990 reaffirmed – 1996 para 7.4 as per the following table.

Condition	Colour of valve
Valves on Fire fighting piping	Red
Valves on piping carrying hazardous material	Golden yellow with black strips
Valves on water carrying piping (potable or non potable)	French blue
All other piping	Same colour as the main piping

Example below shows the colour code for a pipe carrying sour gas where light grey and dark violet colour bands have sequence numbers C and D.

## 2.0 Positive identification system

Positive identification system includes lettered label/legend, direction of arrows and danger sign and shall be used as superimposed on colour coding system for positive identification of the contents of a piping system (Based on British standard, Indian standard and ANSI standard).

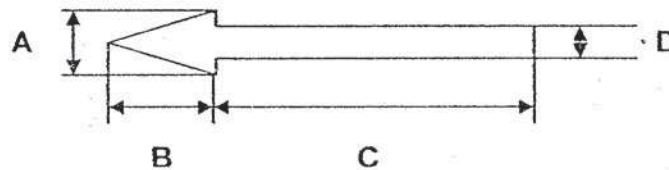
### 2.1 Lettering Label

Positive identification of the contents of piping shall be by lettered label giving the name of the contents in full or the abbreviated form at the locations stated at 1.2.2 Application (a) and next to be colour coding indication.

The lettering shall be as per IS 2379-1990 reaffirmed 1996 para 9.1. The recommended size of letters for pipes of different diameters are given as under :

Outside diameter of pipe or Covering (mm)	Size of legend ( mm )
20 to 30	10
Above 30 to 50	20
Above 50 to 80	30
Above 80 to 150	40
Above 150 to 250	63
Over 250	90

### 2.2 Direction of flow : Flow Direction



1. Flow direction shall be indicated by arrow in the location stated at 1.2.2 application (a) and next to the colour code indication and lettered label.
2. The colour of arrow shall be black or white and in contrast to the colour on which they are superimposed.
3. The size of arrows shall be as per IS 2379 para 9.2 which is :

TABLE -1 COLOUR SCHEME FOR PRODUCTS BEING PROCESSED IN ONGC

## A. GASES

Sl. No.	Description of Products	Colour Code Identification		Sl. No.	Description of Products	Colour Code Identification	
		Base/ Ground Colour	Colour Bands i) First band ii) Second band			Base/ Ground Colour	Colour Bands i) First band ii) Second
1.	Sour gas	Canary Yellow	i) Grey ii) Dark violet	6.	Rich gas	Canary yellow	i) Signal red ii) Smoke grey
2.	Sweet gas	Canary yellow	Grey	7.	Flare gas	Canary yellow	Aluminium
3.	Fuel gas	Canary yellow	i) Light brown ii) White	8.	Regenerated gas	Canary yellow	i) White ii) Dark violet
4.	Residue	Canary yellow	i) Oxide red ii) White	9.	C2-C3	Canary yellow	i) Brilliant green ii) Signal red
5.	Lean gas	Canary yellow	i) White ii) French blue	10.	Propane gas	Canary yellow	i) Signal red ii) Black

## B. LIQUIDS

Sl. No.	Description of Products	Colour Code Identification		Sl. No.	Description of Products	Colour Code Identification	
		Base/ Ground Colour	Colour Bands i) First band ii) Second band			Base/ Ground Colour	Colour Bands i) First ii) Second
1.	Crude oil	Light brown	No band	12.	Surphuric acid	Dark violet	i) Brilliant green ii) Light orange
2.	LPG (Refrigerated)	Dark admiralty grey	i) Brilliant green ii) Dark violet	13.	Hydrochloric acid	Dark violet	i) Signal red ii) Light orange
3.	Kerosene	Light brown	Brilliant green	14.	Sodium Hydroxide	Smoky grey	Light orange
4.	Neptha	Dark admiralty grey	i) Light brown ii) Black	15.	Triethylene glycol (TEG)	Dark Admiralty grey	i) Sea green ii) Yellow
5.	Light diesel oil/heavy cut	Light brown	i) Brilliant green ii) Black	16.	DIPA	Dark Admiralty grey	i) White ii) Black
6.	High speed diesel	Light brown	i) Brilliant green ii) White	17.	MDEA	Dark Admiralty grey	i) Brilliant green ii) Red
7.	Slope oil	Light brown	Black	18.	Oily water	Black	No band
8.	Hydrocarbon condensate	Dark Admiralty grey	i) Signal red ii) Black	19.	Dozing chemical	Dark Admiralty grey	No band *
9.	Methanol	Dark Admiralty grey	i) White ii) Gulf red	20.	NGL	Dark Admiralty grey	i) Brilliant green ii) Black
10.	Mercaptane	Dark Admiralty grey	Signal red	21.	ATF	Dark Admiralty grey	i) Black
11.	Chlorine	Dark violet	Signal red				

TABLE-2 COLOUR SCHEME FOR UTILITY ITEMS USED IN PROCESS IN ONGC

## A. Water

Sl. No.	Description of Products	Colour Code Identification		Sl. No.	Description of Products	Colour Code Identification	
		Base/ Ground Colour	Colour Bands i)First band ii)Second band			Base/ Ground Colour	Colour Bands i)First band ii)Second
1.	Drinking water	Sea green	i)French blue ii) Signal red	8.	Wash water	Sea green	Canary yellow
2.	Domestic Hot Water	Sea green	Light grey	9.	Fire water	Fire red	Crimson red
3.	Cold water service from storage tank	Sea green	i)French blue ii) Canary yellow	10.	Sea/river untreated water	Sea green	White
4.	De mineralized water	Sea green	Gulf red	11.	Waste water	Sea green	i) Canary yellow ii) Signal red
5.	Cooling water	Sea green	French blue	12.	Treated water	Sea green	Light orange
6.	Boiler feed water	Sea green	Gulf blue	13.	Chilled water	Sea green	i) Black ii) Canary yellow
7.	Condensate water	Sea green	i)Light brown ii) Signal red				

## B. STEAM

Sl. No.	Description of Products	Colour Code Identification		Sl. No.	Description of Products	Colour Code Identification	
		Base/ Ground Colour	Colour Bands i)First ii)Second			Base/ Ground Colour	Colour Bands i)First ii)Second
1.	Very high pressure (VHP)steam (above40Kg/cm <sup>2</sup> )	Aluminium	Signal red	4.	Low pressure steam(SL) (1 kg/cm <sup>2</sup> to15 kg/cm <sup>2</sup> )	Aluminium	Canary yellow
2.	High pressure steam(SH) (25 kg/cm <sup>2</sup> to 40 kg/cm <sup>2</sup> )	Aluminium	French blue	5.	Purge steam	Aluminium	Grey
3.	Medium pressure steam(SM) (15 kg/cm <sup>2</sup> to 25 kg/cm <sup>2</sup> )	Aluminium	Gulf red	6.	Steam condensate	Aluminium	i)Sea green ii) Canary yellow

**C. COMPRESSED AIR**

Sl. No.	Description of Products	Colour Code Identification		Sl. No.	Description of Products	Colour Code Identification	
		Base/ Ground Colour	Colour Bands i)First band ii)Second			Base/ Ground Colour	Colour Bands i)First ii)Second
1.	Compressed air up to 15 kg/cm.sq	Sky blue	---	4.	Instrument air	Sky blue	French blue
2.	Compressed air above 15 kg/cm.sq	Sky blue.	Signal red	5.	Drainage	Black	--
3.	Plant air	Sky blue	Silver grey				

**D. OILS**

Sl. No.	Description of Products	Colour Code Identification		Sl. No.	Description of Products	Colour Code Identification	
		Base/ Ground Colour	Colour Bands i)First ii)Second			Base/ Ground Colour	Colour Bands i)First ii)Second
1.	High speed diesel fuel	Light brown	---	3.	Lubricating oil	Light brown	Light grey
2.	Hydraulic power	Light brown	Dark violet				

**E. GASES**

Sl. No.	Description of Products	Colour Code Identification		Sl. No.	Description of Products	Colour Code Identification	
		Base/ Ground Colour	Colour Bands i)First ii)Second			Base/ Ground Colour	Colour Bands i)First ii)Second
1.	Acetelene	Canary yellow	Service brown	4.	Carbon dioxide	Canary yellow	Light grey
2.	Nitrogen	Canary yellow	Black	5.	Acid gas	Violate	No band
3.	Oxygen	Canary yellow	White				

**NOTE : 1.** Any product which is not covered will be governed as per colour code standard IS :2379-1990 / (re affirmed in 1996 )/other standard under reference.

\* Name of the dozing chemicals should be written with flow of direction on pipe lines.

**TABLE-3 FIRE EQUIPMENT, FIRE TENDERS, etc.**

S. N	Item/Application	Standard painting colour	S. N	Item/ Application	Standard painting colour
1	A. Extinguishers : Water based, Foam, DCP, CO <sub>2</sub>	Fire red paint ( shade No. 536 of IS-5-AS AMENDED )	2	Foam tank & foam piping/ Nitrogen cylinder	Dark Admiralty grey
	B. All fire tenders/ Jeep, Fire engines ( except Foam tank, foam piping & Nitrogen cylinder )		3	Driver compartment & inside of the lockers	Pale cream
	C. Fire tender water piping/ Wet risers/ Fire hose reel box		4	Chassis & wheel arches	Black
	D. Fire tender water pump & engine/ Water pipeline in engine & pump.		5	Fire service insignia & identity nomenclatures	Canary yellow with black border on both sides of the vehicle/equipment
	E. DCP tank & DCP piping				

[Please click here for colour coding illustration](#)

**PGMA Details for Painting Schedule Table - ONGC-Hazira HRSG**

<b>Sl. No. of Painting Schedule</b>	<b>PGMA</b>	<b>PGMA description</b>
1-PS 1AC	04-116	Boiler drum without internals-HP
2-PS5	04-116	Boiler drum internals-HP
3-30D	04-144	Drum slide bearing plates-HP
3-30D	04-148	Drum slide bearing plates-LP
2-PS5	04-149	Fasteners for drum saddle-HP
2-PS5	04-158	Fasteners for drum saddle-LP
1-PS 1AC	04-176	Boiler drum -LP
2-PS5	04-458	Fasteners for drum saddle LP-Washer Plat
2-PS5	04-459	Fasteners for drum saddle HP-Washer Plat
4-PS3	07-206	Riser Pipes-HP
4-PS3	07-208	Riser Pipes-LP
4-PS3	07-210	Riser links and headers-HP
4-PS3	07-212	Riser links and headers-LP
2-PS5	07-305	Supports for evaporator modules-HP Front
2-PS5	07-306	Supports for evaporator modules-HP Middl
2-PS5	07-307	Supports for evaporator modules-HP Rear(
2-PS5	07-308	Supports for evaporator modules-LP(DD it
2-PS5	07-311	Supports for Downcomer-DD items(HP)
2-PS5	07-312	Supports for Downcomer-DD items(LP)
3-30D	07-411	Supports for Downcomer-HP
3-30D	07-412	Supports for Downcomer-LP
3-30D	07-504	Disc spring for modules
3-30D	07-505	Supports for evaporator modules-HP Front
3-30D	07-506	Supports for evaporator modules-HP Middl
3-30D	07-507	Supports for evaporator modules-HP Rear
3-30D	07-508	Supports for evaporator modules-LP
10-PS 15	07-511	Supports for Downcomer-Springs(HP)
10-PS 15	07-512	Supports for Downcomer-Springs(LP)
4-PS3	07-993	Erection materials and commisioning spar
3-30D	08-910	EXPANSION MOVEMENT MEASURING COMPONENTS
4-PS3	10-121	SH Inlet Header
4-PS3	10-135	DESH inlet header
4-PS3	10-221	SH Outlet Header
4-PS3	10-235	DESH outlet header
2-PS5	12-301	Supports for HP Saturated Links - DD Ite
2-PS5	12-302	Supports for HP MS Line - DD Items
2-PS5	12-304	Supports for DESH Links - DD Items
2-PS5	12-305	Supports for LP Saturated Links - DD Ite
2-PS5	12-306	Supports for LP MS Line - DD Items
2-PS5	12-312	HP SH - II Module Supports - DD Items
2-PS5	12-313	HP SH - I Module Supports - DD Items
2-PS5	12-314	LP SH Module Supports - DD Items
10-PS 15	12-501	Supports for HP Saturated Links - Spring
10-PS 15	12-502	Supports for HP MS Line - Springs
10-PS 15	12-504	Supports for DESH Links - Springs
10-PS 15	12-505	Supports for LP Saturated Links - Spring
10-PS 15	12-506	Supports for LP MS Line - Springs

4-PS3	12-850	HP Saturated Links
4-PS3	12-851	HP MS Line
4-PS3	12-852	HP DESH Links
4-PS3	12-853	LP Saturated Links
4-PS3	12-854	LP MS Line
4-PS3	12-855	LP SH Inter Conn Links
4-PS3	12-900	HP DESH
3-30D	12-901	Supports for HP Saturated Links
3-30D	12-902	Supports for HP MS Line
3-30D	12-904	Supports for DESH Links
3-30D	12-905	Supports for LP Saturated Links
3-30D	12-906	Supports for LP MS Line
3-30D	12-912	HP SH - II Module Supports
3-30D	12-913	HP SH - I Module Supports
3-30D	12-914	LP SH Module Supports
4-PS3	12-993	Erection materials (SH circuit)
4-PS3	19-101	WPH inlet line
4-PS3	19-102	WPH outlet line
2-PS5	19-301	Supports for HP Eco Feed Pipe - DD items
2-PS5	19-302	Supports for HP Eco Link to Drum - DD It
2-PS5	19-304	Supports for LP Eco Feed Pipe - DD items
2-PS5	19-305	Supports for LP Eco Link to Drum - DD It
2-PS5	19-308	Supports for WPH links-DD items
2-PS5	19-311	Supports for WPH modules-DD items
2-PS5	19-312	HP ECO - III Module Supports - DD Items
2-PS5	19-313	HP ECO - II Module Supports - DD Items
2-PS5	19-314	HP ECO - I Module Supports - DD Items
2-PS5	19-315	LP ECO Module Supports - DD Items
3-30D	19-501	Supports for HP Eco Feed Pipe - Springs
10-PS 15	19-502	Supports for HP Eco Link to Drum - Sprin
10-PS 15	19-504	Supports for LP Eco Feed Pipe - Springs
10-PS 15	19-505	Supports for LP Eco Link to Drum - Sprin
10-PS 15	19-508	Supports for WPH links-Springs
4-PS3	19-701	HP Eco -I Inlet Header
4-PS3	19-702	HP Eco -III Outlet Headers
4-PS3	19-850	HP Eco Feed Pipe
4-PS3	19-851	HP Eco Link to Drum
4-PS3	19-852	HP Eco -I Inter Conn Links
4-PS3	19-853	HP Eco -III Inter Conn Links
4-PS3	19-854	LP Eco Feed Pipe
4-PS3	19-855	LP Eco Link to Drum
3-30D	19-901	Supports for HP Eco Feed Pipe
3-30D	19-902	Supports for HP Eco Link to Drum
3-30D	19-904	Supports for LP Eco Feed Pipe
3-30D	19-905	Supports for LP Eco Link to Drum
3-30D	19-908	Supports for WPH links
3-30D	19-911	Supports for WPH modules
3-30D	19-912	HP ECO - III Module Supports
3-30D	19-913	HP ECO - II Module Supports
3-30D	19-914	HP ECO - I Module Supports

3-30D	19-915	LP ECO Module Supports
4-PS3	19-993	Erection materials (Eco circuit)
4-PS3	24-200	Boiler Drain Trim Piping And Fittings -
3-30D	24-201	Supports For Drain Trim Piping - AD
4-PS3	24-202	Boiler Drain Trim Piping And Fittings -
3-30D	24-203	Supports For Drain Trim Piping - MDD
10-PS 15	24-204	Spring Supports For LP Trim Piping - HRD
4-PS3	24-205	Boiler Vent Trim Piping And Fittings - B
3-30D	24-206	Supports For Vent Trim Piping - AD
4-PS3	24-207	Boiler Vent Trim Piping And Fittings - M
3-30D	24-208	Supports For Vent Trim Piping - MDD
4-PS3	24-220	Safety Valve Esc Piping - BMR
4-PS3	24-221	Safety Valve Esc Piping - AD
4-PS3	24-222	Safety Valve Esc Piping - MDD
3-30D	24-225	Silencer Support-AD
4-PS3	24-260	Valves (Bhel)
8-PS 10	24-273	Direct Water Level Gauge - Bhel
4-PS3	24-275	Drain Headers For Trim Piping
4-PS3	24-280	Safety Valves(Bhel)
8-PS 10	24-285	Safety Valve Silencers(Bhel)
8-PS 10	24-290	Startup vent silencer
4-PS3	24-400	Boiler Drain Trim Piping And Fittings -
3-30D	24-401	Supports For Drain Trim Piping - AD
4-PS3	24-402	Boiler Drain Trim Piping And Fittings -
3-30D	24-403	Supports For Drain Trim Piping - MDD
10-PS 15	24-404	Spring Supports For HP Trim Piping - HRD
4-PS3	24-405	Boiler Vent Trim Piping And Fittings - B
3-30D	24-406	Supports For Vent Trim Piping - AD
4-PS3	24-407	Boiler Vent Trim Piping And Fittings - M
3-30D	24-408	Supports For Vent Trim Piping - MDD
9-PS 9B1	24-420	Safety Valve Esc Piping - BMR
9-PS 9B1	24-421	Safety Valve Esc Piping - AD
9-PS 9B1	24-422	Safety Valve Esc Piping - MDD
3-30D	24-425	Silencer Support-AD
4-PS3	24-460	Valves (Bhel)
8-PS 10	24-465	Valves & Fittings (Sd)
8-PS 10	24-473	Direct Water Level Gauge - Bhel
4-PS3	24-475	Drain Headers For Trim Piping
8-PS 10	24-480	Safety Valves(Bhel)
8-PS 10	24-485	Safety Valve Silencers(Bhel)
8-PS 10	24-490	Startup vent silencer
2-PS5	24-955	Lapping Tools For Sv
2-PS5	24-960	Lapping Tools For Conventional Valves
5-PS 2/3	24-987	Commg Spares For Safety Valves/Erv
5-PS 2/3	24-989	Commg Spares For Conventional Valves
4-PS3	24-993	Consumables & Erection Materials
2-PS5	24-994	Name Plates
2-PS5	28-700	CLADDING SHEET FIXING PINS, NUTS& WASHER
4-PS3	32-055	EXTERNAL INSULATION FIXING COMP. - PIPING
5-PS 2/3	32-110	CLADDING SHEET - CASING

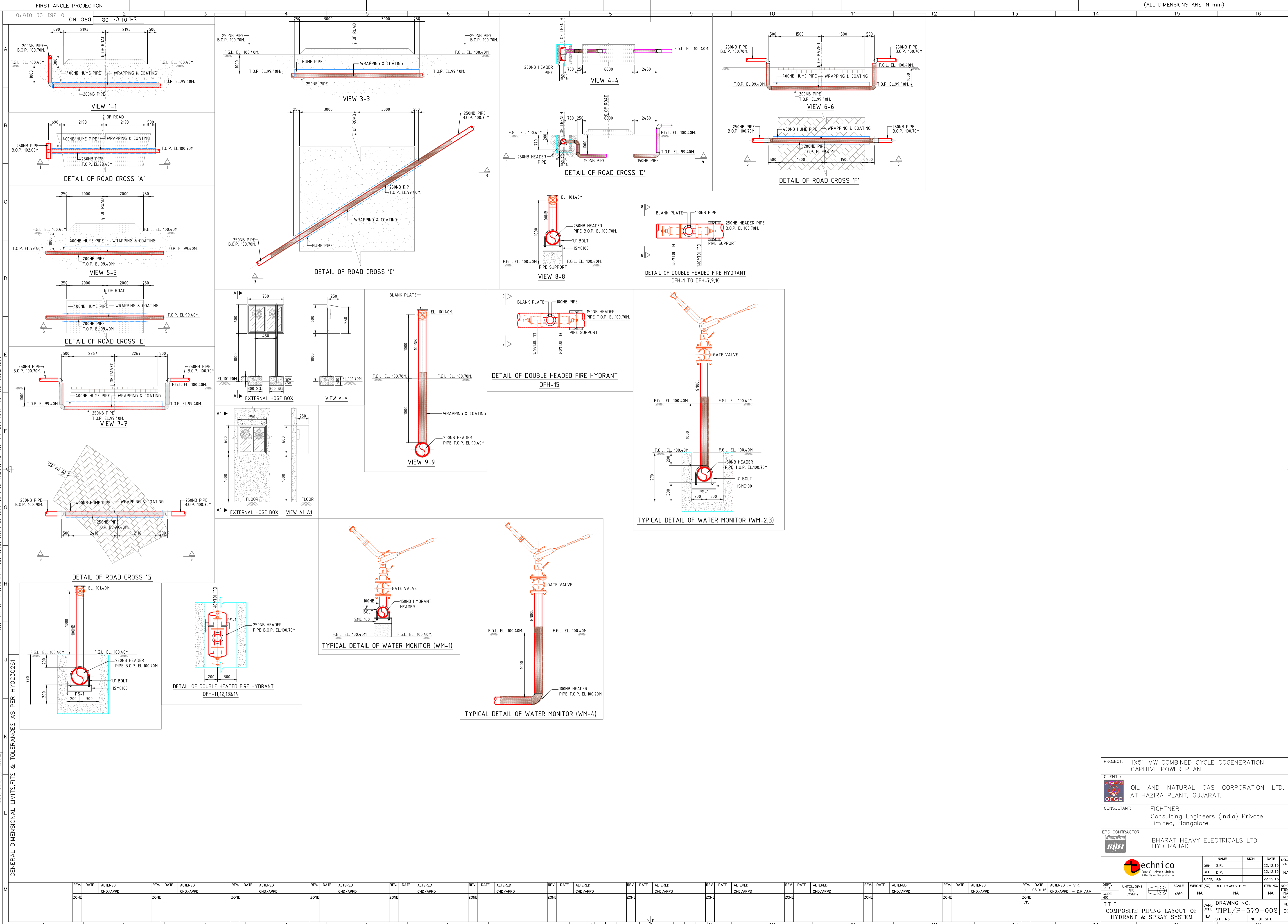
4-PS3	32-993	ERECTION MATERIALS
2-PS5	35-010	FOUNDATION MATERIALS-BOILER
2-PS5	35-011	SLIDE BEARING PLATE
3-30D	35-110	MAIN COLUMNS LEFT
3-30D	35-120	MAIN COLUMNS RIGHT
3-30D	35-131	INLET DUCT SUPPORT STRUCTURE FOR HRSG
3-30D	35-140	AUXILIARY COLUMNS
3-30D	35-220	PIPING SUPPORT - STRUCTURE
3-30D	35-540	AUXILIARY COLUMN BRACING
3-30D	35-591	BOTTOM BRACING BEAM
3-30D	35-592	TOP BRACING BEAM
3-30D	35-593	BASE BEAMS OR MODULE BOTTOM SUPPORT
3-30D	35-594	DUCT STIFFENER BEAMS
5-PS 2/3	35-595	LATERAL SUPPORT BEAM FRONT
5-PS 2/3	35-596	LATERAL SUPPORT BEAM REAR
3-30D	35-597	MODULE AND DRUM SUPPORT STRUCTURE
3-30D	35-610	BOILER ROOF STRUCTURE
3-30D	36-210	MAIN FLOOR 1ST LEVEL
3-30D	36-220	MAIN FLOOR 2ND LEVEL
3-30D	36-230	MAIN FLOOR 3RD LEVEL
3-30D	36-240	MAIN FLOOR 4TH LEVEL
3-30D	36-390	MISCELLANEOUS PLATFORMS
7-PS 6	36-810	FLOOR GRILLS AND GUARD PLATE
6-1 BB	36-820	STAIRS AND LADDERS
6-1 BB	36-850	HANDRAILS AND HAND RAIL POST
2-PS5	37-810	OUTER CASING SHEET -PIPING
3-30D	41-130	DUCT BURNER ASSY
3-30D	42-076	FG-PG CONTROL STATION
3-30D	42-155	PIPING OPRG FLOOR-IGNITOR GAS
3-30D	42-156	PIPING OPRG FLOOR-FUEL GAS
3-30D	42-270	SD BURNER FLOOR SKIDS
3-30D	43-002	SCANNER COOLING/SEAL AIR SYSTEM
3-30D	43-202	SD SCANNER COOLING/SEAL AIR SYSTEM
3-30D	48-200	INSTRUMENT TAPPINGS
3-30D	48-422	HRSG Inlet Duct
3-30D	48-424	EXPANSION JOINT-INLET
3-30D	48-452	DUCT-BOILER OUTLET
3-30D	48-454	EXPANSION JOINT-OUTLET
8-PS 10	48-482	DISTRIBUTION GRID
4-PS3	48-993	ERECTION MATERIAL
4-PS3	80-145	Exhausts & Vents- BMR
4-PS3	80-146	Exhausts & Vents- AD
4-PS3	80-147	Exhausts & Vents- MDD
3-30D	80-219	Dosing system
3-30D	80-273	Dosing system valves
3-30D	80-274	CBD Tank safety valve
3-30D	80-600	Dosing piping-BMR
3-30D	80-601	Dosing piping- AD
3-30D	80-602	Dosing piping- MDD
4-PS3	81-005	Intermittent Blow Down Tank

4-PS3	81-011	Continuous Blow Down Tank
3-30D	97-457	ANGLES AND CHANNELS
3-30D	HL-098	COLUMN CASING BRIDGING COMPONENTS
5-PS 2/3	HL-101	Evaporator modules-HP Front
5-PS 2/3	HL-102	Evaporator modules-HP Middle
5-PS 2/3	HL-103	Evaporator modules-HP Rear
5-PS 2/3	HL-121	Evaporator modules-LP Front
5-PS 2/3	HL-122	Evaporator modules-LP Rear
5-PS 2/3	HL-131	HP SH - II Module Assy
5-PS 2/3	HL-132	HP SH - I Module Assy
5-PS 2/3	HL-141	LP SH - II Module Assy
5-PS 2/3	HL-142	LP SH - I Module Assy
5-PS 2/3	HL-151	HP ECO - III Module Assy
5-PS 2/3	HL-152	HP ECO - II Module Assy
5-PS 2/3	HL-153	HP ECO - I Module Assy
5-PS 2/3	HL-161	LP ECO Module Assy
5-PS 2/3	HL-171	WPH modules
5-PS 2/3	HL-201	Links for evaporator modules-HP Front
5-PS 2/3	HL-202	Links for evaporator modules-HP Middle
5-PS 2/3	HL-203	Links for evaporator modules-HP Rear
5-PS 2/3	HL-221	Links for evaporator modules-LP Front
5-PS 2/3	HL-222	Links for evaporator modules-LP Rear
5-PS 2/3	HL-231	HP SH - II Module Links
5-PS 2/3	HL-232	HP SH - I Module Links
5-PS 2/3	HL-241	LP SH - II Module Links
5-PS 2/3	HL-242	LP SH - I Module Links
5-PS 2/3	HL-251	HP ECO - III Module Links
5-PS 2/3	HL-252	HP ECO - II Module Links
5-PS 2/3	HL-253	HP ECO - I Module Links
5-PS 2/3	HL-261	LP ECO Module Links
5-PS 2/3	HL-271	Links for WPH modules
5-PS 2/3	HL-301	Evaporator module casing-HP Front
5-PS 2/3	HL-302	Evaporator module casing-HP Middle
5-PS 2/3	HL-322	Evaporator module casing-LP Rear
5-PS 2/3	HL-351	HP ECO - III Module Skin Casing
5-PS 2/3	HL-352	HP ECO - II Module Skin Casing
5-PS 2/3	HL-353	HP ECO - I Module Skin Casing
3-30D	HL-501	SIDE CASING S1-S2
3-30D	HL-502	SIDE CASING S2-S3
3-30D	HL-503	SIDE CASING S3-S4
3-30D	HL-504	SIDE CASING S4-S5
3-30D	HL-505	SIDE CASING S5-S6
3-30D	HL-506	SIDE CASING S6-S7
3-30D	HL-601	TOP CASING S1-S2
3-30D	HL-602	TOP CASING S2-S3
3-30D	HL-603	TOP CASING S3-S4
3-30D	HL-604	TOP CASING S4-S5
3-30D	HL-605	TOP CASING S5-S6
3-30D	HL-606	TOP CASING S6-S7





FIRST ANGLE PROJECTION



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 GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261

PROJECT: 1X51 MW COMBINED CYCLE COGENERATION CAPTIVE POWER PLANT																					
CLIENT: OIL AND NATURAL GAS CORPORATION LTD. AT HAZIRA PLANT, GUJARAT.																					
CONSULTANT: FICHTNER Consulting Engineers (India) Private Limited, Bangalore.																					
EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD HYDERABAD																					
	<table border="1"> <tr> <th>NAME</th> <th>SKILL</th> <th>DATE</th> <th>NO. OF VAR.</th> </tr> <tr> <td>DRN. S.R.</td> <td></td> <td>22.12.15</td> <td>NA</td> </tr> <tr> <td>CHD. D.P.</td> <td></td> <td>22.12.15</td> <td>NA</td> </tr> <tr> <td>APPD. J.M.</td> <td></td> <td>22.12.15</td> <td>NA</td> </tr> </table>	NAME	SKILL	DATE	NO. OF VAR.	DRN. S.R.		22.12.15	NA	CHD. D.P.		22.12.15	NA	APPD. J.M.		22.12.15	NA				
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DRN. S.R.		22.12.15	NA																		
CHD. D.P.		22.12.15	NA																		
APPD. J.M.		22.12.15	NA																		
<table border="1"> <tr> <th>REV.</th> <th>DATE</th> <th>ALTERED</th> <th>NO. OF REV.</th> </tr> <tr> <td>1</td> <td>08.01.16</td> <td>CHD/APPD -- S.R.</td> <td>01</td> </tr> </table>	REV.	DATE	ALTERED	NO. OF REV.	1	08.01.16	CHD/APPD -- S.R.	01	<table border="1"> <tr> <th>DEPT.</th> <th>UNTOOL. DIMS.</th> <th>SCALE</th> <th>REF. TO ASSY. DRG.</th> <th>ITEM NO.</th> <th>NO. OF REV.</th> </tr> <tr> <td>NA</td> <td>IS: 10487</td> <td>1:250</td> <td>NA</td> <td>NA</td> <td>NA</td> </tr> </table>	DEPT.	UNTOOL. DIMS.	SCALE	REF. TO ASSY. DRG.	ITEM NO.	NO. OF REV.	NA	IS: 10487	1:250	NA	NA	NA
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DEPT.	UNTOOL. DIMS.	SCALE	REF. TO ASSY. DRG.	ITEM NO.	NO. OF REV.																
NA	IS: 10487	1:250	NA	NA	NA																
TITLE: COMPOSITE PIPING LAYOUT OF HYDRANT & SPRAY SYSTEM DRAWING NO. TIPL/P-579-002 SHE. No. NO. OF SHE. 01																					

REV.	DATE	ALTERED	NO. OF REV.
1	08.01.16	CHD/APPD -- S.R.	01