BHARAT HEAVY ELECTRICALS LTD
PIPING CENTRE, CHENNAI – 17
QUALITY DEPARTMENT.

QUALITY PLAN FOR PIPING FABRICATION
(With Vendor Material)

PROJECT NAME : -BARH STPP STAGE-I (3X 660 MW)
BHEL CUSTOMER Nos: 7285, 7286 & 7287.

QP NO : 7285 : QPC : 19
REV.NO : 00
DATE : 04.08.2015

S.No	COMPONENT & OPERATIONS	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT #	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
										M	B	N	
1	2	3	4	5	6	7	8	9	D*	**10			11
1.00	**Material**	**All Raw material and Fittings shall be sourced from the Vendors approved by NTPC and refer Note:14** **The material shall meet IBR requirements and necessary IBR certificates shall be furnished.**											
1.10	**Pipes as per drg.**	Co-relation & verification of Mill TCs for	Critical	Verfication	100%	BHEL Drawing , Material Spec.		Mill TCs	√	P	V	V	Note 1
1.11		a) Chemical Composition.		Chem. Analysis	1/Heat	BHEL Drawing , Material Spec.							TC - Test Certificate
1.12		b) Mech. Properties		Mech. Test	1/Heat/size	BHEL Drawing , Material Spec.							
1.13		c) Soundness		UT	100%	ASTM E213 with 5% Notch, SA530, SA 999 (Min. 0.3mm; Max. 1.5mm)							
1.14		d) Heat Treatment as applicable		Time/Temp.	100%	Material Spec.							
1.15		e) Surface finish		Visual	100%	Material Spec.							
1.16		f) Dimension (OD / ID & Wall Thk)		Measurement	100%	BHEL Drawing , Material Spec.							
1.17		g) Hardness@@		Measurement	100%	Material Spec.							@@ : for P91 Pipes
1.20	**Plates as per drg.**	Co-relation & verification of Mill TCs for	Critical	Verfication	100%	BHEL Drawing , Material Spec.		Mill TCs	√	P	V	V	Note 1 & 3
1.21		a) Chemical Composition.		Chem. Analysis	1/Heat	BHEL Drawing , Material Spec.							
1.22		b) Mech. Properties		Mech. Test	1/Heat	BHEL Drawing , Material Spec.							
1.23		c) Soundness		UT	100%	SA578							
1.24		d) Dimension & Surface finish		Measurement & Visual	100%	BHEL Drawing , Material Spec.							
1.25		e) Hardness@@		Measurement	100%	BHEL Drawing , Material Spec.		Report					@@ : for Gr91 Plates
1.30	**Fittings, Forgings, Bars & Rounds as per drg.**	Co-relation & verification of Mill TCs for	Critical	Verify	100%	BHEL Drawing , Material Spec.		TCs	√	P	V	V	Note 2
1.31		a) Chem. Composition		Chem.Analysis	1/Heat	BHEL Drawing , Material Spec.							In case of SW fittings, (i) raw matrl. shall be procured from IBR appd. Mill with UT as per SA388 (ii)supply of SA182 F11& F12 to class 2 and F22 to class 3
1.32		b) Mech. Test		Mech. Test	1/Heat	BHEL Drawing , Material Spec.							
1.33		c) Dimensions of fittings (OD & wall thickness, etc.,)		Measurement & Visual	100%	BHEL Drawing , Material Spec.							
1.34		d) Surface Defects		MPI	100%	ASTM E709							
1.35		e) Soundness (for thk > 6mm or dia > NB 200mm for BW fitting		UT	100%	SA 388 / ASME Sec VIII Div II cl 3.3.4							
1.36		f) Soundness for Forgings, Bars & Rounds		UT*	100%	SA 388							*UT only for dia/thickness above 50 mm

PREPARED
VIVEKANANDA YELLU, Sr. ENGR / QA

LEGEND: "D*" RECORDS IDENTIFIED WITH "TICK " (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION
** M: MANUFACTURER / SUB – SUPPLIER B: BHEL / BHEL-TPI. N: NTPC. "P": PERFORM "W": WITNESS `R`RANDOM AND " V": VERIFICATION. AS APPROPRIATE; CHP: CUSTOMER HOLD POINT

APPROVED BY
MADHAVANKUTTY A.P., AGM / Q

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1.37		g) Heat Treatment if applicable		Time/Temp.	100%	SA234 WPB- as per Spec. SA234 WPC- Normalised. SA 182, SA234 WP11,12,22 - Normalised & Tempered							
1.38		h) Hardness@@		Measurement	10%	Material Spec.							@@ : for Gr91 Fittings
1.39		i) PMI for AS fittings		PMI	100%	Material Spec.							
1.40		j) Weld quality (in case of welded fitting, if any)		RT	100%	ASME Sec V / ASME Sec VIII Div-I UW 51							
2.0	**IN PROCESS CONTROL**												
2.1	Welding												
2.1.1	Welding qualifications	Procedure qualification	Major	Review of documents	100%	ASME SEC. IX		WPS&PQR		P	R	---	WPS, PQR shall be approved by BHEL
		Personal qualification	Major	-do-	100%	IBR		WQR		P	R	---	
2.2	Plate formed pipes(EFW)												
2.2.1	Heating & Forming	Temperature monitoring	Major	Log Book	100%	P1: 870-1010 deg. C P4: 925-1010 deg. C P5A: 925-1010 deg. C		R		P	V	V	Forming shall not be below 670deg. C for P1 & 720 deg. C for P4 & 750 deg. C. for P5A Matl
2.2.2	Post forming Heat treatment (Normalising)	Time & Temp. control	Critical	Review of HT charts	100%	#P1: 870-900 deg. C P4: 920-950 deg. C P5A: 920-950 deg. C		R		P	V	V	# No Normalising if forming is completed above 870 deg.C
2.2.3	Post forming Heat treatment (Tempering for P4 & P5A)	Time & Temp. control	Critical	Review of HT charts	100%	P4: 655+/-15 deg. C P5A: 695+/-15 deg. C		R		P	V	V	
2.2.4	**NDE after welding** (NDE shall be carried out by qualified operator as per SNT TC 1A)												
2.2.4.1	Outside weld grooves	Discontinuities	Minor	MPI/LPI After M/c ing	100%	ASME Sec V / ASME B31.1 cl 136.4.3/cl 136.4.4		R		P	V	---	
2.2.4.2	Long Seam	Weld quality	Critical	RT*	100%	ASME Sec V / ASME B31.1 cl		R		P	V	V	*Review of films
2.2.4.3	Repaired Areas (t = depth)												
	t >= 9 mm	Subsurface defect	Major	RT*	100%	ASME Sec V / ASME B31.1 cl 136.4.5		R		P	V	---	
	t< 9 mm	Subsurface defect	Major	MPI	100%	ASME Sec V / ASME B31.1 cl 136.4.3		R		P	V	---	
	Weld & surface Inspection	Profile, surface quality	Minor	Visual	100%	ASME B31.1 cl 136.4.2		R		P	V	---	

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QP NO : 7285 : QPC : 19
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1	2	3	4	5	6	7	8	9	D*	**10			11
2.2.5	Post weld Heat treatment (as applicable)	Time & Temp. control	Major	Review of HT charts	100%	P1: 605+/- 15 Deg. C P4: 655+/- 15 Deg. C P5A: 695+/- 15 Deg. C		R		P	V	V	Soaking 2.5 min/mm of thickness
2.2.6	Dimensional check	Ovality, thickness OD, ID & Length	Major	Measurement	100%	Drawing & IBR		R	√	P	V	V	
2.2.7	Production test Plate for LS Welds	Mechanical Properties	Major	Laboratory Test	As per IBR	Material specn. & IBR		R		P	V	V	
2.3	**Bending**												
2.3.1	Heating and Heat treatment	Time & Temp. control	Major	Review of HT charts/log	100%	**Note 12.0**		R		P	V	V	
2.3.2	Dimensions	Bend angle, Arm length,Radius of bend,Ovality. Thinning,Wrinkles	Major	Measurement & Visual	100%	Drawing & IBR		R	√	P	W	V	Thinning only for R/D < 3 for cold bends and for all hot bends. FOT will be done for cold Bends of R/D > = 3
2.3.3	P91 Bends	Micro	Critical	Replica	@	Material specn		R		P	W*	V	@3 replicas in one bend per HT batch
		Hardness	Critical	Measurement	100%	250 BHN max.		R		P	W	W	
		Soundness	Critical	NDT-MPI	100%	ASME Sec V / ASME B31.1 cl		R		P	W	W	W* :Random Witness
2.4	Post weld Heat treatment	Time & Temp. control	Major	Review of HT charts	100%	**Note 13.0**		R		P	W	V	
2.5	**NDE after PWHT:** (NDE shall be carried out by qualified operator as per SNT TC 1A)												
2.5.1	Butt welds(External piping only)	Soundness	Critical	RT*	IBR CL-I ID≤102, 10% ID>102, 100% CL-II - 10%	ASME Sec V / ASME B31.1 cl 136.4.5		R	√	P	W	W	CL-I:Design temp > 218 deg.c or steam Pr >17.06 Kg/Sq. cm or F.Wtr.Pr > 24.6. Kg/Sq. cm CL-II: Not exceeding above values *Review of films
2.5.2	Butt joints (P91)	Soundness	Critical	MPI	100%	ASME Sec V / ASME B31.1 cl 136.4.3		R	√	P	W	W*	# UT on accessible areas based on feasibility of scanning in nozzle and branch welds.
				UT	100%#	ASME Sec V / ASME B31.1 cl 136.4.5		R		P	W	W	
				Hardness	100%	300 HV10 (Max)		R		P	W	W*	
2.5.3	Full penetration nozzle joints (OD > 114.3mm)	Soundness	Critical	RT / UT$$	100%	ASME Sec V / ASME B31.1 cl 136.4.5/ cl 136.4.6		Report	√	P	W	W*	$$: in lieu of RT/UT, inter satge MPI can be done for every 10mm weld deposit.

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2.5.4	Branch & load Carrying attachment welds	Soundness	Major	MPI/LPI	100%	ASME Sec V / ASME B31.1 cl 136.4.3/cl 136.4.4		R		P	V	V	
2.5.5	Seal welds of screws and hand hole plates	Soundness	Major	MPI & LPI	100%	ASME Sec V / ASME B31.1 cl 136.4.3/cl 136.4.4		R		P	V	V	
2.6	Dimensional inspection	Length, diagonal, Offset, EP, Weld End thickness, Location/Height Of stubs/Orientation	Major	Measurement	100%	Drawing & IBR		R		P	W	W*	
3.0	**FINAL INSPECTION**												
		a) Overall dimensions Orientation, Review of Previous records, RG plug Provision, Flow direction	Major	Measurement	100%	BHEL Drawing		HC	√	P	W	W**	W**: 10% witness of MSL, HRH & CRH
		b) Possitive Material Identification for all alloy Steel components (on Weld & Base material).	Major	Spectro/X-Ray fluorescence	100%	As per Required Material (ASME) Specn.		Report	√	P	W	V	
		c) Surface preparation & Painting	Major	Visual & Measurement	100%	**Refer Note : 8**		HC, IR	√	P	V	V	HC : History Card IR - Inspection Report
		d) Identification ,Marking & Colur coding	Major	Visual	100%	BHEL Drawing, PO		-		P	V	V	Note 9
		e) IBR Certification	Major	Review	100%	IBR			√	P	V	V	
		f) Packing & End protection	Major	Visual	100%	BHEL Drawing, PO		-		P	V	V	Note 10
4.0	**DOCUMENTATION**												
4.1	Inspection clearance	Documentation	Critical	Verification	100%	All reports as required in this QP &IBR				P	V	-	
4.2	Despatch Clearance	Despatch Clearance	Critical	Verification	100%			MDCC		P	V	CHP	**Note 7**

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BHARAT HEAVY ELECTRICALS LTD PIPING CENTRE, CHENNAI – 17 QUALITY DEPARTMENT.	**QUALITY PLAN FOR PIPING FABRICATION** **(With Vendor Material)** **PROJECT NAME : -**BARH STPP STAGE-I (3X 660 MW) **BHEL CUSTOMER Nos:** 7285, 7286 & 7287.	QP NO : 7285 : QPC : 19 REV.NO : 00 DATE : 04.08.2015

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NOTES:

1) (a) If the raw materials are received directly from RM Manufacturer's work, the material shall be accepted based on (i)correlation of Heat number on material with TC and (ii)verification of TCs.
(b) If the materials are received from Dealers place, check test (Chemical and Mechanical tests on one sample per Heat/ size) shall be done in addition to the above for accepting the material BHEL shall identify and witness the sample for check test.
Special requirements like supplementary test , restriction of Raw material Vendors, NDT requirements and if any indicated shall be taken care.
2) Gr91 Fittings shall be procured only from NTPC approved vendors & Refer Note:13. All the requirements covered in para 1.30 to 1.40 shall be taken care by the Sub-vendor while ordering fittings on the manufacturer.
3) Plates used for attachements shall be of BHEL approved make.
4) Heat number transfer to cut piece (raw material) shall be done by Sub-Vendor in the presence of BHEL/BHEL's TPI & IBR/IBR approved Agency.
5) The items shall be manufactured as per BHEL drawing .
6) Welding Electrodes used shall be of BHEL approved make.
7) All items shall be inspected and cleared by BHEL/BHEL's TPI and IBR/IBR approved Agency and NTPC as indicated in the above QP Witness/Hold points. The Vendor shall get despatch clearance from the NTPC before despatch of finished material/items.
8) **Surface Preparation & Painting :-**
a) Indigenous Vendor :- Surface Preparation : Power Tool Cleaning; **Primer Coat :** 2 coats of 25microns of each coat of Red Oxide Zinc Phosphate Primer to IS12744.
Finish coat : One coat of 25 microns of Synthetic enamel paint (long Oil alkyd) to IS 2932
Total DFT : 75 microns minimum. **Shade :** Smoke Grey Shade No 692 of IS 5
b) Foreign Vendor :- Surface Preparation : Blast Cleaning(SSPC-SP10 / SA2 1/2); Primer Coat : One coat of 60 microns of In-Organic Ethyl Zinc Silicate primer;
Finish coat : Two coats of 20 microns each of Heat Resistance Aluminium paint to IS13183 Gr-1.
Total DFT : 100 microns minimum. **Shade :** Aluminium
9) All IBR requirements shall be taken care and IBR documents shall be furnished.
10) The finished components shall be punched with DU code (14 digit work order du details),Heat number, material specification, maker`s emblem, Inspectors seal and Statutory authorities seal
In addition, the DU code, Heat no. and Material specification shall also be paint stencilled.
Colour coding : Red for SA106 Gr B ; Blue for SA106 GrC ; Green & White for SA335P11 ; Black & Red for SA335 P12 ; Blue & Red for SA335 P22; Brown & Red for SA335 P91
11) Machined ends shall be well protected using end caps and fittings shall be suitably packed in box / crate to avoid transit & other damages.

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BHARAT HEAVY ELECTRICALS LTD PIPING CENTRE, CHENNAI – 17 QUALITY DEPARTMENT.	**QUALITY PLAN FOR PIPING FABRICATION** **(With Vendor Material)** **PROJECT NAME :** -BARH STPP STAGE-I (3X 660 MW) **BHEL CUSTOMER Nos:** 7285, 7286 & 7287.	QP NO : 7285 : QPC : 19 REV.NO : 00 DATE : 04.08.2015

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Note 12.0 Post forming Heat treatment

Cold and Hot bending of pipes (OD > = 114.3 mm) — **Temp. in deg.C**

Material	Cold bending (Temp. < 590)	Hot bending	Incremental Bending*
P1	When t > 19 mm SR at 595 - 635	Heating: 900-1010 Bending not below 670 SR at 610 +/- 15 (No SR if bending is completed above 870)	Heating: 900-1010 If t < = 40 mm, No SR If t > 40 mm, SR at 595 - 635
P4	SR at 655 +/- 15	Heating: 920-1010 Bending not below 720 Normalise at 920 -960, Temper at 655+/-15	Heating: 920-1010 Normalise at 920-960 Temper at 655 +/- 15
P5A	SR at 695 +/- 15	Heating: 920-1010 Bending not below 750 Normalise at 920 -960, Temper at 695+/-15	**I. Heating:** **R/D > 2** Tension side: 770-780 Compression side: 830-850 **R/D < = 2** Tension side: 770-780 Compression side: 920-1010 **II. Post forming HT** Normalise at 920-960, Temper at 695 +/- 15 Normalise at 920-960, Temper at 695 +/- 15
P15E Group-I (P91)	Not Applicable	Heating: 1050-1100 Bending not below 1000 Normalise at 1040-1060 Temper at 760-780	Heating: 1000-1100 Normalise at 1040-1070 Temper at 760-780

Cold and Hot bending of pipes (OD < 114.3 mm) — **Temp. in deg.C**

Material	Cold bending (Temp. < 590)	Hot bending
P1	When t > 19 mm, SR at 595 - 635	Hot bend at 870-900; SR Nil
P4	When R/D < 2 or t > 13 mm, SR at 655 +/- 15	Hot bend at 870-900; If R/D < 2: SR at 655 +/- 15
P5A	When R/D < 2 or t > 13 mm, SR at 695 +/- 15	Hot bend at 870-900; SR at 695 +/- 15
P15E Group-I (P91)	i) For Design Temp. <=540°C:-- a) R/D <2.5, SR at 760+/-10°C. b) R/D>=2.5, No HT ii) For Design Temp. >540°C & ,=600°C:-- a) R/D <2.5, Normalise at 1040-1070 & Temper at 760+/-10°C b) R/D=/>2 & <10, SR at 760+/-10°C, c) R/D=/>10, No HT iii) For Design Temp. >600°C:-- a) R/D <2.5, Normalise at 1040-1070 & Temper at 760+/-10°C b) R/D=/>2 & <10, SR at 760+/-10°C, c) R/D=/>10, No HT	Hot bend at 1050-1100 Normalise at 1040-1060 Temper at 760-780

*** :- For Incremental bending, the parameters shall be suitably selected to ensure uniform heating of the entire thickness. Tempering and SR may be combined except for P91.**

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Note 13.0 : PRE HEAT, POST HEAT & POST WELD HEAT TREATMENT TEMPERATURE (Deg. C) FOR PIPING

POST WELD HEAT TREATMENT TEMP. $

Weld joint Base material	Dimension in mm	Pre-heat	Postheat	Butt welds	Stub and Attachment Welds Throat <=19 mm	Stub and Attachment Welds Throat>19 mm
P1 Gr. 1 (Gr. B)	t< = 19	Nil	Nil	Nil	Nil	610+/-15
&	*t>19< = 25	Nil	Nil	610+/-15	Nil	610+/-15
*Gr. 2 (Gr. C)	*t>25< =75	150	Nil	610+/-15	Nil	610+/-15
	*t > 75	150	Nil	610+/-15	610+/-15	610+/-15
P4 And P4+P1 Gr1	OD<=127& t<=13	150	Nil	Nil	t < =13 Nil & t > 13, 655+/- 15	655+/-15
	OD>127 or t>13	150	Nil	655+/-15	655+/-15	655+/-15
P4+P1 Gr 2 (Gr C)	OD<=127& t<=13	150	150 - 2 hrs	655+/-15	t < =13 Nil & t > 13, 655+/- 15	655+/-15
	OD>127 or t>13	150	Nil	655+/-15	655+/-15	655+/-15
P5, P5+P4	OD<=102& t<=8	@150	Nil	695+/-15	t < =8 & t > 8, 695+/- 15	695+/-15
	OD>102 or t>8	@150	250 - 2 hrs	695+/-15	695+/-15	695+/-15
P22+P91	All t	220	280 - 2 hrs	760+/-10##	760+/-10##	760+/-10##
P91+P91	All t	220	280 - 2 hrs	760+/-10##	760+/-10##	760+/-10##

*For P1 Gr. 2 (Gr. C) : These thickness are to be preheated to 150 deg. C and
Also Post heated after welding at 150 deg. C for 2 hrs.

@Preheat temperature for casting & forging: 220 deg. C minimum.

$: For SR< Soaking time, rate of heating and rate of cooling shall be given as below:

i) Soaking: 2.5 minutes per mm of "t"
(1 hour minimum for P22 with dia >= 127 mm and thickness >= 13 mm, 2 hours minimum for P91 and 30 minutes minimum for others.)

ii)Heating and cooling rates:

Thickness of material	Maximum rate of Heating & Cooling above 400 C
Upto 25 mm	220 C/Hr
Over 25-50 mm	110 C/Hr
Over 50-75 mm	75 C/Hr
Over 75 mm	55 C/Hr

: Preheat shall be maintained for P15E Gr-I (P91) until the welding operation is completed. Interpass temp. shall be limited to 350deg.C. After post heating, joints of P15E Gr-I shall be slowly cooled down to room temp & then kept at that temp. for a maximum of 72 Hrs before PWHT.

PREPARED
VIVEKANANDA YELLU, Sr. ENGR / QA

LEGEND: "D*" RECORDS IDENTIFIED WITH "TICK " (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION ** M: MANUFACTURER / SUB – SUPPLIER B: BHEL / BHEL-TPI. N: NTPC. "P": PERFORM "W": WITNESS `R`RANDOM AND " V": VERIFICATION. AS APPROPRIATE; CHP: CUSTOMER HOLD POINT

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S.No	COMPONENT & OPERATIONS	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT #	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
										M	B	N	
1	2	3	4	5	6	7	8	9	D*	**10			11

Note 14.0 : Raw Material Sources

a) For Seamless Pipes :-

Sl.No	Sub Supplier	Place	Remarks
1	ISMT	Ahemdabad / Baramati	CS, P22 (*Hot finished seamless pipes & tubes - OD 38.0 mm to 273.0 mm WT : 3.5 mm to 40.0 mm * Cold finsihed seamless pipes & tubes - OD 18.0 mm to 140.0 mm WT 1.5 mm to 15.0 mm)
2	Vallorec & Mannesamann	France	P91, P22, CS
3	Tennaris Global (Silico Tubes)	Romania	P91, P22, CS
4	Tubos Reunidos	Spain	P91, P22, CS
5	Sumitomo Metals	Japan	P91, P22, CS
6	Vallorec & Mannesamann	Germany	P91, P22, CS
7	Bentler Steel Tube	Germany	P91, P22, CS
8	PRODUCTOS TUBULARES	Spain	P91, P22, CS
9	JFE (Kawasaki)	Japan	P91, P22, CS
10	IBF SPA	Italy	P91, P22, CS
11	Tennaris Global (NKK Tubes)	Japan	P91, P22, CS
12	Wayman Gordan	USA	P91, P22, CS
13	Yangzhou Chengde Steel Pipe Co Ltd	China	CS
14	Yangzhou Chengde Steel Pipe Co Ltd	China	Upto P22 (Wyman Gordon Hard stamp on each pipe)
15	Baoshan Iron & Steel Co Ltd	China	CS - OD upto 88.9mm
16	Hengyang Valin Steel Tube Co	China	CS

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										M	B	N	
1	2	3	4	5	6	7	8	9	D*	**10			11
17	Jindal Saw Ltd		Nasik		CS, P22 (*Hot finished seamless pipes & tubes - OD 33.4 mm to 168.3 mm WT : 3.5 mm to 21.95 mm * Cold finsihed seamless pipes & tubes - OD 6.0 mm to 140.0 mm WT 0.8 mm to 15.0 mm)								
18	Tennaris Global (Dalmine)		Italy		P91, P22, CS								
19	Jiangsu Chengde Steel Tube Share		China		CS, P22 (upto 219.0 mm)								
20	MSL		Raigad		CS - Hot finished seamless pipes - OD 219.1 mm to 355.6 mm WT : 6.35 mm to 35.1 mm								
21	Arcelor Mittal		Romania		CS								
22	Valconvy Trub Chomutov		Czech Rep		CS, P11, P22								
23	Remi		Bharuch		CS, P22 (*Hot finished seamless pipes & tubes - OD 28.6 mm to 177.8 mm WT : 3.0 mm to 28.0 mm * Cold finsihed seamless pipes & tubes - OD 9.0 mm to 127.0 mm WT 1.6 mm to 20.0 mm)								
24	Ringmill		Italy		Forged CS Pipe (upto OD 914 X WT 102mm)								
25	BHEL		Trichy		AS upto P22/T22 grade & OD upto 133mm								

b) For Gr-91 Fittings :-

Sl.No	Sub Supplier	Place	Remarks
1	Sungkwang Bend Co Ltd	Korea	P91 / F91, Formed, Forged & Welded
2	IBF SPA	Italy	P91 / F91, Formed, Forged & Welded
3	Bassi Luigi SPA	Italy	P91 / F91, Forged & Welded
4	Mega SPA	Italy	P91 / F91, & Welded

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									M	B	N	
1	2	3	4	5	6	7	8	9	D*	**10		11
5	Petrol Raccord SPA		Italy		P91 / F91, Formed, Forged & Welded							
6	Techno Forge SPA		Italy		P91, Formed							
7	Allied International SRL		Italy		P91, Formed							
8	Gam Raccordi SPA		Italy		P91, Formed							
9	ERNE Fittings GmBH		Austria		P91, Formed							
10	Bruck Strasse 16 Ensheim		Germany		P91 / F91, Forged & Welded							
11	BGH Edelstahl Seigen GmBH		Germany		P91, Forged							
12	TK Corp		Korea		P91, Formed							
13	Bokyoung Metal Corp		Korea		P91 / F91, Forged							
14	Flash Forge		Vizag		P91 / F91, Formed & Forged (size upto 273 mm dia and thickness upto 30 mm)							
15	TF Tech Co Ltd		Korea		F91, Forged							
16	Dee Development		Palwal		1. Formed - 91 grade (Elbow/Tee 38", Reducer 30", End Caps 12") 2. Forged-91 grade upto 2"							

c) Other than Gr-91 Fittings :- As per the list attached. Refer annexure-I.

d) Any other source for fittings proposed by vendor will be subject to BHEL approval.

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